MOLECULAR COMPUTER

MULTIPROCESSOR COMPUTER SYSTEMS

Installation

And

User's Reference Manual

PREFACE

This manual provides operation, installation, and limited maintenance information for the MOLECULAR Computer Supermicro and DIRAC Systems. The manual also covers the use of MOLECULAR's n/STAR Network Operating System, which provides a multi-user environment that is compatible with Digital Research CP/M.

The manual is organized into the following sections:

Section   I - Describes the standard features of the System and lists specifications of its major components.

Section   II - Describes the physical and environmental requirements for the system.

Section   III - Presents installation instructions, including unpacking, cabling, and initial preparation and testing.

Section   IV - Provides routine operating procedures for the system.

Section   V - Describes the basic concepts and features of the n/STAR Network Operating System.

Section   VI - Provides information on the use of n/STAR File and Record Locking features.

Section   VII - Describes the n/STAR Directory Management System and Password Security System.

Section VIII - Provides information on printer operation, including Print Spooling.

Section   IX - Describes additional n/STAR commands.

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SECTION I

INTRODUCTION

1.1 SYSTEM DESCRIPTION

The MOLECULAR Computer DIRAC, Supermicro 8 and Supermicro 32 systems are a powerful microprocessor based local networking system designed to support multiple CP/M users. They are multiprocessor systems: Each user is provided with a dedicated Application Processor including the Z80A microprocessor and 64K Bytes of RAM for high speed application processing. A Z80A based File Processor, which includes its own 64K Bytes of RAM, controls the disk management and manages other shared peripherals.

Application Processors are linked to each other, and to the File Processor, via a unique high speed bus -- the m/BUS Interprocessor Link. The n/STAR Network Operating System resides primarily in the File Processor, providing each user a CP/M compatible environment, plus a wide variety of enhanced capabilities. A small part of n/STAR resides in each Application Processor, providing the application program and user interface.

1.1.1 m/BUS INTERPROCESSOR LINK

The key to the performance of the Supermicro series is the high speed m/BUS Interprocessor Link. This leading edge design supports communication between the independently operating Application Processors and the File Processor. Additionally, the unique protocol of the m/BUS allows Application Processors to directly communicate with other Application Processors without involving the File Processor. The m/BUS is a contention bus design, using a protocol known as Carrier Sense Multiple Access with Collision Detection (CSMA/CD). This approach eliminates the overhead associated with other network architectures, such as those based on a polling scheme.

1.1.2 n/STAR NETWORK OPERATING SYSTEM

The n/STAR Network Operating System provides a variety of features unique to the MOLECULAR Computer multiprocessor networking environment. CP/M compatibility allows existing CP/M based application programs to run in a multiple user environment. Additionally, concurrent file sharing is provided through implementation of the record locking features of n/STAR.

Other features of n/STAR are:

- Intelligent disk buffering to eliminate redundant operations
- System Password Security
- Private and Common user files
- Foreground/Background processing capability
- Print Spooling

1.1.3 FILE PROCESSOR

The File Processor contains a Z80A microprocessor, 64K Bytes of RAM with parity checking, the floppy disk controller and an interface to one or more Winchester disks. The n/STAR Network Operating System resides in the File Processor, using approximately one half of its RAM capacity. The remainder of the RAM is used to provide a 32K Byte disk buffer pool, which greatly enhances the system throughput in multiple user applications. The File Processor provides two RS232C serial ports, plus one parallel port, designed to support attachment of additional peripherals.

1.1.4 APPLICATION PROCESSORS

Each Application Processor is a 4" by 9" card which is internally mounted in the Network Unit, and connects to the m/BUS Interprocessor Link. Each Application Processor consists of a Z80A microprocessor 64K Bytes of RAM, parity feature, and 2K EPROM. Additionally, each Application Processor contains two RS232C serial I/O ports, or other custom designed ports required to perform special functions.

1.1.5 NETWORK UNIT

The Network Unit is a pleasingly designed stand-alone cabinet which has been created to fit the decor of today's modern office. It houses the File Processor, disk controller boards, Winchester disk drive, floppy disk drive, power supply, Application Processor mounting rack, and optional Streamer Tape Backup Unit.

1.2 SYSTEM DOCUMENTATION

The documentation included with a MOLECULAR Computer system is designed to address a wide range of information needs. The manuals are:

1. Installation and User's Reference Manual-
    A detailed presentation of the steps necessary to take your system from the shipping crate through system generation.

2. Programmer's Reference Manual-
    An in-depth presentation of the architecture of the n/STAR Network Operating System, for the systems programmer needing detailed information to optimize the performance of a specific application.

3. CP/M Manual Set-
    This set consists of seven chapters ranging from simple usage to systems level information, and is relevant for all n/STAR users.

For those users whose familiarity with CP/M is limited, the CP/M manual set is the logical starting place, especially the following chapters:

- User's Guide
- An Introduction to CP/M Features and Facilities

It is essential that the user have a functional understanding of these two sections in order to make best use of the system.

The Installation and User's Reference Manual is intended to give the user the necessary background to integrate the DIRAC or Supermicro multi-user system into daily use. When referring to the system in this manual, the term Supermicro will be used and can be assumed to encompass the DIRAC, Supermicro 8, and Supermicro 32 Systems, except where differences are specifically noted by individual model names.

SECTION II
SITE PREPARATION

2.1 SPACE REQUIREMENTS

The Supermicro System occupies a floor space of 12 inches by 44 inches including cable and adequate ventilation clearance of approximately 6 inches front and rear. It requires a vertical clearance of 25 inches which makes it possible to place the system beneath a table to conserve floor space. The system should be placed such that there is easy access to the rear panel to facilitate installation and removal of cables and modules. Also, power and terminal cables should be routed free of foot traffic for obvious safety reasons.

2.2 POWER REQUIREMENTS

The Supermicro Systems have been designed to fit into today's modern office, usually requiring no special electrical set-up. The system needs a three-prong plug to provide the necessary electrical ground, and will draw 3 to 9 amps of current depending on the configuration (number of users, which Winchester disk drive used, etc.). When installing a system, it is recommended that a list be made of the total electrical power connected to any one outlet, and the figure be compared (in watts or amps) to the rating given at the corresponding circuit breaker.

If there is heavy machinery nearby (such as a printing press or an arc welder), requiring large surges of power, the system's performance could be affected. If this is the case, certain steps may be necessary to insure proper electrical isolation. Consult your field service representative for further information in this situation.

2.3 ENVIRONMENTAL SPECIFICATIONS

The Supermicro series computers have been designed for the modern office, and require no special environmental considerations. To insure optimum performance, the following guidelines are offered:

1. Reasonable space for air-flow around the system -- approximately 12" x 44" of floor space, 25" in height -- is necessary. Avoid placing the system in a completely closed area.

2. The temperature of the room should not exceed 90°F (30°C), and consideration must be given to temperature/ventilation combinations.

3. To minimize the chances of static discharge harming the system, do not place the system on a carpet. This is especially important in dry climates. If all of the available area is carpeted, there are non-static mats available to reduce the problem. These can be purchased from most computer supply houses.

4. Refer to the specification sheets for the particular system being installed for further specifications.

2.4 CABLING CONSIDERATIONS

When installing a system with a large number of Application Processors, planning is required to run the terminal and printer cables neatly and efficiently. By constructing a floor plan, time and effort can be saved. A computer supplies catalog can be a good source of ideas and materials for running the cables through an office neatly and safely. EIA RS232C specifications indicate a maximum RS232 cable length of 250 feet. Because of the low number of signals passing through a terminal or printer cable, cables for these devices have been used successfully at lengths of up to 2000 feet. The variables that determine the maximum cable length that may be used include electromagnetic noise levels in the vicinity of the cable run, and the quality of the RS232 signal drivers in the individual terminal or printer used.

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SECTION III
INSTALLATION

3.1 INTRODUCTION

This section describes the unpacking, initial setup, and checkout of the Supermicro Systems. Following these procedures will enable you to install your system as quickly and as easily as possible.

3.2 UNPACKING

Each system package contains the following items:

1. A MOLECULAR Computer Multiprocessor System

2. Power Cord

3. One or more Application Processors

4. A System Manual set (stored in the side of the shipping container)

To remove the System from its shipping container and place it in its normal operating location, perform the following steps:

1. Examine shipping container for apparent damage. If any damage is observed, note the nature of the damage on the Out-of-Box Report, and mail it to MOLECULAR'S Customer Support Department.

2. Using a pair of diagonal cutters, clip the straps which hold the container together. **Exercise caution when cutting straps to avoid injury,** as they have a good deal of stress on them, and can snap when cut.

3. Remove the top section of the box.

4. Remove the three sheets from the top of the system:

    - Installation Instructions $\text{\it{NA}}$
    - Shipping Checklist $\text{\it{NA}}$
    - Out-of-Box Report

5. Remove the System Manuals, which are shipped on the side of the system, between the box sleeve and the system.

6. Remove the sides of the box.

7. Two people should grip the system at the bottom, one at each end, and lift it from the base of the container.

8. Place the unit on a flat surface in a convenient place for initial preparation and system checkout.

9. Remove the power cord from the bottom of the shipping carton.

10. Complete the Out-of-Box Report and mail it to MOLECULAR's Customer Support Department.

3.3 INITIAL PREPARATION

1. **REMOVE THE CARDBOARD PROTECTIVE SHIPPING DISK FROM THE FRONT OF THE FLOPPY DISKETTE DRIVE.**

2. Remove the right side panel of the system (as viewed from the front) by removing the four screws holding it in place.

3. **UNLOCK THE SPINDLE AND CARRIAGE ON THE WINCHESTER DISK DRIVE** by turning the two lock levers according to the arrows on the unit for a DIRAC System (see illustration 3.1) or the single lock lever for a Supermicro 32 System (see illustration 3.2). The disk drive for the Supermicro 8 does not have a shipping lock.

