```
**********************************
*           Zeus80               *
*       SYSTEM  REFERENCE        *
*    FOR O.E.M.s & PROGRAMMERS    *
*          11/22/81              *
**********************************
```

CONTENTS

CONTENTS (cont)

CPU

Z80A 4MHZ Z80B 6MHZ Z80H 8MHZ
typical cycle time 1 microsecond .66 microsecond .5 microsecond
158 instruction set
S-100 bus , interrupts maskable, non-maskable, vectored

MEMORY

200 ns 150 ns 120 ns access industry-standard dynamic ram with
transparent refresh, standard system contains 64k bytes expandable in 64K banks
up to 1024K total

BASIC I/O

2 asynchronous serial ports for two additional terminals at 19.2K baud or, 1
300 baud modem port and 1 19.2K/9600 baud serial printer port 2 parallel ports
for Centronics' type printer interface

DISK DRIVES

8" single sided for 660 kbyte double density storage
6 ms step rate
200 ms average access time   420 ms maximum
500 kbit transfer rate

8" or special 5-1/4" two sided for 1.34 mbyte double density storage
3 ms step rate
91 ms average access time   250 ms maximum
500 kbit transfer rate

5 1/4" fixed media drive for 5,10,15 32+ mbyte storage
3 ms step rate or high speed buffered step rate
85 ms average access time
205 ms maximum, half that for buffered
step
5 mbit transfer rate

5-1/4" 5,10 or 15 mbyte fixed, with 5 mbyte removable linear voice coil
posistioner for 35 ms average access time
5 mbit transfer rate

14" removable media cartridge drive for 9 mbyte storage
4.5 mbytes removable with 4.5 mbytes fixed
10 ms track to track
35 ms average access time 65 ms maximum
2.5 mbit transfer rate

14" removable media storage module drive for 28 mbyte storage
14 mbytes removable with 14 mbytes fixed
6 ms track to track
30 ms average access time, 55 ms maximum
9.67 mbit transfer rate

CRT

12" P1 green phosphor
1920 characters in 24 line by 80 character format upper and lower case in 7x9
dot matrix with true descenders line insert, line delete, erase to end of
line/screen half intensity, reverse field, under-line, full cursor positioning

OPTIONAL I/O

multi-port serial board

7 asynchronous ports from 150 to 19200 baud including options to use any for
serial printer or modem options for asynchronous/synchronous communications up
to 9600 baud 2 counter/timers for baud rate generation on programmable port and
interrupts for multi-user system

OPERATING SYSTEMS

CP/M 2.2 *

The Digital Research operating system with the largest micro software base.
this o.s. supports single user operation . When combined with the system disk
bios an extremely fast file management system results.

MP/M 2.1*

The Digital Research CP/M 2.2 comparable multi-user, multi-tasking
operating system which enables upgrading to 7 total users with minimum effort.
All MP/M versions support real-time task scheduling and printer spooling & up
to 16 printers and includes built-in file and record locking.

CP/NET *

The digital research network control program which allows other systems to
communicate with an MP/M based system and share all system resources.

* CP/M MP/M & CP/NET are registered trademarks of Digital Research

DOS 9.13 and later.

This bios will work with the p.i.o. (programmed input/output) disk controller and the d.m.a. (direct memory access) controller.
It can only be booted from disk with a V 3.7x system monitor ROM.

Configuring The Bios

The configuration program is called CONFIG9.COM .Please run this program to ensure you have a bios that meets your requirements. A major change in the bios is the support of the disk reset function which allows you to change disks of different formats on your running application. This is BDOS function number 37.

Disk Error Handling with the Bios

If a disk error message appears on the screen you may handle it in one of three ways.

1) Press carriage return and make the disk controller retry the disk operation. After three <CR>s it should give up and warm boot if the I/O operation is a total failure.

2) Enter a <CONTROL-C>. This tells the bios to stop the disk I/O and forces it to do a warm boot.

3) Enter a <CONTROL-D>. Use this sparingly . It tells the bios to clear its' internal error flag and accept the data read or written as O.K. You will want to do this when it is paramount that you get a backup of critically needed files. Note that the data will contain errors but it will at least allow you to complete a copy or pip without aborting back to a warm boot.

note: The end user should not be aware of 2 & 3 above as it is best to leave these options to the applications person in all cases.

The following page is taken from the system screen at configuration
time. The various steps have been numbered for clarity in the
following discussion.

1)   The configurator program name is entered at the keyboard

2)   CONFIG9 clears the screen and signs on. The file CONFIG9 itself
contains the new cbios and CP/M 2.2 operating system. At this point
you may enter <CR> to continue or '^C' to quit.

3)   You may now enter a file name under which CONFIG9 will save the
options you are about to select. Use a name that indicates which end
user will receive this configuration.

4)   At this point you may enter up to 15 characters for an auto-start
system, or enter a <CR> to skip this option. In this case 'BASIC80
MENU' was entered. Thus when the system cold boots it will load
BASIC80 and then run the menu program called 'MENU'.
The bios is such that a warm boot will go back to the system level.

5)   Enter a sequence of 4 digits for the drive size to be used on
drives A, B, C & D (now or in the future), if only 8" drives are to
be used you may enter a <CR>. In this case A, B & C = 8" and D = 5".

6)   Enter the step rate to be used on 4 drives. A '0' selects 3ms, a
1 selects 6 ms and a 2 selects 15ms.

7)   Enter the number of drives used on the system. This is equal to
the number of drives to be used at this time. If more drives are added
later just run CONFIG9 to reset this value.

8)   You may now enter the default list device. The device selected
here is the one used by CP/M for all listing after a cold boot. It may
be changed to another list device by using 'STAT' .(see System   I/O
Modes).

9)   You may select single or dual head loading now. Systems are
shipped with single head loading. Dual head loading requires jumper
changes on each floppy disk drive (see section on drive options).
Dual head loading may be of help in situations where a large amount of
disk to disk I/O occurs as it reduces disk access time and may even
reduce diskette wear by minimizing head loads/unloads.

10)   After the input to number 9 above CONFIG9 will save a copy of
itself on disk with the options as selected above in a file called
'ENDUSER'. It will then ask if you want to sysgen a drive with those
options set or quit with a <CR>. In this case drive B: was sysgened.

11)   After the sysgen CONFIG9 will loop back for another possible
sysgen or a <CR> to re-boot.

4

Following is the Session With CONFIG9.COM

1)   CONFIG9 <CR>

2)   DOS 9.1x Configurator V 1.01 <CR> starts <CR>

3)   Enter name of this configuration   ENDUSER

4)   Enter turnkey file name (15 characters max) or <CR> to skip   BASIC80 MENU

5)   Enter 4 drive size codes 0 = 8", 1 = 5" or <CR> for 8"   0001<CR>

6)   Enter step rate codes 0 = 3ms, 1 = 6ms, 2 = 15ms   0002<CR>

7)   Enter number of drives actually on system, <CR> for 2   4<CR>

8)   Enter default printer option
      0 = modem 1 = line printer 2 = letter quality 3 = serial printer   2

9)   Dual head load (Y/N), <CR> FOR NO   <CR>

12) Destination drive or <CR> to quit   B

13) Destination drive or <CR> to quit <CR>

The system just configured is run later to make anther disk for the
same customer with the same options, thus the dealer uses the file
called ENDUSER created from the original configuration.

