MOLECULAR COMPUTER

MULTIPROCESSOR COMPUTER SYSTEMS

Installation

And

User's Reference Manual

References are made throughout this manual to the name
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PREFACE

This manual provides operation, installation, and limited maintenance information for the MOLECULAR Computer InfiNET 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 InfiNET I System is a powerful microprocessor based local networking system designed to support multiple CP/M users. It is a multiprocessor system: 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 MegaBUS 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 interface.

1.1.1 MegaBUS INTERPROCESSOR LINK

The key to the performance of the InfiNET series is the high speed MegaBUS Interprocessor Link. This leading edge design supports communication between the independently operating Application Processors and the File Processor at a speed of 1.25 MBytes/second. Additionally, the unique protocol of the MegaBUS allows Application Processors to directly communicate with other Application Processors without involving the File Processor. The MegaBUS 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

MOLECULAR COMPUTER

1.1.3 FILE PROCESSOR

The File Processor contains a Z80A microprocessor, 64K Bytes of RAM with parity checking, and the floppy disk controller. 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 MegaBUS 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 an InfiNET 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. System Maintenance Manual–
    A detailed presentation of the hardware subsystems that make up the MOLECULAR family of computers, written for the technician or engineer providing technical support to the customer.

4. 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 InfiNET System.

The Installation and User's Reference Manual is intended to give the user the necessary background to integrate the InfiNET multi-user system into daily use.

SECTION II
SITE PREPARATION

2.1 SPACE REQUIREMENTS

The InfiNET 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 InfiNET 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 InfiNET 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.

SECTION III

INSTALLATION

3.1 INTRODUCTION

This section describes the unpacking, initial setup, and checkout of the InfiNET and DIRAC 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
   - Shipping Checklist
   - 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 (see illustration 2.1).

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 MegaBUS 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-1001 and AP-1003 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.

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

There are two printer configurations available:

1) <u>Local Mode</u> - 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) <u>Print Spooling Mode</u> - By using an Application Processor as a dedicated 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 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.

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. If your printer does not provide the DTR (Data Terminal Ready) signal, you may jumper pin 5 to pin 20 of the DB-25 connector which attaches to the Application Processor.

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 3.2 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:

> **FILE PROCESSOR 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**
>
> **A>**

where "2.2" is the CP/M version number which this release of n/STAR emulates and "xx" is the n/STAR version number.

At this point the system is operational and any standard CP/M command may be entered and executed. To check that the system is operating properly, type the following command to display the contents of the disk file directory:

> **DIR**

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 InfiNET 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**
>
> **A>**

At this point the system is operational and users may begin entering commands. See the CP/M manuals provided with the InfiNET System for general information about the operation of CP/M: *Drey DIGITAL RESEARCH Intro. to CPM features*

Detailed application programming information for n/STAR may be found in the **n/STAR Programmers Reference Manual.**

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.

1a.   Type   MaintUsr

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 InfiNET 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 first logical drive of 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 InfiNET 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 InfiNET System.