4. Remove the left side panel by removing the four screws holding it in place.

5. Remove the rear cover by removing the two screws holding it in place.

6. Inspect the Application Processors to verify proper seating in the m/BUS connectors. If any are loose, reseat them by pushing them gently in until they seat properly.

3.4 TERMINAL AND PRINTER SETUP

The system supports standard ASCII RS232C terminals and printers. There are two RS232C DB-25 connectors on each Application Processor, and two connectors at the top rear of the system attached to the File Processor.

Cable specifications are determined by the type of RS232C device to be connected to the system. The standard AP-8001 and AP-8003 Application Processors support the asynchronous protocol and require a 3-wire cable with the DB-25 connector pins 2(transmit data), 3(receive data), and 7(ground) connected for terminals, and usually require a 4-wire cable with DB-25 pins 2, 3, 7 and 20 (Data Terminal Ready) for printers.

Terminals are connected to the right-hand connector of the Application Processors, as viewed from the rear of the system.

Carriage Lock

Spindle Lock

Disk Drive Unlocking Points

Illustration 3.1

UNLOCK LOCK

D.C.
POWER

CAUTION:
BE SURE LOCKING
LEVEL IS NOT
UNDER THIS
PLATE.
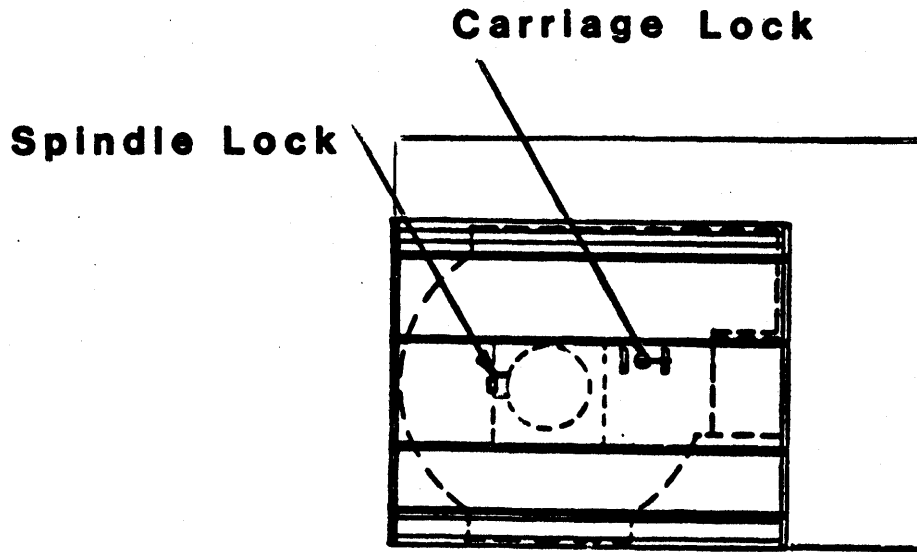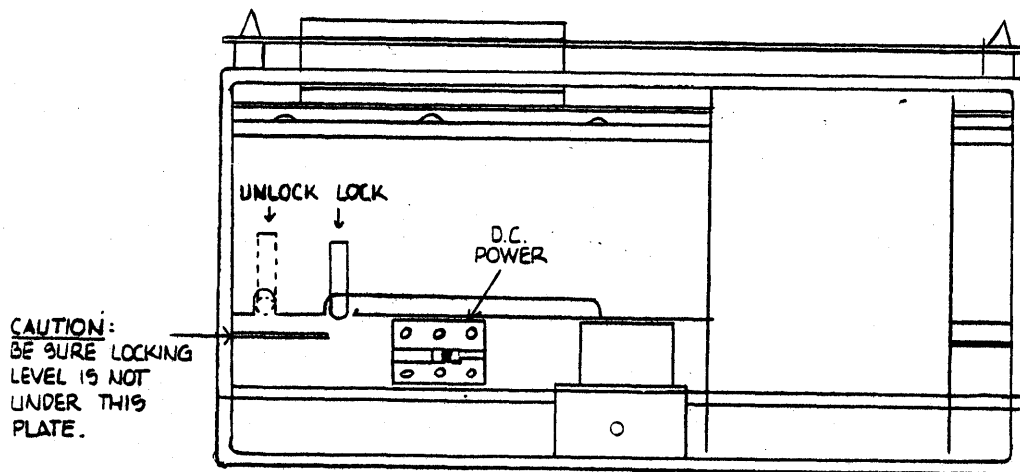
**Supermicro 32 Disk Drive
Unlocking Points**

Illustration 3.2

There are three printer configurations available:

1) Local Mode - A printer is connected to the left-hand connector of the Application Processor, as viewed from the rear of the system, and is dedicated to that processor.

2) System Mode - A printer is connected to the bottom DB-25 connector of the File Processor, and may be used by other processors in the system. Refer to the section on system print mode for more information.

3) Print Spooling Mode - By using an Application Processor as a dedicated de-spooling processor, a printer may be connected to each of the two DB-25 connectors on that processor, and may be used by other processors in the system. Refer to the section on Printer Spooling for more information on this feature.

The top DB-25 connector at the rear of the system is the File Processor terminal port, and is used only for the Diagnostic Mode.

The ASCII parameters for the terminal are initialized by n/STAR to the following values:

TERMINAL PORT
Full Duplex No Parity 8 Data Bits 1 Start Bit 1 Stop Bit 9600 Baud

Follow the instructions supplied with the terminal to set these parameters. Setup examples for two popular terminal models are:

ADDS Viewpoint
Switch S1: 3,5 up; all others down

Televideo 950
Switch S1: 1,5,6,7 up; all others down Switch S2: 1,6,7,9,10 up; all others down

You may wish to look at the documentation of application programs you will be running to determine if additional terminal setup is required. Consult the terminal operations manual for instructions on connecting the power cord, turning the unit on, adjusting brightness for video terminals, and attaching the data cable to the terminal.

While the Application Processor hardware supports all of the important RS232 interface lines on the terminal port, the n/STAR operating system supports only the following:

Pin No.	RS232 Name	Ordinary Name	Function
2	BA	TXD	Transmit data from the terminal to the computer.
3	BB	RXD	Receive data from the computer to the terminal.
7	AB	SG	Signal ground.

The ASCII parameters for the printer port are initialized in n/STAR to the following values:

PRINTER PORT
No Parity
8 Data Bits
1 Start Bit
1 Stop Bit
9600 Baud
DTR (Data Terminal Ready)

Follow the instructions supplied with the printer to set these parameters. Consult the printer operations manual for instructions on connecting the power cord, turning the unit on, and attaching the data cable to the printer.

The Local Print Mode of the n/STAR operating system supports only the following lines on the printer port:

Pin No.	RS232 Name	Ordinary Name	Function
2	BA	TXD	TRANSMIT DATA From the printer to the computer.
3	BB	RXD	Receive Data from the computer to the printer.
7	AB	AB	Signal Ground.
20	---	DTR	Data terminal ready.

The DTR line is used by many printers to indicate that the printer is ready to accept additional data from the computer or other device driving it, such as a modem. The n/STAR system will not send data unless DTR is high.

Some printers, for example the Diablo 630, use a data protocol to tell the computer to stop or start sending data. There are two common protocols:

- XON/XOFF -- The printer sends a XOFF (ASCII DC3, hexadecimal 53) to the computer via the TXD line in order to stop data. The data is restarted by sending XON (ASCII DC1, hexadecimal 51).

- ETX/ACK -- The computer periodically asks the printer if it can accept more data by sending it an ASCII ETX (hexadecimal 43). When the printer can accept more data, it sends back an ASCII ACK (hexadecimal 46).

n/STAR will support local or system printers using either the DTR "handshake" or the XON/XOFF protocol. The spooler will support any of the three methods.

If the printer is to be used as a LOCAL or System printer and does not support DTR or the XON/XOFF protocol, the speed of the printer port on the Application Processor must be set to no faster than the actual speed of the printer, in order to prevent data overrun.

The final issue concerning cabling is that some devices require additional input lines to be active in order for them to work. This can be solved by "jumpering" two or more pins on the RS232 connector for the device, that is, by wiring the pins together on the printer side

Here are two common problems and jumpers to solve them:

Problem (Line Required by the Printer)	Jumper
CTS (pin 5)	RTS (pin 4) to CTS (pin 5)
DSR (pin 6)	DTR (pin 20) to DSR (pin 6) or RTS to DSR

If the printer does not support DTR, any other RS232 pin that is always high can be wired to DTR on the computer. Appendix C has instructions for some specific printers in common use.