      ENDUSER <CR>

      DOS 9.1x Configured System

      **** Options Selected ****

      turnkey name BASIC80 MENU
      drive size codes 0001
      step rate codes 0002
      number of drives 4
      printer option Q
      dual head load N

      Destination drive or <CR> to quit   B<CR>

When the newly configured disk is booted up it will print the sign-on
message with the major options coded in the DOS level word as follows.

 DOS 9.13 X Y CP/M 2.2

In the DOS level word above X indicates the default printer option and
has the following values:

'M' modem port , 'L' line printer port
'Q' letter quality printer port , 'S' serial printer port
'Y' is the number of drives in the system

A few ways to execute auto-startup or turnkey operation are given below.

The easiest form of startup file is accomplished by entering the name of the application language as above followed by a menu program written in that language:

```
BASIC80 MENU
COBOL80 MENU
CRUN MENU
etc.
```

Given the limit of 15 characters it may be necessary to run a submit program in order to set all the needed system defaults. An example of an application using submit files follows.

In this example a number of defaults must be run before entering the end user menu. The order of file execution is discussed first.

Load and execute BASIC80 followed by the menu program and the BASIC80 file defaults. The command line for this appears as:

```
BASIC80 CHIRO /S:255 /F:12
```

In this case BASIC80 will load, it in turn will run the menu program 'CHRIO', and will use 256 byte records and allow 12 files to be open. The command line required to execute all of this would be 26 characters long, 11 longer than will fit into the turnkey buffer as entered under CONFIG9.

We can automate the loading of all the files by creating a submit file as shown next.

The submit file called MENU.SUB contains the command line:

```
BASIC80 CHIRO /S:255 /F:12
```

The turnkey name entered at configuration time for this is:

```
SUBMIT MENU
```

At cold boot time CP/M executes submit which in turn loads the MENU.SUB file. This loads BASIC80 then the menu program and the BASIC80 file defaults so that the end user menu finally gets executed and ready for user response.

Read over your documentation supplied by Digital Research for users of
CP/M. You may want to supplement this with any one of several books
now on the market which guide new users in the operation of CP/M.
Following are a few of the most commonly used features of CP/M for
the first-time user.

DIR

DIR<CR>

This displays the directory of the current logged on drive
A directory is a list of files (programs & information) on the disk

DIR B:<CR>

This displays drive Bs' directory

STAT

STAT<CR>

Show the amount of free space (in bytes) remaining on the drive

STAT VAL:<CR>

Show all possible device assignments (names of attached equipment)for:

con: = console
rdr: = paper tape reader
pun: = paper tape punch
lst: = printer

STAT DEV:<CR>

Show the actual current device assignment for the above peripherals

STAT LST:=LPT:<CR>

Change the system printer assignment from it's current name to a new
name. This allows you to use a high speed printer for on task and a
letter quality printer for another task.

ERA

ERA BASIC80.COM<CR> erases the file BASIC80.COM
ERA *.BAS<CR>   erases all files of type .BAS
ERA TEST.*<CR>   erases all file types with TEST as a name

                    !!!!!!!!!!CAUTION!!!!!!!!!!

                            ERA *.*
                !!!!!!ERASES ALL FILES ON YOUR DISK !!!!!!

PIP

PIP is a program used to transfer information from on device to another in CP/M. A device can be a disk drive or a printer etc.

PIP B:=A:BASIC80.COM

Transfers the file 'BASIC80.COM' from drive A: to drive B:

PIP B:=A:*.COM

Transfers all files of type .COM from A: to B:

PIP B:=A:MYFILE.*

Transfers all file types with the name 'MYFILE' from A: to B:

PIP B:=A:*.*

Transfers all files from A: to B:

PIP LST:=MYFILE.DOC

Print 'MYFILE.DOC' on the printer

COPY

Not part of CP/M per se, this is an O.E.M. supplied program used to make a backup copy from one disk to another. Both disks must be formatted exactly alike.

COPY.COM is the name suggested for the DKCOPY9.COM program when it is installed on an end user diskette.

ED

ED is CP/Ms text editing program for users writing letters or source programs

ASM

The CP/M assembler for machine code programmers

SUBMIT

The CP/M batch process program for unattended execution of a series of tasks

XSUB

Can be loaded before submit to do command line processing sequences

The Console

The console device may be changed using the stat command:

stat con:=tty:

This is the standard mode which prints on the screen .The system is in this mode at power-up.

stat con:=crt:

This mode makes the system a slave to another system. In this case it treats the modem port as the system console so that another system calling in on the modem may take command. Typing 'control-@' (a nul) at the slave keyboard resets the system to the standard mode (tty:)

The Printer

The printer may be changed to one of four devices using the stat command:

stat lst:=crt:

This is the line printer output mode

stat lst:=lpt:

This uses the letter quality port for printing

stat lst:=ul1:

This uses the serial printer port for printing

stat lst:=tty:

This sends the printer data to the modem port

See the system configurator notes for setting up various default printer values.

SYSGEN9.COM   This program is needed to sysgen all disks with the new
system tracks.

CONFIG9.COM   This is the new DOS 9.13 bios configurator. It works on a
ram image of the bios and CP/M and saves the configured version   on
disk under a user supplied name. You may sysgen a disk with the saved
configuration at any time in the future.

DKCOPY9.COM   This program does disk to disk copies (backup). It works
the same as previous programs but now it also supports 1K byte sectors
and makes three retries on a write error. This last feature means it
will never abort a copy unless the diskette has MAJOR defects.

RECOVER9.COM   The answer to diskettes with major defects. This
utility will allow you to recover ALL sectors from a disk which gives
solid read errors.

To use it run the program from drive A. When it is ready insert a disk
of the same format type as the bad one in drive B and then insert the
bad disk in drive A. Now enter <CR> and the program will read all of
diskette and copy it to drive B.

When the program is finished it will tell you to put the system disk
back in drive A and enter a <CR>. You may now read the data on drive
B. Note that bad sectors copied over to drive B: will contain one or more
bytes of incorrect data. The system will now read these sectors and not
give an error message as the data was written as accepted. To correct
these errors you will have to re-run the program on the good copy to
the point where the error was found on the bad disk and look for
errors to correct. In a word-processing program this will show up as
incorrect words. In a data base situation the errors will show up as
bad fields.

FORMAT9.COM   This program works like earlier format programs but it
creates the correct system tracks needed to support the DOS 9.13 bios.
A read test is done after the formatting operation.

WARNING ABOUT FORMAT PROGRAMS

All standard format programs have been written so as to prevent you
from easily formatting a system disk in drive A:. This drive usually
contains the CP/M system, high level languages and application
programs. Your important customer information is usually on drive B.

HOWEVER

Format programs destroy all live data on any disk they format, so be
sure you are not erasing weeks of accumulated data on the disk you
format.

IN OTHER WORDS

Since one day you will make the above fatal mistake
!!!!!!!!!! PLEASE BACKUP !!!!!!!!!!

