
* SYSTEM REFERENCE *
* 11/22/83 *

CONTENTS

System Specifications.....p1

CP/M SECTION

DOS 9.13 Notes.....p3

DOS 9.13 features & configuring your bios

Using the System Configuration Program.....p4

A Brief Introduction to CP/M.....p7

SYSTEM I/O Modes.....p9

how to change console and list I/O from the keyboard

Standard Utilities for DOS 9.11.....p10

Additional CP/M Utilities.....p11

Disk Error Messages.....p15

how they appear, what they mean

The System Monitor.....p16

MP/M SECTION

A Very Brief Introduction to MP/M.....p18

Configuring MP/M 2.1.....p19

software & hardware considerations & an intro to MP/M

Memory Board Option Notes.....p21

Multiport Board Notes.....p22

GENERAL INFORMATION

Back Panel Signal Lines.....p23

system communication with the outside world

System Port Notes.....p24

the 15 standard I/O ports & their options

System Cable Diagrams.....p25

connections for I/O devices to the system

System Bus Signals.....p26

internal control for the system

Model 5000 Terminal Notes.....p28

The Wordstar Keyboard.....p29

Video Display Control Characters.....p30

take advantage of the screens' programability

Displayable Video Characters.....p31

Some Printer & Floppy Disk Options.....p32

switch & jumper options for the LSI 300 & Shugart SA850

CONTENTS

(cont)

System Care & Maintenance.....p35
routine checks & cleaning for reliable operation

Trouble Shooting Guide.....p37

System Specifications

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" double 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 positioner 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 modular 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

.NP

System Specifications
(cont)

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 compatible 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

New Floppy CP/M Bios Notes
(DOS 9.13)

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.

Notes on the System Configurator

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.

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 another 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

Notes On Turnkey System Files

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.

CP/M Quick Guide

Read over your documentaion 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 feratures 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 attatched 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 one 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:=ull:
```

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.

A Brief Guide To Utilities For DOS 9.13

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 disketes 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 !!!!!!!!!!!!!

Additional CP/M Utilities

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 then creates a file in User Area 15 which points to all the bad disk sectors. In this way application programs will not encounter bad spots on the disk.

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 accidentally 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 selectin 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 'l1ist' 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.

Disk Error Messages

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
```

System Monitor

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 specified 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
```

A Very Brief Introduction To MP/M

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.

Configuring MP/M 2.1

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

Multi-Port Board I/O

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 first -----				
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 next -----				
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.

Back Panel Signal Lines

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 consol use

the baud rate is always 9600

third connector: line printer & fourth connector: letter printer

pin #	signal	level
1	strobe*	t11 (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

System Port Notes For C.P.U.

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 compatability 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

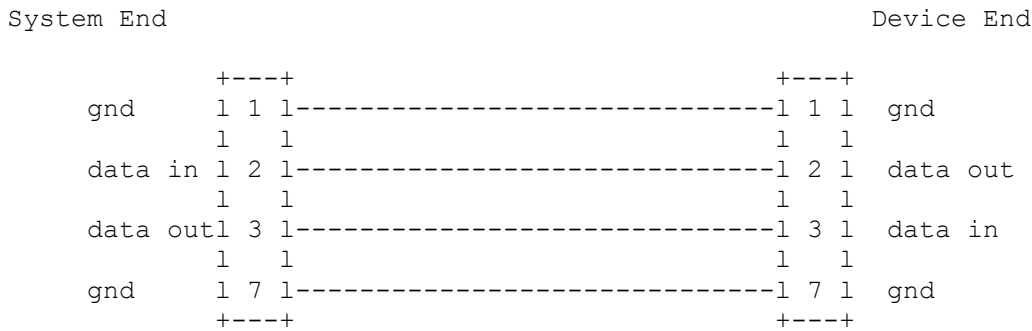
port 0BH turn on cpu monitor rom

port 0CH turn off MP/M interrupt

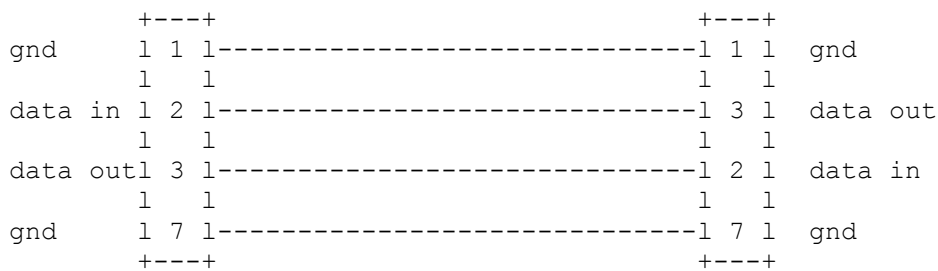
port 0DH turn on MP/M interrupt

Standard System Cable Diagrams

standard serial cable to console

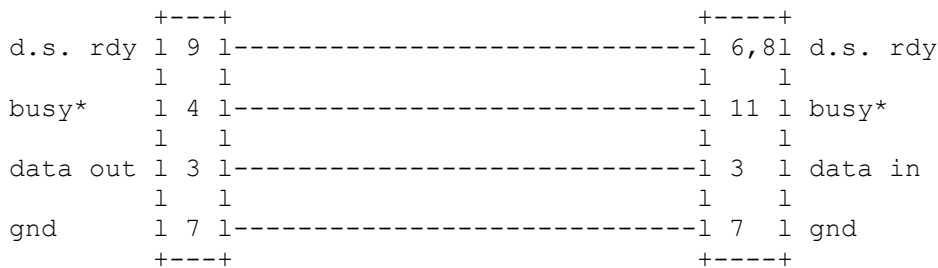


standard serial cable to modem



new serial cable to printer

note: for lsi 300 busy* is pin 14 at printer



parallell cable , centronics type interface



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	O2	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
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

IEEE S100 System Bus Signals
(cont.)

pin #	name	function
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 tranfere 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

Model 5000 Terminal

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 receptical 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 with the external contrast knob.

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 @ 1/2 intensity
scroll dn page	3	03	lead-in for graphics
scroll up page	18	12	reverse field
delete word righth	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
<--- down arrow	19	13	reverse at 1/2 intensity
	24	18	insert line
--->	4	04	disable cursor

Model 5000 Video Display Control Characters

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

Shugart 850 Jumper Options

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'

LSI 300 Printer Option Data

Serial Operation

Basic Switch Settings For Serial Or Parallel Use

Refere 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

LSI 300 Printer Options

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 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

Floppy Disk Clean Program

DCLEAN.COM

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.

Trouble Shooting Guide

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 now low reading is 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.

Trouble Shooting Guide (cont)

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.