Additionally note that pins 5 and 6 (CTS and DSR) are held high on the System printer port, and on the console port (port "A") of the AP's. These lines are not high on the Local printer port (port "B"). When using port "A" on an AP for spooling printer, failure of the system to operate the printer may indicate that a modification is needed on the AP or the printer cable, to jumper pins 19 and 20 together (units shipped after June 1, 1982 do not have this problem).

3.5 FINAL PREPARATION

1. Replace the rear cover, routing the terminal and printer data cables down the rear of the unit to exit through the opening in the bottom of the cover. Replace the two mounting screws, one on each side of the cover.

2. Replace the side panels and mounting screws.

3. Connect the appropriate end of the power cord to the receptacle on the rear of the system enclosure. Connect the opposite end of the power cord to a properly grounded (three prong) outlet.

3.6 SYSTEM CHECKOUT

This section contains information concerning the initial power-up and checkout of the system.

```
CAUTION:

Be certain that the Winchester Disk Drive is unlocked as
described in section 3.3 prior to applying power to the system.
Failure to do so could cause damage to the disk spindle motor
and driver circuitry.
```

1. Turn the terminal power on.

2. Verify that the Emergency Power-Off breaker switch on the rear of the system is in the ON position.

3. Apply power to the system by depressing the power-on button located on the front near the name plate. The button should light indicating that power is ON.

```
Note:

This switch does not turn the power off. The power-down
procedure is initiated via software control.
```

At this point, the Winchester Disk Drive will begin its startup sequence which takes approximately 30 seconds to complete. During this time, the terminal should display the message:

```
xxx INITIALIZING. . .
```

where "xxx" is the Application Processor unit address in the range 000 to 254. If the message:

```
MSM DID NOT RESPOND
```

should also appear, recheck to make certain the Application Processor is fully seated in its backplane connectors. Press the terminal BREAK key to reset the Application Processor.

When the disk startup sequence completes, the n/STAR Network Operating System will be loaded and the terminal will display the n/STAR Initialization Message:

```
- n / S T A R -
64K V2.2xx    UNIT = xxx
```

where "2.2" is the CP/M version number which this release of n/STAR emulates and "xx" is the n/STAR version number. This is followed by the MOLECULAR Computer logo, and the message

```
Enter User ID (        )
```

Type "MAINTUSR" and hit carriage return. The system will respond with:

```
- n / S T A R -
64K V2.242    UNIT = xxx    USER = MAINTUSR
A>
```

At this point the system is operational. To check that the system is operating properly, type the following command to display the contents of the disk file directory:

```
DIR
```

At this point CP/M may be copied over to the hard disk by inserting the CP/M diskette and entering:

```
B:PIP A: = B:*.* [ ROV ]
```

Note that after each command has been typed, you must press the "RETURN" key on your terminal to signal the system that you have completed entering the command. When this has been done, a listing of the system command files should appear on the terminal. for more information on the use of these commands, refer to the CP/M manuals and to the appropriate sections of this manual.

SECTION IV
OPERATION

4.1 INTRODUCTION

This section contains the general operating instructions for the Supermicro and DIRAC Systems.

4.2 SYSTEM STARTUP

This procedure should be followed every time the system is powered-on prior to normal multiple user operation:

1. Turn the terminal power on.

2. Verify that there is no diskette in the floppy drive.

3. Press the power-on button firmly (located on the front of the system, near the name plate).

At this point, the Winchester Disk Drive will begin its startup sequence which takes about 30 seconds to complete. During this time, the terminal should display the message:

> **xxx INITIALIZING. . .**

where "xxx" is the Application Processor unit address in the range 000 to 254.

When the disk startup sequence completes, the n/STAR Network Operating System will be loaded and the terminal will display the n/STAR Initialization Message:

> **- n / S T A R -**
> **64K V2.2xx   UNIT = xxx**

This is followed by the logon screen which has a "MOLECULAR Computer" logo and a prompt to enter a user ID. At this point the system is operational and users may begin logging on and entering commands.

4.3 SYSTEM SHUTOFF PROCEDURE

To protect against the accidental loss of user's data due to removal of power from the system while files are being written, the power-down sequence has been implemented in software. Note that the front panel power-on switch will not shut off the system. To power down the system, perform the following steps:

1. Verify that all users have logged off the system.

2. With the command prompt (">") on the screen, enter the command "DOWN" and press the "RETURN" key on the terminal.

3. If any users are logged on the system at the time the DOWN command is issued, a warning message will be displayed on the terminal and the power-down sequence will not occur. The message will supply the user ID of any users logged on, and the Application Processor number on which the user is logged.

    If no user is logged on, the power down sequence will begin with the Winchester disk entering its shutdown cycle. After about 30 seconds the power will automatically disconnect and the power-on indicator light on the front panel will go out.

4. Turn the terminal power off. Refer to the instructions supplied with the terminal for details on terminal operation.

CAUTION:

Although removing power from the system by means of the emergency power-off breaker will not cause physical damage to the system, it may cause loss of data due to the prevention of the proper closing of currently open data files. For this reason, the above power-down procedure should be followed to remove power from the system in all but extreme emergency situation or as described in Appendix A.

4.4 DIAGNOSTIC MODE

Diagnostic Mode is used to run certain hardware dependent diagnostic utility programs which would be unsuitable for operation in a multiple user environment. The Diagnostic Mode is the single-user configuration of the Supermicro systems, and can be used for normal operation running the CP/M Operating System, as well as for diagnostic use. Only the user connected to the DB-25 connector on the top right of the rear panel and a printer connected to the lower connector will be functional. These connectors are connected directly to the File Processor. When booted from the floppy diskette, a 60K version of CP/M 2.2 will be loaded into RAM, allowing access to the floppy diskette drive and the Winchester disk.

For diagnostic use, this configuration is used to run certain hardware dependent diagnostic and utility programs which exercise the system in a manner unsuitable for maintaining data integrity in n/STAR's normal multi-user environment.

The following procedure is used to invoke the Diagnostic Mode:

1. Be certain that all users have completed their work on the Supermicro System and that no files are currently being written.

2. Connect a 9600 baud terminal to the File Processor Diagnostic Console connector located in the upper-right hand corner of the rear panel on the Supermicro System.

3. Insert the n/STAR Distribution Diskette into the Diskette Drive. Close the door on the Diskette Drive.

4. Depress the terminal "BREAK" key.

At this point, the File Processor will bootstrap a copy of CP/M from the diagnostic diskette and place the system in Diagnostic Mode. The terminal should now display the following:

```
60K CP/M V2.2

A>
```

NOTE: When operating the system in Diagnostic Mode, the floppy disk drive is treated as logical drive "A". All logical drives on the Winchester disk(s) are therefore accessed by the letter one greater than that used when running under n/STAR. For example, the first logical drive on the Winchester is accessed as drive "B", the second as drive "C", etc.

4.5 DIAGNOSTIC UTILITY PROGRAMS

There are several programs classed as utilities that run under Diagnostic Mode:

- DKM -- Formats and verifies diskettes.

- GENSTAR -- Installs a release of n/STAR on the hard disk.

- SYSINT -- Formats, verifies and initializes the hard disk unit.

- GPMON -- An exerciser program that allows a user to test memory locations.

- DSD -- Verifies the operation of the m/BUS and the ability of all application processors and the file processor to talk to each other.

- TAPE -- A standalone utility used to backup files to tape.

The Diagnostic Utilities are on the n/STAR Distribution Master diskette shipped with the system.

4.5.1 DKM

The DKM program is used to format and verify diskettes. DKM is menu-driven and requires only single-character responses. Before formatting a diskette, DKM warns the user to remove the diskette containing the DKM program and insert a new diskette. Release 2.242 of DKM can be used to format single and double density diskettes. This version of DKM requires the Engineering Change of January 24, 1982 in order to operate. Any system manufactured after late January of 1982 will already have this change. In order to determine whether this E.C. has been applied, examine the EPROM on the File Processor. If the date code is 012182 or later, the change has been incorporated. If not, then either arrange to have the change applied, or use a previous release of DKM. The change is necessary to support dual-density.

4.5.2 GENSTAR

The GENSTAR program installs a copy of the n/STAR operating system on the hard disk and then displays the message:

> **FUNCTION COMPLETE**

GENSTAR may also display a write-error message if the hard disk fails to perform the operation. The computer system is shipped with n/STAR installed. The GENSTAR program is only required when the hard disk unit has been reformatted or replaced, or when a software upgrade of n/STAR is to be performed.

4.5.3 SYSINT

SYSINT CAN ERASE ALL OF YOUR FILES.

The SYSINT program formats, initializes and verifies the hard disk unit. The computer system is delivered with a properly formatted and tested hard disk. The SYSINT program is only required when the hard disk has been replaced or if it is desired to completely erase all data from the disk. The SYSINT program for the DIRAC and Supermicro 32 begins with a warning message, and then asks whether a single or multiple passes are to be run. If a single pass is run, SYSINT terminates at the end of the operation. If multiple passes are run, the operation may be interrupted by entering CTRL-C.

When SYSINT is run on the Supermicro 8, the program begins by asking for the number of the physical 10 megabyte drive to be tested. Enter the drive number from 0 to 2. The program then asks if a format or verify operation is desired. If "V" (for verify) is specified, the program asks if a single or multiple passes are desired and then begins a non-destructive test of all sectors on the specified drive. If "F" (for format) is specified, a warning message is issued, and the program asks if bad sectors are to be redirected.