DUF.COM

DUF is written to assist in testing drives & directories under CP/M.
When executed the following menu appears on the screen:

CP/M Disk Drive Utility
Enter Drive To Run Tests On A: to P: B<CR> <-- you select a drive here

Program Options

Dump Directory on Screen   1
Display All Invalid Directory Entries 2
Rename All Invalid Directory Entries   3
Remove All Invalid Directory Entries   4
Test Entire Disk Surface   5
Remove Bad Blocks On Drive   6
Select Another Drive   7
Enter <Control C> to Quit

Enter Your Choice

Options 1 to 6 will be followed by a printer output option so that a hard
copy of the session may be generated if needed.

Option 1 displays the entire directory on the screen with information on the
directory entry number, the extent number and the number of records written
for that extent.

Option 2 will display only improper directory entries which include files
with 'illegal' names that have embedded control characters or spaces, or
files that have pointers larger than the disk storage capacity.

Option 3 allows you to create a seed name for all bad files so that the
program will rename all such files and give you valid file names to work
with. NOTE, files with bad pointers are not renamed as they have no real
disk locations.

Option 4 erases all bad files detected by option 2 UNLESS they have
good pointers AND have been renamed by Option 3.

Option 5 WRITES DATA ONTO THE ENTIRE disk drive starting with the
directory. It then starts from the directory again and reads all the
data written. Each CP/M sector is given a unique 3 byte code when
written. If any code is missing on the read a list of the expected
code and actual code will be printed. Also any damaged sectors will
generate disk error messages. ALL INFORMATION PREVIOUSLY ON THE DISK
IS DESTROYED FOREVER, SO COPY OFF ALL YOUR DATA IF NEEDED.

Option 6 scans the entire disk from the directory and flags all bad
sectors. It the creates a file in User Area 15 which points to all the bad
disk sectors so application programs will not encounter them.

Option 7 allows you to select another drive for testing.

DM.COM

This utility has many routines for testing floppy disk drive
problems. When you run it you may get a help menu by entering
'h'<CR>.Pip this program to a c.e. disk and use it with a second
"scratch" disk when running tests. Disk test will let you know it is
ready by signing on with a '*' character.

The functions available are:

A: B: C: D: Enter one of these to tell it which drive to test

ERASE   This destroys all data on the selected disk by writing E5H
              in all sectors.

INIT   This destroys all data on the disk by writing a test
              pattern on each sector.

S/R R/W C/V   Select a combination to do sequential or random
                  sector access, test read or writes, & crc checks
                  or verify data patterns.

eg.   SRC will do sequential reads with crc checks.
              V   will verify the disk, use v only by itself as:
              *V   will verify the current disk

TON TOFF   Will turn on or off a trace print to the screen which
                  will print the current track and sector number under
                  test.

KON KOFF   Will enable or disable further disk test commands from
                  the keyboard.

LOW TRACK,   HIGH TRACK will set the lowest and highest tracks to be
                  tested. Enter a hex value from 0 to 4C for single sided
                  drives or 0 to 97 for double sided drives.

STATUS   Entering this command will prompt 'disktest' to print the
                  current drive and test option selected.

                              CAUTION

You should remove the write enable sticker from customer data
disks you wish to read test as a precaution against a write
command being accidently entered.

MASTER.COM

This program is run under CP/M from a system connected to another
system by modem or locally via cable to the modem port. The second
system is in the STAT CON:=CRT mode and the MASTER system now has
complete control of it. Both screens display the same data in response
to commands from the master system. The master system is run in the
normal manner, but it has control of the slave systems' disk and
printer(s). To exit master, enter a 'control-@' (nul) on the master
keyboard for early type keyboards. Wordstar keyboards use a 'control-
shift-2' sequence to generate a nul.

PRINTER.COM

This utility will check all printer ports for available printers. When
you run it "PRINTER" will ask you to turn on all printers connected to
the system and set them on line. You may then enter a <CR> and
"PRINTER" will display on the screen all the printers it has found to
be ready. You may then select which printer you wish to use as the
CP/M list device by entering a number from the selection menu "PRINTER"
provides.

This program may be useful in deciding if a port or printer is working
correctly by swapping cable connections and re-running "PRINTER" to
test the ready status on all the ports.

You may want to use this in some cases as a start-up list select
program on systems with two or more printers. Take a look at the
"PRINTER.ASM" file or the System Port Notes page in this guide for
assistance in writing a similar program in BASIC etc.

TBOOTGEN.COM

This utility allows you to sysgen a disk in drive B: which can then be
booted from a cold start when it is in drive B:.

To do this run 'TBOOTGEN.COM' from drive A:. When asked for source
drive enter a <CR>, and enter B as the destination drive. The disk in
drive B: will then be sysgened with a special bios which responds to a
second boot routine entered at the console at initial system start-up
time.

When the sysgen is done reset the system and enter a 'T' instead of
a 'B' to boot in CP/M. The system will boot from drive B and treat
drive A: as B: and drive B: as A:. This may be of help when it is
difficult booting from drive A: and you wish to determine if the
problem is controller or drive related. Use the disk you have created
as part of your C.E. kit.

Operation Of XFER.COM File Transfer Utility

Used To Transfer Files From System To System Via The Serial RS232 Port

Hardware Requirements:

Connect an RS 232 cable of modem type to the System modem/serial port and then to a similar port on the transmitting system.

Set the baud rate to 9600 or 300 baud on each system

Operation:

Run the program "XFER.COM" on drive A of the system. The program will ask you to enter the file extension type you wish to use. Next it will ask for a <CR> when ready to read in a transmitted file. You may enter the <CR> right away as XFER.COM will then be ready for transmitted data.

We will give a transfer example using a Basic interpreter next.
On the transmitting system load the desired source file and 'llist' it to the selected serial port. When BASIC indicates the list is complete enter a '^@' (a null character) on the system keyboard. XFER will then ask for a filename from 1 to 8 characters followed by a <CR> & create a file then loop back and repeat the prompt string for receiving another file.

NOTE:

Any ASCII or .COM files from the transmitting system may also be saved by PIP'ing the file to the serial port while XFER.COM is in the input mode.

IN CASE OF TROUBLE

If the program seems to create an empty file it may be due to the connections in the RS232 cable . Try reversing the wires connected to pins 2 & 3 on one connector end. The reason for this is often due to 'xmitted data ' & 'received data ' signal names in some systems being incorrectly referenced.

M7.COM

This is a public domain file transfer program. It is very easy to use as it has a Help command and extensive documentation. It's only drawback is that the two systems sending/receiving data need the program customized to run in each hardware environment. M7 will run as is on a ZEUS80 or RAINBOW.

Floppy disk systems will display disk error messages as outlined below

In the event of a disk I/O problem the disk will do 30 re-tries on the
sector. If it is still unable to read the sector the bios will ring the
bell and print a disk error code message as shown below.

The user may remove the disk, inspect it for lack of write-enable
sticker, or dirt or poor disk seating. the same disk must then be re-
inserted in the system and a carriage-return typed. The system will
allow the operator to repeat the above procedure three times before
giving up on the disk. If the system reads the disk O.K. it will erase
the error message from the screen .If the system gives up it will
print 'Bdos Err on drive X, bad sector ' and wait for a <CR> or
<control-C> .

```
disk error   drive    err type        track  #  sector # head
:              :         :              :         :         :
:              :         :              :         :         :
:    +----------+        :              :         :         :
:    :                   :              :         :         :
:    :  +---------------+               :         :         :
:    :  : +-------------------------+            :         :
:    :  : :  +-------------------------------+         :
:    :  : :  :  +---------------------------------+
Err A: x tt ss h
```

where x is 1 to 7

1 = drive not ready
2 = disk write protected (write enable sticker not in place)
3 = data write failed
4 = can't find data on sector
5 = bad crc on data read
6 = data lost during read or write
7 = disk not of readable format

the codes for the error message are:

disk err   a disk I/O error has occurred
drive   the drive in error (eg A:, B:)
err type   a number from 1 to 7 as noted before
sector #   the sector giving the error
track#   the track on the disk in error which is bad
head   0 is bottom head, 1 is top head

The new system monitor (V 3.75) accepts the following boot codes:

B   boot CP/M or MP/M from floppy drive A:

      this command will boot a p.i.o. or d.m.a. floppy disk controller.