3. Insert the Diagnostic System 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>
```

See Section V for details on the Diagnostic Utility programs.

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 MegaBUS 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 InfiNET 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. If the system security feature is 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 InfiNET 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, magnetic tape driver routines, 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 MegaBUS 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 InfiNET and DIRAC Systems and other Winchester Disk systems.

5.6 FLOPPY DISK ACCESS

The InfiNET 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 initiate a write attempt to 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

where d: is the drive on which the locked file was encountered.

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. When the SHARE program is invoked on an existing file, bit F5 of the File Control Block (FCB) is set. When a disk access request for that file is generated, the HUB routines in n/STAR create 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 a different record,

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

      3)   closes the file.

The file to be shared must already exist, and should only be processed randomly.

The "SHARE" command is invoked as follows:

> SHARE x:ufn [$ON/$OFF]

x is the desired drive which, if omitted, defaults to the currently logged drive. The file "ufn" must be an existing unambiguous name (i.e. no "*" or "?" in name or type fields). The optional parameter "$ON" is the default indicating the file is to be marked "shared". The "$OFF" parameter must be specified to return a shared file to normal status.

The SHARE program uses BDOS function 30 to set bit F5 in the File Control Block (FCB) of the indicated file. Thus, an application program could also mark a file shared by using BDOS function 30; Set File Attributes.

Note:

There are several assumptions and limitations which must be taken into account when implementing CP/M File Sharing, using existing CP/M programs:

1. The assumption is made that a program must read a record before updating (writing) it. Application programs which write records without first reading them should not be used in SHARE mode. Otherwise unpredictable results may occur.

2. Applications which close files and then continue to read and write records without re-opening the file may cause unpredictable results. Files must be opened and closed properly by the program in order for the record locking to function properly.

3. Programs which use 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 record, and thus all records under control of that record, until the first user accesses another record.

4. Files should only be processed using the random access method when in SHARE mode. The system assumes that all sequential reads are part of the same record, thus the entire file would eventually be locked if sequential processing were done on a file in SHARE mode.

Providing the above restrictions are adhered to, the SHARE mode works well. However, for applications which are heavily used by multiple terminals in shared file mode, it is highly recommended that the Enhanced File Sharing capabilities described in the next section be implemented. This capability eliminates all the above limitations and provides the tools for real shared data base implementation.

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. Invoking the "UNLOCK" program on an existing file will set bit F6 of the FCB. When a disk access request for that file is generated, the HUB routines in the File Processor make an entry in an internal locking table, indicating that the file is to be shared, and that record locking may be implemented using the extended BDOS functions 42 (Record Lock) and 43 (Record Unlock). More than one record in a file may be locked at the same time by a user, using multiple function 42 calls. The function 42 calls produce return codes, such as "operation successful" or "record already locked by another user".

The file to be "UNLOCK"ed must already exist, and should be processed using only the random access method.

The "UNLOCK" command is invoked as follows:

> **UNLOCK x: ufn [$ON/$OFF]**

where x is the desired drive which, if omitted, defaults to the currently logged drive. The file "ufn" must be an existing unambiguous file name. $ON is used to indicate that the file is to be unlocked to allow Enhanced file Sharing. $OFF specifies that the file is to be returned to normal status.

The "UNLOCK" program uses BDOS function 30 to set bit F6 in the FCB of the indicated file. Thus an application program could also mark a file unlocked by using Function 30, Set File Attributes.

For further information on the use of "UNLOCK", see the n/STAR Programmer's Reference Manual.

SECTION VII
n/STAR DIRECTORIES AND DATA SECURITY

7.1 INTRODUCTION

Depending upon the needs of the users of the n/STAR Network Operating System, there are two options for file directory management. The first is similar to that of CP/M, with extensions to allow for the added capacity of the Winchester Disk Drive. The second is the full n/STAR Data Security System, which employs passwords to create a system of private directories which can be flexibly designed for the various users of the system.

7.2 CP/M FILE MANAGEMENT

The disk storage on the InfiNET System has been divided into Logical Drives of approximately 5 Mbytes each. Logical Drives are denominated by letters, beginning with A, B, C, etc. Each has 256 possible directory entries, with provision for partitioning the directory through the use of the Data Security System Maintenance Program "MAINT". The USER command documented in the CP/M 2.0 User's Guide is not supported, although no error message appears when it is used. Up to 16 users, numbered 0 - 15, are allowed on each logical drive. Note that the user numbers on each logical drive must share the storage space and directory entries for that drive.