The usual response to this question is "Y" for yes. The program then asks if single or multiple passes are desired, and begins a destructive test of the specified disk drive.

4.5.4 GPMON

This program was used to test, dump, read, and write memory and input/output ports during the initial bring-up of prototype systems. Most of its functions are performed better by the CP/M utility DDT. The reason it is included on the n/STAR Distribution Diskette is that there is a memory (RAM) diagnostic in GPMON. A description of this single use follows. From Diagnostic Mode or from an application processor running under n/STAR, the user enters:

```
GPMON
```

The program responds:

```
MOLECULAR COMPUTER
TEST MONITOR V1.1
>
```

The ">" symbol is a prompt. The user enters:

```
T
```

The program responds

```
TEST FROM
```

The user enters the four digit hexadecimal address of the first location to be tested. The system responds:

```
TO
```

The user enters the address of the last address to be tested. The program writes randomly generated data into each of the locations tested and verifies that the correct value was stored. After each complete pass the program displays a "P" on the terminal. Any key will interrupt the memory test and cause the prompt symbol to appear. Note that the memory test is destructive. If the user tries to test 0000-FFFF, the program will write random data over itself until it fails. The highest address that can be tested is F7F6.

4.5.5 DSD

The DIRAC System Diagnostic is an effective and simple means of determining the integrity of the inter-processor communications for an entire Supermicro System. The Diagnostic runs primarily on the File Processor, with portions running in each of the Application Processors on the system. It performs bus operations similar to those required by n/STAR and verifies the

integrity of each operation. Results are displayed on an easy to read single-page "score board" that accomodates the File Processor and up to 63 Application Processors.

In order to run DSD, the system must first be powered off via the DOWN command. The CP/M + n/STAR diskette should be loaded into the floppy disc drive, and a terminal should be attached to the File Processor Console port. Then push the power-on button, and enter DSD when the command prompt appears. DSD will then ask if it should "Exclude modules in error?". The normal response is yes. Detailed operating procedures and error code analysis are documented in the Hardware Maintenance Manual.

4.5.6 TAPE

The Tape utility is a menu-driven file backup utility with the option of backing up or restoring all files or selected files. Options include selection of files to be transfered on the basis of logical disk drives, user numbers, ambiguous file identifiers, and specific file names, tape labeling with the date and a user-entered message, multi-volume tapes, and the ability to list a directory of all files on the tape to the console or printer.

If TAPE is to be run on other than a DIRAC 34-x, then the file "TAPEDISK.DAT" on the CP/M + n/STAR diskette must be modified. This is an ascii file containing one line, which is a list of valid disk letters ending with a carriage return. Some examples of the proper contents for specific system configurations follow:

BCDEFG [cr]	for a DIRAC 34-x
BCDEFGJKLMNO [cr]	for a DIRAC 68-x
BCDE [cr]	for a Supermicro 8 with an expansion drive or for a Supermicro 32 with a single disk drive

TAPE, like all other programs that run in Diagnostic Mode, must be run from the Floppy disk drive, with a terminal connected to the File Processor Console Port. The tape backup function is, therefore, a standalone process that requires all users to be signed off of the system.

SECTION V
n/STAR CONCEPTS

5.1 INTRODUCTION

The n/STAR Network Operating System forms the heart of the MOLECULAR Computer Multiprocessor Network. n/STAR has been designed to allow the independently operating Application Processors to share files and peripherals and to communicate with each other in a highly efficient manner. This communication is handled over a high speed bus, the m/BUS Interprocessor Link. n/STAR incorporates all of the standard features of the CP/M Operating System, but supplies enhancements to facilitate programming of sophisticated multiple user applications while providing improved data security.

5.2 CP/M COMPATIBILITY

n/STAR provides a CP/M 2.2 compatible environment for each user, including all standard CP/M interfaces, routines, formats and calls, plus enhanced BDOS and CBIOS operations featuring a variety of additional capabilities. Extensive file management facilities have been added to coordinate those functions necessary for an efficient multiple user system.

These functions include multiple user file sharing, password protection, print spooling, and foreground/background processing capabilities. There are also special calls made available to application programs to perform direct communication from one Application Processor to another (Interprocessor Communication).

5.3 UPGRADE CAPABILITY

n/STAR is the operating system used by all systems in MOLECULAR Computer's Supermicro Series. Under n/STAR, adding another user is as easy as inserting an additional Application Processor into the system; n/STAR automatically reconfigures itself to recognize the newest user. With the system security feature in use, a menu-driven security maintenance utility allows the definition of the additional user along with the specification of any new data volumes, while maintaining the integrity of the security system already in place. n/STAR provides complete transportability of software from one system to another in the Supermicro Series.

5.4 n/STAR ORGANIZATION

The I/O handlers of the operating system reside in the File Processor. This portion of the operating system includes the disk and file handling routines, system printer functions and other system functions. The size of the operating system, including request tables and system buffers, is approximately 32K

Bytes. The remaining 32K Bytes is used as a disk sector buffer, providing increased performance for the Application Processors when doing disk I/O. All data transfers to or from the disk are buffered to maximize disk throughput.

Since the majority of the Operating System code resides in the File Processor, only a small amount of code is required to be resident in the Application Processors. These "local" routines provide interfaces to the application programs, and communicate with the File Processor over the m/BUS Interprocessor Link. The Transient Program Area (TPA) available to the user application program in every Application Processor is equal to the maximum space available in a standard CP/M system.

5.5 n/STAR ENVIRONMENT

n/STAR provides an environment within the Application Processor which is compatible with the full 64K Digital Research CP/M version 2.2 operating system. A CBIOS jump vector table is also provided for programs which perform direct CBIOS calls for console I/O. This CBIOS jump vector table may not be used for disk I/O. However, any calls to the disk I/O portion of the CBIOS will result in the following error message:

```
Illegal Bios Call
```

This serves to trap any programs which are hard-coded for diskette I/O and thus incompatible with the Supermicro and DIRAC Systems and other Winchester Disk systems.

5.6 FLOPPY DISK ACCESS

The Supermicro system diskette drive has been implemented to allow access by only one user at a time. The user gains access to the floppy disk drive by entering d:, where d: is the logical drive to which the floppy is assigned. If the drive is currently being accessed by another user, the following error message appears:

```
Bdos Err on d: Drive In Use
```

where d: is the drive to which the floppy disk is assigned.

If the drive is not in use by another user, the diskette directory will be read by n/STAR, the allocation table will be built, and the floppy disk drive will be assigned to that user. When a diskette is changed, the drive must be reset before a write operation can be performed. This is accomplished by pressing the "CONTROL" and "C" keys on the terminal which is accessing the floppy drive.

To release the floppy disk drive, making it available to another user, simply log in a logical drive other than the floppy and perform a "CONTROL/C".

SECTION VI
n/STAR FILE AND RECORD LOCKING

6.1 INTRODUCTION

The n/STAR multiple user environment allows different users to access data simultaneously in three different ways. These are termed "File Locking", "CP/M File Sharing", and "Enhanced File Sharing".

6.2 AUTOMATIC FILE LOCKING

If no file sharing is indicated, the first user to access a file will cause that file to be locked. Any other user attempting to read only will be allowed to do so, while a write attempt will produce the following error message:

```
BDOS Error on d:   File in Use

Function nn   File PPPPPPPP.SSS
```

where d: is the drive on which the locked file was encountered, nn is the number of the BDOS function being performed, and PPPPPPPP.SSS is the file name.

6.3 CP/M FILE SHARING

To enable users of existing CP/M applications written without record-locking mechanisms to take advantage of n/STAR's file sharing capabilities, the "SHARE" mechanism has been implemented. The shared indicator "$SHR" is set and cleared on an existing file(s) by using the utility "SET". This indicator is tracked by the system as bit F5 of the File Control Block (FCB). When a disk access request for that file is generated, n/STAR creates an entry in an internal locking table, indicating that the file is to be shared, and that the automatic record locking mechanism is to be invoked.

If a user attempts to read a record already locked by another user, the system will automatically hold the request until the first user either:

      1)   reads or writes a different record in the same file,

      2)   writes (updates) the currently locked record, or

      3)   closes the file.

The file to be shared must already exist, and must have the "SHARE" attribute set. The "SHARE" attribute is set on a file(s) as follows:

```
SET afn $SHR
```

where afn is an ambiguous file reference.

The SET program uses BDOS function 30 to set bit F5 in the File Control Block (FCB) of the indicated file(s). Thus, an application program can mark a file shared by using BDOS Function 30; Set File Attributes. The SET program is fully described in section 9 of this manual.

The are several assumptions and limitations which must be considered when implementing CP/M File Sharing, using existing CP/M application programs:

1. The assumption is made that a program must read a record before writing it. Applications which write records before reading them should not be used in SHARE mode since the automatic record locking only takes place on a read operation. Records that are added to the end of a file will not be locked by the write operation, but will be locked on any subsequent reads.

2. Applications which close files and then continue to read and/or write records will encounter errors on such read or write attempts. Files must be opened and closed properly in order for automatic record locking to function. There is a file attribute that may be set on files that are processed by applications that do not follow this rule, called the Partial Close Attribute. This attribute is set on a file via the SET command, e.g. SET afn $PCL. When this file attribute is set, a close request from an application will perform all normal file close operations, but will retain the file lock entries, and allow subsequent reads and writes to occur.