H   boot CP/M or MP/M from a hard disk

T   boot CP/M from drive B:

      this will boot a p.i.o. or d.m.a. floppy controller from drive B:
      provided that drive contains a disk with the 'TBOOT' CP/M on it.

System Monitor Function Codes

The following functions are supported by the monitor :

D ssss eeee   dump hex data from start address ssss to end address

                 eeee   in hex with ASCII decodes to right.

E mmmm   examine a memory location in hex at mmmm. By hitting the

            space bar the monitor will increment to the next location.

I pp   input from hex port pp and show the data input in hex

K   act like a typewriter, that is echo all keyboard input
           on screen & go back to command mode if 'ESC' key hit

L   do system memory test until last bank checked after an 'ESC'
           character is entered at main keyboard

M   use the modem port for all I/O. You can run the monitor
           from another screen or modem

O pp dd   output to the specified port pp the hex data dd

P   allow hex code programming from the location speci-
           fied in the examine code. you may enter 2 hex nibbles
           , then the monitor will increment to the next location
           and wait for the next code to be entered.

R   run a program from the current location specified
           in the examine code.

Monitor Power Up Sequence And Messages

At power up the monitor tests all memory banks by writing and
reading a 'walking' data pattern into the lower 60K. It works on one
location at a time for the pattern shifting after it has nulled all of
memory. Next it checks to see if any nulled location has changed. If
so it will report an error on the system screen. If the lower 60K
tested O.K. it will then write a 60K program in memory starting from
location 0000H, and then execute that program. It prints the character
'O' on the screen just before executing the program. If it should fail
the system will probably lock up at this point. If the program runs
O.K. the next bank of memory will be tested. When the last bank has
been tested the program will switch back bank 00 and run a test on the
upper 4K. Finally it will write nulls into every bank and all 64K in
order to have a good parity setting, then reset the parity flip-flops
and sign on as follows:

Last Bank = 00   (may be 00 to 07)
V 3.73   (or greater)
>Ready

If an error occurred in the system ram it will print the bad data and
address as follows:

DD AAAA

AAAA is the exact address of the memory failure in hex

DD is has a logical one set for each bad bit found

eg:

01   bit 0 bad
02   bit 1 bad
03   bit 0 and bit 1 bad

Outlined below are the main features of MP/M which will affect the way
you approach this o.s. from an application standpoint.

File and Record Locks

A disk file is automatically locked from access by other users once it
has been opened. In the case of files you wish to make accessible to
all users (such as WordStar and its' overlays or utilities) you must
set them under STAT with the $SYS and $R/O attributes activated. It
may be necessary to use some of the compatibility attributes for file
I/O. Check the application notes with MP/M for further details.

DSKRESET

This is an MP/M processor which must be run each time media is changed
in a drive. You may emulate this program by using BDOS function 37 in
your application. If a program such as 'BASIC80' or 'WORDSTAR' has
loaded a file or opened a file you will not be able to run the
dskreset until all files are closed. In order to change media and run
dskreset the application program must use its' own reset function
first.

!!!!!!!!NOTE!!!!!!!

When loading an application language or package you may see from time
to time the 'Disk Reset Denied' message on the console. This does not
affect the program but it messes up the screen. Also it doesn't mean
you will fail in loading your other modules, it simply indicates a
condition at one particular instant.

Detaching From A Program

A '^D' at the keyboard detaches a program provided that program is
reading the console and uses the system I/O editor to detect the '^D'.
BASIC, WORDSTAR etc. don't allow this feature, however a call to a
routine to detach should be possible.

Aborting A Program

On the other hand you may abort 'BASIC80' etc from another console.
Suppose you are at console 1A and BASIC80 is on console 0B (logged on
to drive B) by typing 'abort BASIC80.COM 0B' you will force 'BASIC80'
to do the equivalent of a 'SYSTEM' command.

MPMSTAT

This program displays the current system status with respect to memory
allocation, running processes, attached processes , waiting processes
etc.

MP/M 2.1 is configured by running GENSYS.COM as shown below.

GENSYS

MP/M II V2.1 System Generation
Copyright (C) 1981, Digital Research
Default entries are shown in (parens).
Default base is Hex, precede entry with # for decimal

```
Top page of operating system (FF) ? <CR>
Number of TMPs (system consoles) (#4) ? <CR>
Number of Printers (#1) ? #3<CR>
Breakpoint RST (06) ? 05<CR>
Enable Compatibility Attributes (N) ? <CR>
Add system call user stacks (Y) ? <CR>
Z80 CPU (Y) ? <CR>
Number of ticks/second (#60) ? <CR>
System Drive (A:) ? <CR>
Temporary file drive (A:) ? <CR>
Maximum locked records/process (#16) ? <CR>
Total locked records/system (#32) ? <CR>
Maximum open files/process (#16) ? <CR>
Total open files/system (#32) ? <CR>
Bank switched memory (Y) ? <CR>
Number of user memory segments (#3) ? #5
Common memory base page (C0) ? <CR>
Dayfile logging at console (Y) ? N<CR>

 SYSTEM  DAT  FF00H  0100H
 TMPD    DAT  FE00H  0100H
 USERSYS STK  FC00H  0200H
 XIOSJMP TBL  FB00H  0100H

Accept new system data page entries (Y) ? <CR>

 RESBDOS SPR  EF00H  0C00H
 XDOS    SPR  CD00H  2200H

Select Resident and Banked System Processes:

 ABORT   RSP (N) ? <CR>
 MPMSTAT RSP (N) ? <CR>
 SCHED   RSP (N) ? <CR>
 SPOOL   RSP (N) ? <CR>

 BNKXIOS SPR  BC00H  1100H
 BNKBDOS SPR  9900H  2300H
 BNKXDOS SPR  9700H  0200H
 TMP     SPR  9300H  0400H
 LCKLSTS DAT  9000H  0300H
 CONSOLE DAT  8C00H  0400H
continued on next page...
```

```
Enter memory segment table:

 Base,size,attrib,bank (8C,74,80,00) ? <CR>
 Base,size,attrib,bank (00,C0,00,01) ? <CR>
 Base,size,attrib,bank (00,C0,00,02) ? <CR>
 Base,size,attrib,bank (00,C0,00,03) ? <CR>
 Base,size,attrib,bank (00,C0,00,04) ? <CR>
 Base,size,attrib,bank (00,C0,00,05) ? 0,8C,0,0 <CR>


 MP/M II Sys  8C00H  7400H   Bank 00
 Memseg  Usr  0000H  C000H   Bank 01
 Memseg  Usr  0000H  C000H   Bank 02
 Memseg  Usr  0000H  C000H   Bank 03
 Memseg  Usr  0000H  C000H   Bank 04
 Memseg  Usr  0000H  8C00H   Bank 00


Accept new memory segment table entries (Y) ? <CR>

** GENSYS DONE **

A>
```

Resident System Processes take up common memory, thus reducing user
ram space. Your best bet for now is to get along without them but you
should include a few on a special disk to get familiar with
them.