3. Programs using indexed files may cause large portions of the file to be locked at a given time. When an index record is read, other users will be unable to read that index record, and thus all data records under the control of that index record, until another index record is read, the index record is rewritten, or the index file is closed.

Providing the above considerations are adhered to, the SHARE mode works well. For new applications which are designed to be heavily used by multiple terminals against a common data base, it is highly recommended that the Enhanced File Sharing capabilities described in the next section be utilized.

Existing applications which can not be run efficiently with these restrictions can operate safely in a single user environment by placing the files on an UNSECURED volume. Any volume can be designated UNSECURED through the MAINT volume definition facility (MAINT is fully described in section 7).

When files residing on UNSECURED volumes are accessed, all n/STAR file and record locking mechanisms are inhibited. All other capabilities such as Read only files are maintained.

6.4 ENHANCED FILE SHARING

The most flexible of the file sharing techniques was designed for those applications that will be implementing record locking under program control. If a file is opened in unlocked mode, multiple users can access the file at the same time. Two new functions have been added to BDOS to allow individual records to be locked and released by a user. The application program has complete control over whether a particular record is or is not currently accessible to multiple users. A detailed discussion of how to implement enhanced file sharing appears in the Programmer's Reference Manual.

SECTION VII
n/STAR DIRECTORIES AND DATA SECURITY

7.1 INTRODUCTION

The n/STAR Network Operating System provides a file directory management system similar to that of CP/M. Extensions to allow for the added capacity of the Winchester Disc drive, logical drive partitioning of the physical disc, partitioning of logical drives into volumes, and read and write password protection of volumes are supported. In addition, the n/STAR Security System allows for specification of user id's and user profiles, which contain user drive assignments, user passwords, CP/M device assignments, and an optional auto start program specification.

7.2 n/STAR DISK MANAGEMENT

The Winchester disk storage on the Supermicro System has been divided up into logical drives of approximately 5 to 8 Mbytes each. Logical drives are denominated by letters beginning with A, B, C, etc. Each logical drive has a separate file directory, which can be further partitioned into 16 volumes through the use of the n/STAR Security System Maintenance Program "MAINT". Using the User Profile Facility of the Security System, a volume can then be mapped to any one of 16 User Drives.

Note: Although this mapping corresponds to CP/M USER numbers, the CP/M "USER nn" command and the BDOS Function 32, Set/Get User Code, are not supported and are ignored when running under the n/STAR Security System. While it is possible for a user to run without the n/STAR Security System, it is not recommended. A discussion of this mode of operation can be found in section 7.8.

The size of the logical drives, and the number of logical drives per physical Winchester disk, vary with each model in the Supermicro Series. In all cases, logical drives are lettered beginning with the letter "A", and are numbered consecutively beginning with physical Winchester drive 0, then 1, etc. An exception to this lettering scheme occurs with the floppy diskette drive. The letters "G", "H", "O", and "P" are reserved to reference the floppy disc drive.

The following chart denotes the lettering scheme for each Supermicro Model:

MODEL:	DIRAC 34-x	DIRAC 68-x	Supermicro 8	Supermicro 32
DRIVE 0	A,B,C,D,E,F	A-F, I-N	A,B	A,B,C,D
DRIVE 1	I,J,K,L,M,N	----	C,D	E,F,I,J
DRIVE 2	----	----	E,F	K,L,M,N
Floppy (1 side, single density)	G	G	G	G
Floppy (1 side, double density)	H	H	H	H
Floppy (2 sided, single density)	O	O	n/a	n/a
Floppy (2 sided, double density)	P	P	n/a	n/a

7.3 THE n/STAR SECURITY SYSTEM

Data Security is provided through the use of a user ID and password scheme, guaranteeing that only authorized users may sign on to the system and gain access to private data volumes. A volume is defined as a Logical Drive and CP/M User Number Combination. Volumes are defined by the Security System utility "MAINT" (described later in section 7). Up to 16 CP/M User numbers can be used on a logical drive, thus, up to 16 volumes can be defined per logical drive. A graphic example of the volume assignments that might exist on a typical, single-drive Supermicro 8 follows:

Logical Drive:	A	B	G	H
USER 0	SYSTEM *	INVCTL01	FLOPPY	FLOPPY1D
1	USERSYS	INVCTL02		
2	DAVEVOL1	INVCTL03		
3	TIMVOL1			
4	JOHNVOL1			
5	SMITHV1			
6	SMITHV2	ACCOUNT1		
7		ACCOUNT2		
8		ACCOUNT3		
9				
10				
11				
12				
13	BENCH01			
14	BENCH02			
15	MAINT *			

* Logical drive A User 0, and User 15 are reserved for the system.

As is the case with CP/M Users, all volumes on a logical drive merely represent a logical partitioning of the directory for that logical drive. All volumes defined on a logical drive share the available directory space and data storage area for that logical drive. Thus the user would only create a new volume when a requirement for a new logical directory arose. If, in the above example, user "SMITH" ran out of directory space in his volume "SMITHV1", he would also be out of directory space on "SMITHV2". In fact, all volumes defined on logical drive A would be out of directory space, as they all share a common pool of available directory entries. To reallocate volumes and correct this situation, the system maintenance person could create a new volume on drive "B" called "SMITHVOL", and copy all files from volume "SMITHV1" to "SMITHVOL". Then all files within volume "SMITHV1" could be deleted, and finally, the volume definition "SMITHV1" could be deleted.

Each volume may be protected with a Read Password and a Write Password. Once signed on to the system, the user gains access only to those private volumes to which he is assigned, and to public volumes to which he is also assigned. A Directory Default feature allows single copies of frequently used application programs to be kept in a public volume where they can be accessed by many users. This feature avoids the need to store duplicate copies of frequently used programs in each user area, and greatly simplifies software maintenance on the system. Whenever a program is not found on the current user drive, the console command processor (CCP) will search subsequent user drives. If the program is found with a matching name, and the $SYS flag is set, then that copy of the program will be fetched for execution.

Each User is identified by a name of up to eight characters, with an optional user password of up to eight characters. Once signed on, the User Profile created by the Security System Maintenance utility "MAINT", defines up to 16 "User Drives" that are available to the user, where each User Drive is associated with a specific volume. These User Drives are accessed by the user by using the letters A through P, in the same manner as logical drives are accessed in the CP/M File Management System.

For example, assume the User Profile for user "SMITH" specifies:

```
A: = SMITHV1    ;1234
B: = SMITHV2    ;1234
C: = INVCTL01
D: = INVCTL02
E: = INVCTL03
 . . .
O: = USERSYS
P: = FLOPPY1D
```

When user "SMITH" signed on to the system, the CP/M drive prompt would be "A>" reflecting the currently logged on drive as User Drive "A". By referring back to the sample Supermicro 8 Volume Assignment table, one can see that operations performed on "SMITH"'s User Drive "A", would be performed on

the system's Logical Drive A, User number 5. "SMITHV1" would probably be a Private Volume, with a read or write password of "1234". In order to perform an inventory control function, our user might logon to drive "C" by entering the CP/M command: "C:".

The three "INVCTLxx" volumes would probably be semi-public volumes, assigned only in the User Profiles of those users having a need to perform an inventory control function, but not requiring a password. The volume "USERSYS", would be a public volume, mapped as User Drive "O" for all users, onto which the Software Maintenance person had placed programs to be made available to all users. An access to User Drive "P" would access System Logical Drive "H", which would be a single-sided, double-density floppy diskette. The Floppy Drive Volume is always placed last in the list of User Drives. This is done because the Directory Default Feature will terminate the search for a desired program if there is not a floppy diskette loaded in the drive.

By knowing the read or write password for a volume, a user may assign it to one of his User Drives by using the processor "ASSIGN". Thus, users may share some volumes with other users, and still have some volumes which are completely private. This feature makes it unnecessary to sign off and back on the system in order to gain access to different volumes. In order for user "SMITH" in our example to have this ability, the utility "ASSIGN" would be placed in the public volume "USERSYS" and would have the "$SYS" flag set. If Smith was logged on to his drive "C" and entered "ASSIGN", the system would search his user drives "C", "D", "E", and lastly "O", where the program "ASSIGN" would be found and fetched for execution.

7.4 SECURITY SYSTEM COMMANDS

The Security System Commands are actually transient programs that control access to the system, and govern the relationships between users, volumes, and logical drives. The four commands are LOGOFF, LOGON, ASSIGN, and MAINT.

• LOGOFF -- Prevents the terminal from using the system until a user performs LOGON (described next).

• LOGON -- Allows a user to access the system. LOGON works slightly differently depending on whether the terminal is in the Logged-Off State or already Logged-On by the same or a different USER.

   1. If the terminal is logged-off, its screen will show a system message, e.g. "MOLECULAR Computer," followed by:

Enter User ID (   )

The USER enters the user name of one to eight characters assigned to him. If the USER also has a password, the system displays:

```
Enter Password (          )
```

The USER enters his password, which is not displayed. If the password is entered incorrectly, the system displays:

```
INCORRECT PASSWORD....Hit any key to retry
```

After a key is pressed, the terminal returns to the logged-off state.

2.   If the terminal is already logged-on, the user can type the following to log on under a different User I.D.

```
LOGON <user name> [ <;password> ]
```

If the password is entered incorrectly, the terminal goes to the logged-off state.

● ASSIGN -- Modifies a USER's volume assignment profile. User enters:

```
ASSIGN
```

System Response:

```
Enter your Password (          )
```

The USER enters his password, followed by a carriage return. The reason for this is that ASSIGN will later display the password, and requiring the entry of the password here prevents anyone who does not already know it from discovering it. User enters:

```
<password>
```

System Response: The system displays a screen showing the USER's password user drive assignments, list device, and initial command.

```
              n/STAR Resource Assignment Program

                    Profile of User SMITH

   PASSWORD PW: = SECRET
   LOGICAL ASSIGNMENTS
   A: = SMITHV1;1234      I: =                   LST: = LOCAL
   B: = SMITHV2;1234      J: =
   C: = INVCTL01          K: =
   D: = INVCTL02          L: =
   E: = INVCTL03          M: =
   F: =                   N: =
   G: =                   O: = USERSYS
   H: =                   P: = FLOPPY1D


   INITIAL COMMAND
   CMD: =
   ENTER COMMAND (                              )
```

The system then requests the user to enter a command. The types of commands are

> **PW:= <password>**

Allows the USER to establish or change his password.

> **<user drive>:=<volume name> [;<password>]**

Allows the USER to assign a volume to one of the user drives A through P.

Example:

> "A: = ACCOUNT1" assigns a volume called ACCOUNT1 to user drive A.

> **CMD: = <initial command>**

Allows the system automatically to bring up a code file whenever the USER logs on. This is useful to a USER who has only one type of activity to perform on the system.

Example:

> CMD:=WS will cause Wordstar to be executed automatically whenever the USER logs on. (Assuming that Wordstar is installed on the system).

> ### LST: [SPOOL/LOCAL/SYSTEM]

Specifies the method of printing:

- SPOOL -- Means that printer output is written to a disc file, and printed later by a separate Application Processor dedicated to spooling. Spooling allows multiple users to simultaneously generate printer output which is queued for printing on one or more spool printers.

- LOCAL -- Means that printer output is written to a printer connected to the USER's Application Processor. If the optional parameter is omitted, then LOCAL is assumed as default.

- SYSTEM -- Means that printer output is directed to a system printer connected to the File Processor. No spooling is performed.

• MAINT -- The MAINT program maintains the user and volume directories, the system master password, and the initial commands for each Application Processor. MAINT should not be used by anyone other than USER's responsible for maintaining the system, since MAINT allows the creation and deletion of USERS and volumes. For this reason access to MAINT is controlled by a special system master password, which should only be known to authorized users.

The "MAINT" utility may be used to create or delete a user ID, or to modify the user's characteristics. Volumes may be assigned to the user, the user password may be changed, the default LIST device may be specified, and the user auto start program (if any) may be changed.

The "MAINT" utility may also be used to create, modify, or delete volumes. A new volume is created by assigning a name and optional read and write passwords and specifying the Logical Drive and User Number. Once created, the volume may be assigned to any number of users. If only the read password is known, the user may read, but not modify the volume. If the write password is known, the user may both read and write to the file in the volume.

The "MAINT" utility may also be used to assign the sign-on characteristics of a given Application Processor. MAINT may also be used to specify initial baud rates for the printer and console ports on the application processors, and initial commands.

To use MAINT, the USER types:

> **MAINT**

The system responds:

> **Enter System Password (   )**

The user enters the master system password. If the password is entered incorrectly, the system responds

> **Incorrect password, access not permitted**

and returns control to the Console Command Processor (CCP). If the password is entered correctly, MAINT displays a menu of choices:

  0) Change the system password
  1) User maintenance
  2) Volume maintenance
  9) System configuration

The USER depresses the number key corresponding to the option he wishes to select. The system then engages in an interactive dialogue with the USER.

If "0" (Change the system password) is entered, the system asks for the new password. Once it has been entered, MAINT requires it to be reentered to ensure that a keying error was not made.

If "1" (User maintenance) is entered, MAINT displays a list of all currently defined users for the system and asks for the name of the user profile that is to be displayed and/or modified. Enter the name of the desired user profile. The name may be up to 8 characters in length. MAINT will then display the user profile and display **"Enter command or 'del' to delete this user"**. The command entry format is exactly the same as that used for the ASSIGN program. For example, to change the users default list device from the System printer to a local printer one would enter:

> **LST:=LOCAL**

If "2" (Volume maintenance) is entered, MAINT displays a list of all currently defined volumes on the system and asks for the name of the volume definition that is to be displayed and/or modified. Enter the name of the desired volume, up to 8 characters. MAINT will display the current volume definition parameters for that volume. If this is a new volume, the "DRV:=" and "USR:=" parameters must be entered. These parameters specify the System Logical Drive and User definition for that volume name. It is the responsibility of the user to ensure that only one volume name is assigned for a given

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logical drive and CP/M User number combination. If 'del' is entered to delete a volume, only the association of the volume name to the drive/user definition is deleted - no deletion of files occurs.

For either new or existing volumes, the user may additionally specifiy a read password "RPW:=", a write password "WPW:=", and whether or not the Security System features will be applied to this volume by entering "SECURED" or "UNSECURED". The remaining parameter "FP:=", is used to define the file processor m/BUS address controlling the logical drive. For all current implementations, this value defaults to "FP:=255" and should not be changed.

If "9" (System configuration) is selected, the system will ask for the m/BUS address of the device whose default parameters are to be changed. This address is the number that is to the right of the version message after initial logon or after a break is entered from the terminal ("...UNIT = nnn") The user may modify the initial baud rate for the console port ("C:=") or the printer port (P:="), or modify the initial command. The initial command is usually "LOGON", and is maintained by the Security System for applications processors that are used for terminal handling. If the applications processor is to be used as a spooler, the user enters "CMD:=SPOOLER parm1 parm2" (see section 8 for instructions on setting up a Spooler).

Note that the initial command entered for a m/BUS Unit under option "9" of MAINT is not the same as the initial command entered for a User id under option "1" of MAINT or with ASSIGN. The initial command for a m/BUS Unit is used to define the start-up and break processor for the unit, and is usually "LOGON" for application processors. The initial command for a user is used to determine an auto start program for a particular User Id.

7.5 n/STAR SECURITY SYSTEM INSTALLATION

Each new system is originally shipped with a minimal Security System already installed. In addition, the latest version of all n/STAR utilities will be in place on logical drive "A", CP/M User 0, which is defined as volume "SYSTEM". Before copying CP/M utilities and any other software to the Winchester disk, it is important that the Security System Maintenance person determine the User Profile and Volume Definition requirements for the System, and enter these definitions with the utility "MAINT".

The system is shipped with the volumes SYSTEM, MAINT, FLOPPY, FLOPPY1D, and SAMPLE defined. Additionally, the user id's MAINTUSR and DEMO are also defined. The user id MAINTUSR defined with user drive "A" as SYSTEM and user drive "B" as FLOPPY. It is recommended that this user id be password protected after initial system setup is completed.

The first step is to define user id's for everyone that will be using the system along with their user profile. This will involve using MAINT option "1" to define printer assignments, autostart programs if desired, and user disk

volume assignments. The single largest problem for the Security System Maintenance person will be software maintenance - how to keep software in all volumes of the disc at the same and current levels. This problem can be minimized by implementing a User System volume as defined below.

The second step is to define the volume assignments that will be needed initially. The volume SAMPLE can of course be deleted. The volumes SYSTEM and MAINT should be retained and password protected. The volume SYSTEM, defined to be logical drive A, User 0, is the only area of the disc that is updated by n/STAR software generation and release update procedures. These procedures, as well as the n/STAR operating system, assume that the user will not delete any of the files that are placed there. Because of its importance to the running of the system, this volume should not be assigned in any user profiles other than MAINTUSR.

Instead, it is recommended that a second volume be created, called USERSYS, on logical drive A, User 1. This volume will be assigned to all user profiles as user drive "O" (recall that the floppy should be assigned as the last user drive or "P"), and will contain all n/STAR utilities that all users need to access. This set of utilities consists minimally of the processor LOGOFF, and might include ASSIGN, SET, etc. depending on system requirements. Additionally, any CP/M utilities or application programs that are to be accessable by all users will be placed in the volume. By setting the "$SYS" file attribute with the processor SET, these programs will become accessable to all users through the Directory Default feature.

Having defined all "system" volumes, all that remains is to partition the logical disks available into user volumes, and to make the appropriate assignments in the user profiles. All of these definitions can be added to and changed at any time as system requirements change, but a bit of forethought and initial planning can eliminate the need for a complete disk reorganization at some later time.

When creating user volumes, one should also consider the volume of data that will be kept in each volume. Remember that all volumes defined for a logical drive share the available directory space and data storage space. By placing functionally different user groups on their own logical drives, the planner can give each group a definate specification of the disk resources available to them and give them the responsibility for managing those resources.

7.6 SECURITY SYSTEM RECOVERY

It is possible for all terminals on the system to be locked out by the Data Security System. This can happen if all users have been assigned an invalid volume name to their logical drive A. Also, it is possible that the master password for the MAINT program may be forgotten. If this is the case, then a bootable diskette must be used to override and re-install the security system.