   Note on PIPing over files from the Digital Research MP/M disk

When creating a new MP/M disk you may run it under a submit file which
selects the file extension types you really need. For instance you
don't need any of the '.ASM' type files, the '.LIB' files, the '.SUB'
files , and in customer applications you may omit a number of the
'.COM', '.SPR' and 'RSP' files. Check your MP/M guides for further
details. THE IDEA IS TO KEEP AS FEW ENTRIES AS POSSIBLE IN THE
DIRECTORY OF AN MP/M SYSTEM. This reduces the search & load time when
disk contention is high.

Selecting The Memory Page Size For EARLY MP/M RAM Boards

The page select switch is SW 5 on the lower-centre of the ram board.
The eight rockers are viewed as an upper and lower address nibble for
the memory page boundary. The individual rockers are in turn arranged
as low order bit at left to high order bit at right. If the rocker is
set to the 'off' position it represents a logical one or high. In the
'on' position it represents a logical zero or low.

If your board is shipped initially set for the memory boundary at C000
hex then the rockers appear as follows;

upper   high bit   off = 1   for an upper
nibble   off = 1   nibble value
                                 on = 0   of C hex
                 low bit   on = 0

lower   high bit   on = 0   for a lower
nibble   on = 0   nibble value
                                 on = 0   of 0 hex
                 low bit   on = 0

Setting The Board & Bank Address Switches

SW 2 is set according to the boards bank locations. If it is the first
256K board, then the four rockers on the right are set on, all others
set off. If it is the second 256K board then the second 4 rockers from
the right are set on the last switch is set on all others are off.

To the right of SW2 is SW3. The last four rockers from the right are
always on, with the first four always off. SW1 is always empty (off).

Jumper Plug Option

 If the board is the first one in the system then the jumper plug just
below U12 is in place. If it is the second board in the system then
the jumper plug is removed.

The basic port data for all I/O channels on the system with a fully populated multi-port board is as follows:

port name	status port value	data port value	receive ready	xmit ready
------------------ main chassis ports ------------------				
main screen	00H	01H	02H	04H
0 con. 1	04H	05H	01H	80H
1 con. 2	02H	03H	01H	80H
line printer	06H	07H		01H
letter printer	06H	06H/07H		80H
------------------ multi-port channels ------------------				

multiport label & system function	status port value	data port value	receive ready	xmit ready
0 con. 3	12H	13H	01H	80H
1 con. 4	14H	15H	01H	80H
2 con. 5	16H	17H	01H	80H
3 con. 6	1EH	1FH	01H	80H
4 con. 7	10H	11H	01H	80H
COM	1DH	1CH	02H	01H
5 uart	22H	23H	01H	80H
6 uart	24H	25H	01H	80H

Multi-port #6 has its' baud rate changed by outputting 00H or FFh to port 2EH. The actual rates are selected on the board via jumper options as desired.

top connector : modem or serial I/O port or MP/M console 1 port

```
pin #      signal                 level
------------------------------------------------------------------
1          gnd
2          input data             RS232
3          output data            RS232
7          gnd
```

A jumper from pin 11 to 12 sets baud rate at 300
A jumper from pin 12 to 13 sets baud rate to 9600 or 19.2K

second connector : serial printer port or MP/M console 2 port

```
pin #      signal                         level
------------------------------------------------------------------
1          ground
2          input data                     RS232
3          output data                    RS232
4          busy * from printer            RS232
7          gnd
9          data set ready                 +12v with 1k series resistor
```

A jumper from pin 11 to 12 sets it for serial printer use
A jumper from pin 12 to 13 sets it for console use.
The baud rate is always 9600

third connector: line printer & fourth connector: letter printer

```
pin #      signal                 level
------------------------------------------------------------------
1          strobe*                ttl ( same for all signals )
2          data bit 1
3          data bit 2
4          data bit 3
5          data bit 4
6          data bit 5
7          data bit 6
8          data bit 7
9          data bit 8
11         busy
14         gnd
```

note: A signal name followed by "*" means active low (IEEE standard
designation)

Serial Data Signal Note

the serial data output is formatted as follows:

start bits = 1 , data length = 8
stop bits = 2 , parity disabled

```
port 00H   video display status port
           02H = keyboard data available
           04H = ready for transmission to screen

port 01H   keyboard & screen data I/O port


port 02H   if serial printer then:
           serial printer status port
           80H = printer ready for data

port 03H   if serial printer then:
           serial printer data port

port 02H   if MP/M console then:
           console status port
           01H = data from console ready
           80H = console ready to receive data

port 03H   if MP/M console then:
           console data I/O port

port 0FH   MP/M console data in port for above console
           to maintain compatibility with early c.p.u.

port 04H   if modem or MP/M console
           device status port
           01H = data from device ready
           80H = device ready to receive data

port 05H   if modem or MP/M console
           device data I/O port


port 06H   parallel printer(s) status port
           01H = line printer busy
           80H = letter printer busy

port 07H   parallel printer(s) data out port

port 08H   clock/calendar command port

port 09H   clock/calendar data port

port 0AH   turn off cpu monitor ROM.

port 0BH   turn on cpu monitor ROM.

port 0CH   turn off MP/M interrupt

port 0DH   turn on MP/M interrupt
```

```
                      Standard System Cable Diagrams


Standard Serial Cable to Console
System End                                                Device End


            +---+                               +---+
    gnd     : 1 :-------------------------------: 1 :  gnd
            :   :                               :   :
    data in : 2 :-------------------------------: 2 :  data out
            :   :                               :   :
    data out: 3 :-------------------------------: 3 :  data in
            :   :                               :   :
    gnd     : 7 :-------------------------------: 7 :  gnd
            +---+                               +---+


Standard Serial Cable to Modem


            +---+                               +---+
    gnd     : 1 :-------------------------------: 1 :  gnd
            :   :                               :   :
    data in : 2 :-------------------------------: 3 :  data out
            :   :                               :   :
    data out: 3 :-------------------------------: 2 :  data in
            :   :                               :   :
    gnd     : 7 :-------------------------------: 7 :  gnd
            +---+                               +---+


Serial Cable to Printer
note: for lsi 300 busy* is pin 14 at printer


            +---+                               +----+
    d.s. rdy : 9 :-----------------------------: 6,8: d.s. rdy
            :   :                               :    :
    busy*    : 4 :-----------------------------: 11 : busy*
            :   :                               :    :
    data out : 3 :-----------------------------: 3  : data in
            :   :                               :    :
    gnd      : 7 :-----------------------------: 7  : gnd
            +---+                               +----+


Parallel Cable or Centronics type interface


            ------                              ------
    strobe* : 1  :-----------------------------: 1  :  strobe*
    data 1  : 2  :-----------------------------: 2  :  data 1
    data 2  : 3  :-----------------------------: 3  :  data 2
    data 3  : 4  :-----------------------------: 4  :  data 3
    data 4  : 5  :-----------------------------: 5  :  data 4
    data 5  : 6  :-----------------------------: 6  :  data 5
    data 6  : 7  :-----------------------------: 7  :  data 6
    data 7  : 8  :-----------------------------: 8  :  data 7
    data 8  : 9  :-----------------------------: 9  :  data 8
    busy    : 11 :-----------------------------: 11 :  busy
    gnd     : 14 :-----------------------------: 16 :  gnd
            ------                              ------
```
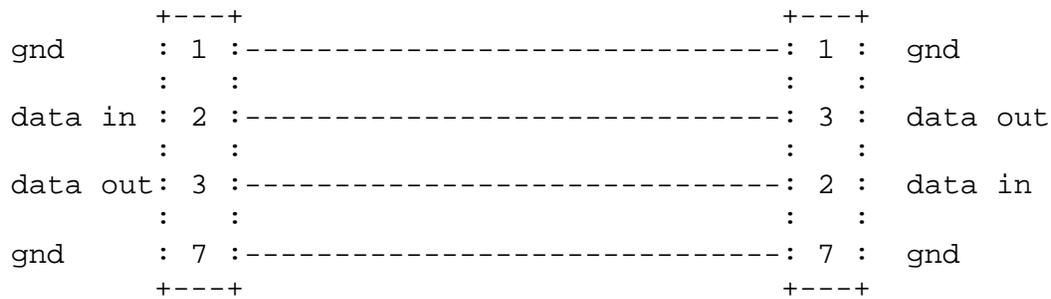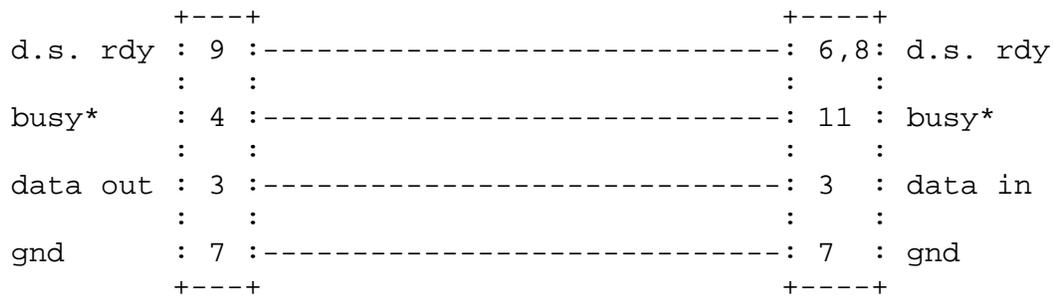
IEEE S100 System Bus Signals