The following procedure is recommended for system recovery:

Boot from the floppy disk drive

Enter: "**USER 15**"

Enter: "**ERA B:VECTORS.SYS**"

Boot from the Winchester disk, executing "MAINT" to create a new master password and insure that a valid volume has been assigned to logical drive A for each user. Then re-install any system configuration parameters that are different from the defaults supplied by MAINT.

7.7 SECURITY SYSTEM GUIDELINES:

- Every USER must have a valid volume assigned to volume A. This means that a valid volume name and the correct password must follow the "A:=" for every USER.

- The system message file is displayed on the first 22 lines of all terminals that are in the logged off state. The message file is a standard text file that is compatible with ED and with Wordstar. The message file is in the volume SYSTEM, and is called "MESSAGE.SYS". The message may be modified for custom installations.

- The System does not insure that multiple volumes are not associated with the same Logical Drive/User Number combination. System maintenance personnel must assure that each volume is created with a unique Logical Drive/User Number Specification.

- If a USER's profile requires floppy disc, it is best to assign that device to user drive P: This is accomplished by invoking the ASSIGN program and entering:

        | P: = FLOPPY |

The reason is that if a file is not found on the current USER drive, the system will search the other USER drives. If a floppy disc is not mounted in the drive, a BDOS "Bad Sector" error will occur if the system tries to look at the directory. For that reason, the floppy disc should be last in the chain.

The system does not check for the validity of the volume name when volumes are assigned to the user profiles. System maintenance personnel must exercise care to assign only valid volumes to each user's logical drives.

7.8 OPERATION WITHOUT THE SECURITY SYSTEM

The Security System is invoked on a terminal by the program LOGON. This program is normally maintained as the initial AP command for an AP by the security system with no need for intervention by Security System Maintenance Personnel. If the initial command for an AP is not LOGON, then that terminal will run in CP/M mode, without the benefit of any n/STAR user id's, volumes, record or file locking, etc. In this mode, the USER xx command is operable. There is absolutely no protection or security provided by the operating system when running in this mode.

SECTION VIII
n/STAR PRINTER OPERATION

8.1 INTRODUCTION

The n/STAR Network Operating System provides three modes of printer operation. Printers may be installed as Local Printers, Spooling Printers, or as a System Printer. Installation and usage of each type of printer is described in this section. In addition, each user may access a printer in one of two ways. The specification "LST:=" in the user profile may be used to specify the CP/M list device as a local printer, the system printer, or a disk spool file. Any process that directs data to the CP/M list device will print on the device selected by the "LST:=" specification in the user profile. Secondly, any user may explicitly request the listing of a file by using the program LIST and specifying the file to be printed, and the print device to be used.

8.2 LOCAL PRINT

A local printer is a single user printer attached to the printer port (port "B") of a user's application processor.

8.3 SYSTEM PRINTER

A printer may be connected to the printer port on the file processor (this is the lower of the two RS232 connectors on the upper-right side at the back of the processor). This printer is a shared resource with methods for obtaining access and subsequently releasing access to it, and is called the System Printer. Only one user is allowed to use this printer at a time, and should a second user attempt to access the device, an error message will be displayed:

> Bdos Error: System Printer in Use

Entering control-Q from a terminal will attach the System Printer to that terminal. A subsequent control-Q will release the printer for use by another user. The control-P key will also automatically attach and detach the System Printer as well as performing its normal function of controlling the echo of screen text to the printer. If data is sent to the System Printer without first attaching it, the system will automatically attach the System Printer to that terminal. Logging off will also release the System Printer.

8.4 PRINT SPOOLING

Print Spooling is available by dedicating one or more application processors to the function of printing files that have been queued to the spooling printers. The only way to use a spooling printer is to execute a LIST command specifying the data to be printed and the name of the Spooling Printer to be used. A user may spool print data to disc at any time by specifying

"LST:=SPOOL" in their user profile. A file is then created to receive print data and is closed when the assignment of the CP/M list device is changed. This file may then be printed by listing to a local or system printer using the processor LIST, or it may be sent to a spool device. The file name used is $nnSPOOL.$$$, where nn is derived from the AP Unit number.

8.4.1 INSTALLATION OF THE PRINT SPOOLER

A print spooler can be installed by the Security System Maintenance person. Hardware installation consists of attaching one or two correctly cabled printers to an application processor that is to be dedicated to the spooling function (see printer cabling requirements in section 3.4). Software installation consists of defining the names that will be used by users when queuing print requests to the Spooler, as well as the baud rates and protocal requirements of the printers to be used. This is done by utilizing option "9" of the Security System Maintenance program MAINT.

Under option "9" of MAINT, enter the unit number of the application processor to be used as a spooler. Assign the spooler function to that AP by entering "CMD:=SPOOLER param1 param2", where param1 and param2 are as described below. The first set of parameters, param1, describes the printer attached to port "A" of the application processor, normally called the console port, positioned at the right-hand side of the AP as viewed from the rear of the system. The second set of parameters describes the printer attached to port "B" of the AP, normally referred to as the local printer port. If param2 is omitted it is assumed that there is no printer on port B. If param1 is empty, i.e. "()", then there is no printer supported on port A.

The format for param1 and param2 is "(name,baud rate,protocal)". Name is a user chosen string of up to eight characters. More than one spooling printer may be assigned the same name. In this case, output directed to that name will be printed by the first printer available with that name. Rate is a decimal value from 0 through 6 defining the baud rate of the printer and derived from the following table:

```
0 ==   110 BAUD
1 ==   150 BAUD
2 ==   300 BAUD
3 ==  1200 BAUD
4 ==  2400 BAUD
5 ==  4800 BAUD
6 ==  9600 BAUD
```

If this parameter is omitted, then the baud rate is obtained from the "C:=" or "P:=" baud rate setting for that AP. One of two protocal types may be chosen. A zero in this field indicates that an ETX/ACK protocal will be used by the printer to indicate a buffer full condition. A one indicates that either DTR handshaking or XON/XOFF protocal will be used. If this parameter is omitted, the combined DTR and XON/XOFF protocal is assumed. If the printer to be

used is capable of either ETX/ACK or XON/XOFF, the XON/XOFF is preferred. This is because the printer may occasionally be used as a local print device, where the ETX/ACK protocal is not supported.

For example, assume that two printers are to be assigned to AP unit 254, one of them a daisy wheel printer running at 9600 baud and utilizing XON/XOFF protocal, and the other a matrix line printer running at 4800 baud and also utilizing the XON/XOFF protocal. The user would enter option "9" of MAINT, enter the AP address "254" and:

```
CMD:=SPOOLER (DAISY) (MATRIX,5)
```

Or the user could enter the following two commands:

```
CMD:=SPOOLER (DAISY) (MATRIX)
P:=4800
```

In either case, the daisy printer would be connected to port A, and the matrix printer would be connected to port B of the Application Processor.

8.4.2 THE LIST COMMAND

The list command has been enhanced to allow despooling of spooled data and listing onto the system printer. The format of the list command is:

```
           SPOOL     LOCAL
LIST                 SYSTEM
           ufn       device
```

If SPOOL is specified then the current spool file will be closed and printed on the selected device. If an unambiguous file name is specified then that file will be printed on the selected device. If the list device is LOCAL or SYSTEM then the file will be printed on the local printer or the system printer respectfully. Any other list device name implies a despooling printer. The file will be queued to that despooling device and printed on a first come first serve basis. The default list device is the local printer.

Example: using the spooler definition from the previous example, when the command "LIST TEST.PRN MATRIX" is executed from a terminal, the file TEST.PRN will be sent to AP #254 port B to be printed on the matrix printer.

Specifying an undefined device name will cause the file to be queue up waiting for the device name to be assigned to a physical printer. This feature could be used to implement special forms handling. The device names assigned to a particular spooler processor may be changed at any time by using option 9 of MAINT to change the initial command for that unit.

SECTION IX
ADDITIONAL n/STAR COMMANDS

9.1 INTRODUCTION

There are a variety of additional commands available to the user under n/STAR which are not available in CP/M. These commands are described in this section.

9.2 SUBMIT

n/STAR supports the CP/M SUBMIT command and all applications which generate submit files. This is accomplished in the multiple user environment by internally renaming the submit file to be unique to the user generating the file. Thus, instead of the "$$$.SUB" file name, the second and (if necessary) third "$" in the name is replaced with the complement of the unit number in hexadecimal of the terminal entering the command. For example, unit 254 would generate "1.SUB" and unit 192 would generate "$3F.SUB".

This procedure is performed within n/STAR and is transparent to the application program.

The following commands are exclusive to n/STAR and are, therefore, not included in the CP/M manuals.

9.3 DOWN

The DOWN command is used to shut the system down following normal system operation. For full information on the use of this utility, refer to "System Shutoff Procedure" in Section IV of this manual.

9.4 SETBAUD

The SETBAUD command allows a user to alter the BAUD rate of either the printer or the console port of the user's Application Processor to any standard rate from 110 to 9600. The program is menu-driven and self explanatory. The program is invoked by entering:

```
SETBAUD
```

9.5 DIRECTORY UTILITY

The directory utility provides an extended display of file directories. The display program is initiated by typing one of the following forms:

```
D
D AFN
```

The first form is equivalent to the form "D *.*". The program will display a sorted list of all files satisfying the ambiguous file reference, afn. The display includes the file size, rounded up to the next 1K bytes, and an indicator for the file attributes shared, partial close, read only, system and archived.