pin #   name   function

1   +5V/+8V   +5V if regulated else +8V if unregulated
2   +12V/+16V   +12V if regulated else +16V if unregulated
3   XRDY   ready input # 1
4   VI0*-   vectored interrupt line 0
5   VI1*-   vectored interrupt line 1
6   VI2*-   vectored interrupt line 2
7   VI3*-   vectored interrupt line 3
8   VI4*-   vectored interrupt line 4
9   VI5*-   vectored interrupt line 5
10   VI6*-   vectored interrupt line 6
11   VI7*-   vectored interrupt line 7
12   NMI*-   non-maskable interrupt
13   PWRFAIL*   optional power fail
14   DMA3*-   TMA priority bit 3
15   A18   extended address bit 18
16   A16   extended address bit 16
17   A17   extended address bit 17
18   SDSB*-   disable 8 status signals
19   CDSB*-   disable 5 command/control
20   GND   logic ground
21   NDEF   not defined
22   ADSB*-   disable 16 address
23   DODSB*-   disable 8 data out
24   02   master liming signal
25   pSTVAL*   status valid strobe
26   pHLDA   cpu transfers bus control
27   RFU   reserved for future use
28   RFU   reserved for future use
29   A5   address bit 5
30   A4   address bit 4
31   A3   address bit 3
32   A15   address bit 15
33   A12   address bit 12
34   A9   address bit 9
35   DO1/ED1   data out bit 1/even data bit 1
36   DO0/ED0   data out bit 0/even data bit 0
37   A10   address bit 10
38   DO4/ED4   data out bit 4/even data bit 4
39   DO5/ED5   data out bit 5/even data bit 5
40   DO6/ED6   data out bit 6/even data bit 6
41   DI2/OD2   data in bit 2/odd data bit 2
42   DI3/OD3   data in bit 3/odd data bit 3
43   DI7/OD7   data in bit 7/odd data bit 7
44   sM1   op-code fetch
45   sOUT   data to output device
46   sINP   data from an input device
47   sMEMR   data from memory
48   sHLTA   show a halt condition
49   CLOCK*   optional 2mhz clock
50   GND   logic ground

```
pin #       name        function

51          +5V/+8V     same as pin 1
52          -12V/-16V   -12V if regulated else -16V if unregulated
53          GND         logic ground
54          SLAVE CLR*- system reset for slave processors
55          DMA0*-      TMA priority bit 0
56          DMA1*-      TMA priority bit 1
57          DMA2*-      TMA priority bit 2
58          sXTQR       request for 16 bit slaves to assert SIXTN
59          A19         extended address bit 19
60          SIXTN*-     16 bit slave response to sXTQR
61          A20         extended address bit 20
62          A21         extended address bit 21
63          A22         extended address bit 22
64          A23         extended address bit 23
65          NDEF        not defined
66          NDEF        not defined or Z80 refresh signal
67          PHANTOM*-   phantom control
68          MWRITE      write data to memory
69          RFU         reserved for future use
70          GND         logic ground
71          RFU         reserved for future use
72          RDY-        ready input #2
73          INT*-       primary interrupt request line
74          HOLD*       bus command control signal
75          RESET*-     reset system signal
76          pSYNC       signal identifying BS1
77          pWR*        valid data on DO or data bus
78          pDBIN       data input request on DI or data bus
79          A0          address 0
80          A1          address bit 1
81          A2          address bit 2
82          A6          address bit 6
83          A7          address bit 7
84          A8          address bit 8
85          A13         address bit 13
86          A14         address bit 14
87          A11         address bit 11
88          DO2/ED2     data out bit 2/even data bit 2
89          DO3/ED3     data out bit 3/even data bit 3
90          DO7/ED7     data out bit 7/even data bit 7
91          DI4/OD4     data in bit 4/odd data bit 4
92          DI5/OD5     data in bit 5/odd data bit 5
93          DI6/OD6     data in bit 6/odd data bit 6
94          DI1/OD1     data in bit 1/odd data bit 1
95          DI0/OD0     data in bit 0/odd data bit 0
96          sINTA       strobe interrupt device
97          sWO*        cycle transfer of data from master to slave
98          ERROR*-     error condition during current cycle
99          POC*        power on clear ( reset system )
100         GND         logic ground
```
* means active low signal, - means open collector signal

Optional Printer Port Control Data

A serial printer may be controlled and driven by the 5000 terminal.
When ordering a terminal with the printer option specify the correct
interface type to match your printer. The printer may be fed data
transmitted to the terminal in one of three modes.

1) data sent to console is written only to printer
2) data sent to console only
3) data sent to console is written on console and printer

The console is in mode 2 at power-up.