9.6 SET - UTILITY TO SET FILE ATTRIBUTES

The commands "SHARE" and "PCLOSE" have been replaced by the command "SET". SET provides a common command for setting file attribute as well as additional features. The valid commands for SET are

```
SET
SET afn $LCK
SET afn $SHR
SET afn $NCL
SET afn $PCL
SET afn $R/W
SET afn $R/O
SET afn $DIR
SET afn $SYS
SET afn $MOD
SET afn $ARC
```

The first form will cause a description of this utility to be displayed. The other forms will cause the selected file attribute to be set or reset. "afn" may be any valid ambiguous file name. The indicators R/W, R/O, DIR, and SYS are the same as the ones used by STAT and have the same meaning. The indicator SHR will set the share attribute. The indicator LCK will reset the share attribute. The indicator PCL will set the partial close attribute, the indicator NCL will reset it. The indicators ARC and MOD will set and reset the archived attribute. The archived attribute is normally set by a file backup utility. It is always reset by n/STAR whenever the file has been modified.

For example, to make the LOGOFF program available to all users, one would copy the program from the volume SYSTEM to the volume USERSYS, where USERSYS was a volume assigned in all user profiles, and enter the following command:

```
SET O:LOGOFF.COM $SYS
```

assuming that USERSYS was currently assigned as user drive "O".

APPENDIX A
SYSTEM RESET PROCEDURES

A.1 INTRODUCTION

The following procedures are provided to clear error conditions which may occur in the system. These conditions may be caused by application program error, hardware malfunction, or system software error.

A.2 RESETTING THE APPLICATION PROCESSOR

During normal system operation, there should be no need to reset a user's Application Processor. There are two broad categories of conditions that do require intervention:

1) It is possible for a program to "hang", a condition indicated by no response at the terminal, usually caused by an error in the program leaving the processor in an illegal state.

2) Some programs run continuously, without providing the user a way to interrupt execution once started.

Should such a condition occur, the individual Application Processor may be "reset" in either of two ways:

1) Depress **CONTROL/C** (both keys at once)

This causes the Command Control Processor (CCP) to be reloaded, and restores terminal response in most situations, especially #2 above.

If successful, the terminal will return with the logged-on drive, and the command prompt:

d>

where "d" is the logged-on drive.

The user may then begin to enter commands again.

If not successful, the prompt will not appear, and the second procedure should be tried.

2) Depress **BREAK** or **CONTROL/BREAK**

This completely reloads the Operating System into the Application Processor, and logs on the default drive and user. When CONTROL/C does not work, utilizing the BREAK sequence will take care of almost all other situations.

If successful, the terminal will display the n/STAR Initialization Message shown in Section 4.2.

Note: If the n/STAR Data Security System is not installed, then the contents of the user's application area (TPA, using the CP/M convention) are still intact and may be saved to disk for later analysis, using the "SAVE" command. This feature is especially useful in a software development environment, allowing the programmer an opportunity to carefully analyze the situations causing a program under development to fail (or "hang"). For further information, see the CP/M "SAVE" command in the "CP/M Features and Facilities" manual provided with the system and section 7.8 of this manual.

A.3 RESETTING THE FILE PROCESSOR

If a situation should arise where all of the terminals fail to respond to an n/STAR command (possibly accompanied by the "MSM DID NOT RESPOND" message), and the Application Processor reset procedure does not cure the problem, it may be necessary to reset the File Processor. This is accomplished by:

1)   Connecting a terminal to the File Processor Diagnostic Console connector located in the upper-right hand corner of the rear panel on the Supermicro System. Remove the diskette if one is loaded.

2)   Depressing the terminal "BREAK" key.

3)   The terminal will display the following message:

   | 255 RESTART |

4)   Disconnect the terminal cable from the File Processor and reconnect it to an Application Processor.

5)   Depress the terminal "BREAK" key.

If successful, the terminal should display the n/STAR Initialization Message shown in Section 4.2.

CAUTION:

Resetting the File Processor may cause loss of data due to the prevention of the proper closing of currently open data files. For this reason, the File Processor should be reset **ONLY** when there is sufficient indication that such action is necessary to restore the system to an operational state.

A.4 RESETTING THE SYSTEM

If resetting the File Processor was not successful, one of the Application Processors has possibly caused a "Bus hang" condition, due to that processor hanging up while asserting the "Bus Busy" signal. To correct this condition the system may also be brought down by loading the n/STAR Distribution Diskette, booting from it via the File Processor console port, and entering "DOWN". Then remove the diskette and power the system back on.

If the above procedures have not restored normal system response, there are two possibilities:

1)   The copy of n/STAR on the Winchester drive has been damaged, or

2)   Some part of the hardware has failed.

In the first case, reloading the n/STAR Operating System will correct the situation. To do this, follow the steps in Section IV, Diagnostic Mode, followed by:

1)   "GENSTAR" - this program will re-load n/STAR onto the hard disk, then respond with "FUNCTION COMPLETE".

2)   Remove the diskette from the floppy drive.

3)   Depress CONTROL/BREAK, re-setting the File Processor; the terminal should display:

> "255 RESTART"

4)   Remove the terminal cable from the File Processor connector, replacing it in an Application Processor.

5)   depress CONTROL/BREAK.

If successful, the usual system sign-on message should be displayed on the terminal (See Section 4.2).

If the system does not return to normal operation, contact your field service representative.

APPENDIX B
n/STAR ERROR MESSAGES

Message   **Meaning**

MSM Did Not Respond

> The FP did not respond to a m/BUS request. This usually
> means that the FP has gone down. Call your system service
> representative.

Bdos Error on d: Bad Sector

> This error occurs when there is a hardware error on the
> disk. It may occur as a result of trying to read a diskette of
> one density in a drive that is set for a different density, or
> with an improperly inserted diskette, or if there is no
> diskette in the selected drive. Entering ctrl-C will reboot
> the AP, any other key will cause the system to ignore the
> error.

Bdos Error On d: Select

> An unassigned drive has been selected.

Bdos Error On d: File R/O

> An attempt was made to modify a file that was set to read
> only.

Bdos Error On d: R/O

> An attempt was made to modify a file on a drive that was
> set to read/only.

Bdos Error On d: Drive In Use

> An attempt was made to access the floppy drive while it
> was in use by another user. If the floppy appears to be
> available but the error still occurs then the drive is still
> assigned to the last user. The solution is to find out who
> last used the floppy, yell at him, and then reboot his AP by
> entering ctrl-C or break at his terminal.

Bdos Error On d: File In Use

> An attempt was made to modify a file that is opened in
> lock mode by another user.

Bdos Error: System Printer In Use

> An attempt was made to access the system printer while it was being used by another user.

Bdos Error: Disk Error On Spooler Operation

> This usually means the spooling operation encountered a directory or disk full condition. All or part of the spool file may be lost.

Bdos Erron On d: Lock Table Full

> An entry is made in the lock table for each opened file and locked record. This error occurs when the lock table overflows. The lock table contains room for over 200 entries which is enough for normal use. If the table becomes full, it is usually because some application program is not closing its input files.

Bdos Error On d: Internal Error

> This error message should never appear. If it does, call your System Service Representative.

Illegal BIOS Call

> A program has attempted to perform a direct BIOS call which is not supported by the system.

APPENDIX C
CABLES FOR VARIOUS PRINTERS

This Appendix contains specific cabling recommendations for printers we have used ourselves or otherwise made to work. For each printer, a diagram like the following is shown.

```
        Printer        Computer

          2      ---      2
          3      ---      3
         4/5
          7      ---      7
```

The numbers refer to the pins on the RS232 connectors on the printer and computer connector ends of the cable. "---" means the pins are connected via the cable. "4/5" means that pin 4 is jumpered to pin 5 on the same connector (in the example, the printer connector).

Where appropriate, other printer information is provided here, such as recommended baud rates and application software notes.

We intend to add new printers to this section as we learn details. We welcome any information you may have about other printers that are not documented here yet.

Printer: Diablo 630

Cable: Printer   Computer

```
            2      ---      2
            3      ---      3
           4/5/6
            7      ---      7
           20      ---     20
```

Other Information: Pin 20 (DTR) "handshake" or the XON/XOFF protocol may be used with the local printer or system printer driver. The print spooler additionally supports the ETX/ACK protocol.

Printer: Texas Instruments 810

Cable: Printer   Computer

```
            3      ---      3
           6/8/9
            7      ---      7
           19      ---     20
```

Other Information: There is an 8-bit switch inside the printer that must be set correctly (see manufacturers manual). What worked for us was to set switches 1-6 down and switches 7-8 up, set the speed switch on the front to "H" (high), and run at 1200 baud.

Printer: NEC Spinwriter 5525

Cable: Printer   Computer

	Printer		Computer
	2	---	2
	3	---	3
	5/6/8/20		
	7	---	7
	19	---	20

Other information: There is an 8-bit switch inside the printer that must be set correctly (see manufacturers manual). What worked for us was to set switches 1-6 down and switches 7-8 up, set the speed switch on the front to "H" (high), and run at 1200 baud.

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