It is advisable to turn the console on before the printer to ensure
that no false data goes to the printer during console initialization.
The modes are set in the console by the following control sequences:

mode   character string sent to console
----
1   esc chr(01)   (esc/ctrl-A)

2   esc chr(03)   (esc/ctrl-C)

3   esc chr(02)   (esc/ctrl-B)

In all other respects the system terminal looks like the main screen of the
system as far as your software is concerned.

Adjustment Of Console Contrast, Focus And Brightness

If the console does not seem to have a good range of contrast or focus when
in full and half intensity modes you may remove the top cover (via two
screws in the rear lower portion of the cover) and thus gain access to
additional controls. Be sure to unplug the unit before removing the cover.

With the cover off turn the power on and let the screen warm up for a few
minutes. If you are not on the system remove the console signal cable and
insert a wire jumper from the receptacle pins 2 and 3 to enable your
keyboard to print on the screen. Enter a series of characters on the
screen in full, then half intensity. Turn the external contrast knob to
a position of full intensity, then back it off so that the image is close to
the desired end result.

You can now adjust the focus and brightness pots on the video
deflection board. This board is mounted vertically in the console near
the c.r.t. tube.

Adjust the focus control to sharpen the image. Now slowly adjust the
brightness control and remove your hand from the control from time to time
to see the actual effect (the proximity of your hand to the impedance
and voltage in this area produces a modification to the circuit which
will be noted when you remove your hand). Check your final setting by
ensuring there is still an adequate range of control available.

Wordstar Keyboard Character Codes

The WordStar keyboard has a number of keys read by the Wordstar
program to initiate screen editing. these keys have the chr$ and hex
values listed below. note that each key also has an effect on the
system screen itself as shown on the right.

How the system responds to these keys depends on the type of keyboard
character handling of the application language, the application
program or CP/M when in the CP/M command mode.

Wordstar key name	chr$	hex	usual response
para reform	2	02	erase to end of screen
insert	22	16	underline @ ½ intensity
scroll dn page	3	03	lead-in for graphics
scroll up page	18	12	reverse field
delete word rigth	20	14	half intensity
insert line	14	0E	fore space
delete line	25	19	delete line
special character	16	10	none
block move	11	0B	home
on screen format	15	0F	up line
help	10	0A	line feed
quick	17	11	stop attribute
<--- word	1	01	erase to end of line
^ :	5	05	none
---> word	6	06	enable cursor
<---	19	13	reverse at ½ intensity
down arrow	24	18	insert line
--->	4	04	disable cursor

```
               Model 5000 Video Display Control Characters

control          function                        chr #        hex
character
-----------------------------------------------------------------
ctr-@            ignore                            0           00
ctr-a            erase to end of line              1           01
ctr-b            erase to end of screen            2           02
ctr-c            lead-in special characters        3           03
ctr-d            disable cursor                    4           04
ctr-e            none                              5           05
ctr-f            enable cursor                     6           06
ctr-g            bell                              7           07
ctr-h            back space                        8           08
ctr-i            tab                               9           09
ctr-j            line feed                         10          0A
ctr-k            home                              11          0B
ctr-l            none                              12          0C
ctr-m            carriage return                   13          0D
ctr-n            forespace                         14          0E
ctr-o            up line                           15          0F
ctr-p            none                              16          10
ctr-q            stop attribute                    17          11
ctr-r            reverse field                     18          12
ctr-s            reverse at half intensity         19          13
ctr-t            half intensity                    20          14
ctr-u            underline                         21          15
ctr-v            underline at half intensity       22          16
ctr-w            no enhancement                    23          17
ctr-x            insert line                       24          18
ctr-y            delete line                       25          19
ctr-z            clear screen                      26          1A


ESC=OY,OX        cursor position        ESC        27          1B
                                        =          61          3D
                 O = offset             O          32          20


Thus a position @ line 10 col. 23 is obtained with:

27,61,42,55 decimal sent to the screen

Following is a basic routine to position the cursor

10 width 255
20 def fnyx$(y%,x%) = chr$(27) + chr$(61) + chr$(32+y%) + chr$(32+x%)
30 rem print starting prompt at line 5, character 40
40 a = 5: b = 40
50 a$ ="please enter your choice from menu"
60 gosub 10000
70 ......

10000 print fnyx$(a,b)a$
10010 return

note: Always set the width to 255 in Microsoft Basics
```

Displayable Video Characters

print	chr#	hex		print	chr#	hex
space	32	20	:	P	80	50
!	33	21	:	Q	81	51
"	34	22	:	R	82	52
#	35	23	:	S	83	53
$	36	24	:	T	84	54
%	37	25	:	U	85	55
&	38	26	:	V	86	56
'	39	27	:	W	87	57
(	40	28	:	X	88	58
)	41	29	:	Y	89	59
*	42	2A	:	Z	90	5A
+	43	2B	:	[	91	5B
,	44	2C	:	\	92	5C
-	45	2D	:	]	93	5D
.	46	2E	:	^	94	5E
/	47	2F	:	-	95	5F
0	48	30	:	'	96	60
1	49	31	:	a	97	61
2	50	32	:	b	98	62
3	51	33	:	c	99	63
4	52	34	:	d	100	64
5	53	35	:	e	101	65
6	54	36	:	f	102	66
7	55	37	:	g	103	67
8	56	38	:	h	104	68
9	57	39	:	i	105	69
:	58	3A	:	j	106	6A
;	59	3B	:	k	107	6B
<	60	3C	:	l	108	6C
=	61	3D	:	m	109	6D
>	62	3E	:	n	110	6E
?	63	3F	:	o	111	6F
@	64	40	:	p	112	70
A	65	41	:	q	113	71
B	66	42	:	r	114	72
C	67	43	:	s	115	73
D	68	44	:	t	116	74
E	69	45	:	u	117	75
F	70	46	:	v	118	76
G	71	47	:	w	119	77
H	72	48	:	x	120	78
I	73	49	:	y	121	79
J	74	4A	:	z	122	7A
K	75	4B	:	{	123	7B
L	76	4C	:	l	124	7C
M	77	4D	:	}	125	7D
N	78	4E	:	~	126	7E
O	79	4F	:		127	7F

For a standard floppy system make the following options.

cuts

on the jumper plug
cut jumper 'x'
cut 'hl'

jumps

at 'hi' jump 'c'
'DS'
'S2'
'IW'
'rs'
'850'
'AF'
'2S'

For the SA 1004 winchester system check for the following jumps

'IW'
'2S'
'850'
'RS'
'S2'
'AF'
'IT'
'M'

Make sure all the jumpers on the jumper plug are in place

For dual head load select as follows:

 jumps

 'DS'
 'C'

 cuts

 'A'
 'HL'

Serial Operation

Basic Switch Settings For Serial Or Parallel Use

Refer to LSI 300 manual, section 3, starting at table 3-2

switch sb options

switch #	position	results
1	off	suppress cr/lf at right margin
2	on	suppress cr on ff, lf, vt
3	on	no lf on cr command
4	on	no perf. skip
5	n/a	consult lsi rep.
6	off	single space
7	off	6 lines/inch
8	on	allows option changes

switch sc options

switch #	position	results
1	on	serial port active
2	off	no parity
3	off	no substitution on error
4	n/a	
5	on	half duplex
6	on	2 stop bits
7	off	off line at power up
8	off	primary font

Serial Operation

switches sd and se (for serial operation only)

set all positions to off

Baud Rate Setting On LSI 300

Check LSI 300 manual table 3-7 for baud rate switch setting.

Additional Serial Options

Check table 3-8 in the LSI 300 manual for options set on the logic
card within the printer chassis. This card, the type of switches and
options available differ from revision to revision, so insure that
your manual matches your logic card. check with you LSI rep. If it
does not match.

Parallel Options

In general all the above options remain the same except for switch
sc, rocker # 1 which is now turned off. Note that the printer must be
turned off, then on again for any option to take effect.

Floppy Disk Care & Maintenance

Preventive Maintenance

The basic objective of preventive maintenance is to ensure minimum machine downtime. Visual inspection should be the first step in every preventive maintenance operation. Look for dirt, wear, corrosion, loose connections, binding, etc.

The electro-mechanical nature of the disk drive makes it the primary component requiring preventive maintenance. A clean operating environment promotes longer disk life and extended periods between disk drive malfunctions.

The following inspections and operations should be performed every 12 months.

unit	observe	action
read/write head	check oxide build up	clean if needed
belt	frayed or weak areas	replace if needed
head position band	dirt or oil build up	clean if needed
base	oxide and dirt build up	clean if needed
read/write head	proper alignment	make necessary adjustments

Details on adjustments and service checks can be found in the service and maintenance manual for MFE 500-550 and 700-750 series of flexible disk drives, or the Shugart 850/851 maintenance manual.

Inspect And Clean Disk

The disk drives should be cleaned every day using the special cleaning disk provided with the system. Cleaning of the drives is carried out by running the disk cleaning program provided with the system. The program will guide the operator through the steps required to clean both disk drives . The cleaning disk itself should be visually inspected before each use in order to determine if it shows signs of excessive wear. If the cleaning disk has rips or areas where the fabric is frayed it should be discarded and a new one used in its place. Some cleaning disk kits require a fluid to be applied to the disk before each use. In general the "dry" type of cleaning disk is supplied with the system, but if a "fluid" type is supplied follow the program directions in applying the cleaning fluid to the disk.

Note

Shugart recommends only one brand of cleaning diskette check with Sales for type and availability.

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     Familiarize yourself with the disk cleaning directions supplied
with the cleaning kit. Examine the cleaning disk for wear. Put the
diskette with the disk cleaning program in drive A and remove any
program diskette that may be in drive B, then run the disk cleaning
program. The program will remind you to inspect the disk. The program
will cue you to insert the cleaning disk in drive B and close the
door. Enter the required response when this is done and the program
will spend about one minute cleaning the heads on drive B. You will
then be cued to remove the program disk in drive A and insert the
cleaning disk in it. When inserted, enter the correct response and the
program will clean the drive. After a minute the program will cue you
to remove the cleaning disk and re-insert the program disk.

CRT Glass & Keyboard Care

     Dirt build-up on crt and keyboard will increase the chances of
gritty matter entering the system case and damaging the customer
program and data diskettes.

Cleaning The CRT

     The crt screen will attract a film of dust with time and thus
reduce the contrast of the characters on the screen. It may be cleaned
with a lint free cloth and a standard window cleaning solution .Be
sure the system is turned off during this operation and that the
keyboard top is covered so that none of the airborne solution filters
down between the keys.

Cleaning The Keyboard

     The keyboard may be cleaned with the same solution used on the
crt glass but the solvent should first be applied to a lint free cloth
until it is just damp. This is to prevent a rapid build up of cleaning
solution inside the base of the keyboard. The keys may then be wiped
with the cloth and dried with a similar cloth once the keys appear
clean.

As noted earlier most problems with the system can be traced to some
mechanical based source in the form of dirt, extreme mechanical shock
or poor connection. In many cases the cause cannot be easily seen and
a method of test and elimination will be needed to reach the problem
source. With this in mind use the following guide to assist you in
eliminating any problems.

System Will Not Turn On

1)   Check the power cord connections at the rear of the system and in the
wall outlet. Make sure some other device can work in the same outlet
to eliminate a fuse or breaker problem in the building wiring.

2)   Listen for operation of the fan or disk drives. If they seem to be
running the problem is likely in the D.C. power supply. If the fan and
drives are running skip down to 8).

3)   With the power cord removed from the outlet inspect the A.C. fuse(s)
in the system.

4)   Make sure the power switch will turn fully on. Some internal
obstruction may keep the contacts from closing.

5)   Remove the cabinet cover and examine the A.C. terminal block for bad
connections.

6)   With the power cord removed from the wall outlet connect the leads of
an ohm meter or DVM set to low ohms on each of the power cord prongs.
If you turn on the system power switch the ohms reading should drop to just a
dozen or so ohms. If a low reading if registered trace along each conducting
element in the primary power end until you find an open element.(eg:
defective wire in power cord, open conductor in power cord filter connector
on rear chassis, open fuse non-closing power switch etc).

7)   Replace faulty part in primary circuit and check system for operation.
If all primary circuits are now working but the system is still not
working then continue with 8).

8)   Check D.C. power supply for bad connections in primary winding of
transformer. Remove the primary winding from the system power block and
measure it with an ohms scale. It should give a reading of under a few dozen
ohms. If it does not replace the supply. Remove any power connectors going
to the mother board and disk drives and turn the power on again. With a
volt range check for +5 volts working on the supply. If no voltage is
measured replace the supply. If +5 is O.K. check for +12, -12, -5 and +24
volts as required by the system. If any voltage is not present replace the
supply. If all power is available turn off the supply and connect it to one
load at a time, then power on again and check for good D.C. In this way you
may find a drive or logic card is loading the supply down. If any load will
always load the supply down then replace the supply. If just one particular
load kills the supply replace the board or drive or C.R.T. causing the
problem. Note that if the card cage loads the supply down you may

remove all the boards and re-test the supply. If it is still loaded
down replace the card cage. If it is alright then insert one logic
card at a time (by itself) to find the card loading the supply. If
only two or more cards cause the problem then replace the supply.

System Gives Memory Errors Or Won't Boot After Power-up Test

9)   Check the power supply for proper voltages on the D.C. side. If any
voltage is over + or - 5% then work down from step 8.

10)   If this is a booting problem check and replace the disk drive control
cable leading to the disk controller.

11)   Remove cards from mother board and check for dirty contacts. If any
look dirty clean all of them with isopropyl alcohol (98% tech).

12)   If problem persists replace the logic cards with know good ones one at
a time until the problem corrects itself.

13)   If replacing all cards has no effect then with system powered on check
the +5, +12 and -12 voltages on each logic card. If one card has a low
reading it may indicate a bad card slot. If possible shift that card
to an unused slot. If any voltage seems too high or low check it back
at the power supply. If it is O.K. at the supply there may be a high
resistance in the cables going to the mother board, or on a power bus
on the mother board itself. Replace the mother board if this is so.

14)   If the system still will not boot insert a 'TBOOT' disk in drive B and
enter 'T' to load the system from that drive. If the system loads
place a disk in the former drive A and try to read it's directory (it
is now drive B remember). If it will not respond replace the drive.

System Gives Intermittent Problems With Disk File I/O

15)   Perform checks as indicated from steps above to ensure all connections
and voltages are O.K. If everything looks O.K. you should document the
problems carefully and check with the manufacturer.