The highest lettered Logical Drive, plus one, is the system diskette drive and it is configured for the CP/M 8" floppy diskette standard 241K, single-density format.

For example, in the case of the 30 Mbyte disk drive, Logical Drives A through F refer to the Winchester Disk Drive, and Logical Drive G is the Floppy Disk Drive. In a multiple drive system, Logical Drives are first assigned to drive 0, followed by drive 1, drive 2, and drive 3. A maximum of 16 logical drives is supported by CPM.

The division of Logical Drives and Users is shown below:

	A	B	C	D	E	F	G
USER 0							
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							

7.3 THE n/STAR DATA SECURITY SYSTEM

Data security is provided through 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/User Number combination as described in the preceding section. That is, it is one of the small rectangles in the chart shown above. A user will not have access to a volume without a valid password. Once signed on, the user gains access only to those private volumes to which he is assigned, and to public volumes globally available to all users. A directory default feature allows single copies of frequently used application programs and files to be kept in an area 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. Whenever the system is unable to find a file on the current user drive, subsequent user drives are searched.

When the Data Security System is installed, each user is identified by a name of up to eight characters, rather than a number. Each user also has an optional password of up to eight characters. Once signed on, each user has up to sixteen "User Drives" available. Each User Drive may be associated with a volume. The set of User Drives available to a user is referred to as that user's profile. These User Drives are denominated by the letters A through P, and are accessed by the user in the same manner as Logical Drives are accessed in the CP/M File Management System. That is, the user may switch from one volume to another by changing his User Drive by using the CP/M commands:

> A:, B:, etc.

To the system, volumes are identified by names of up to eight characters and by separate read and write passwords of up to eight characters each. Each volume is, in fact, a Logical Drive/User Number combination as described above. This diagram shows the relationships between User Drives, Volumes and logical drives:

User Sees	Security System User Directory	Security System Volume directory	CP/M Sees
		Volume Name | USERVOL	User No.
B>	B: = USERVOL | Volume Name User Drive	DRV: = C USR: = 5 Logical Drive and CP/M User#	USER 5 C: | Logical Drive
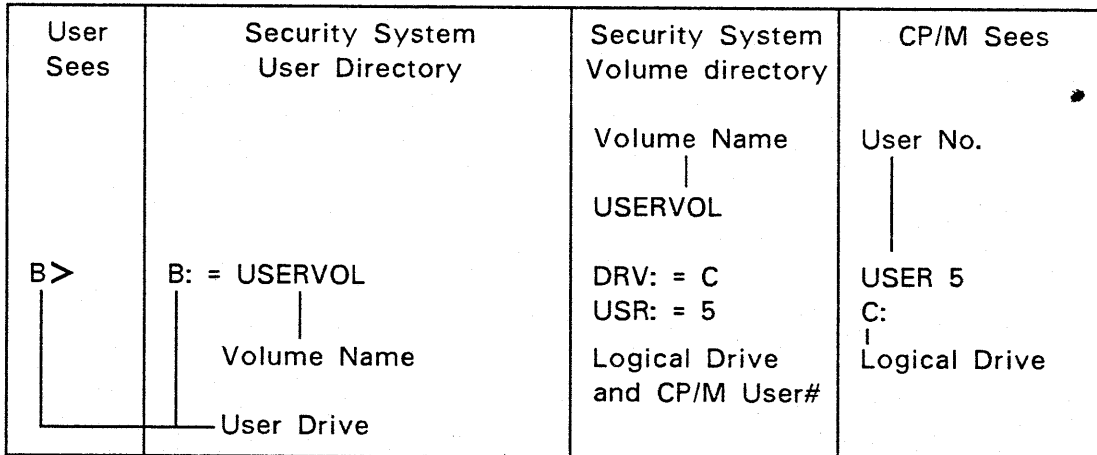
By knowing the name and read or write password for a volume, a user may assign it to one of his volumes lettered A through P. A given volume may be assigned to more than one user. Thus users may share some volumes with other users, and still have volumes which are completely private. This feature makes it unnecessary to sign off and back on the system to gain access to different volumes.

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 passwork, 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: = VOL1              I: =                  LST: =         │
│   B: = VOL2              J: =                                 │
│   C: =                   K: =                                │
│   D: =                   L: =                                │
│   E: =                   M: =                                │
│   F: =                   N: =                                │
│   G: =                   O: = SYSTEM                          │
│   H: =                   P: = FLOPPY                          │
│                                                              │
│   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: = VOLUME1 assigns a volume called VOLUME1 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 Word STAR to be executed automatically whenever the USER logs on. (Assuming that Word STAR 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.

- SYSTEM -- Means that printer output is directed to a system printer connected to the File Processor. No spooling is performed. If the optional parameter is omitted, then LOCAL is assumed as default.

- 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 sign-on option 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 special sign-on characteristics to a given Application Processor. By specifying the Application Processor address, from 0-255, and modifying the contents of a special field, it is possible to bypass the sign-on procedure for a given Application Processor. This capability should be used with care, as it allows a user to enter the system without the protection of the security system.

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) Display user list
2) Create a user
3) Modify a user
4) Delete a user
5) Display volume list
6) Create a volume
7) Modify a volume
8) Delete a volume
9) Enter an AP initial command

The USER depresses the number key corresponding to the option he wishes to select. The system then engages in a self-explanatory interactive dialogue with the USER. The following points should be noted:

1. Volume and USER names are up to eight characters long.

2. Each volume should be assigned to a unique logical drive/USER number pair.

7.5 n/STAR SECURITY SYSTEM INSTALLATION

The following procedure will allow the system user to install the n/STAR Network Operating System with either of the two Directory Management schemes described above. To install the extended CP/M configuration, perform the following steps:

1. Connect a terminal cable to the File Processor's upper DB-25 connector at the rear of the system.

2. Insert the CP/M floppy disk into the diskette drive.

3. Press CONTROL/BREAK at the terminal, booting the system from the floppy.

4. Type:

> **PIP B: = A: *.***

This will copy all the files from the CP/M diskette to the first logical drive of the hard disc.

5. Type:

> **SYSGEN**

When asked for which drive to load from, enter:

> **A**

6. Remove the CP/M diskette. Insert the n/STAR distribution diskette.

7. The system has asked diskette to write to. Respond:

> **A**

The system will load the CP/M operating system onto the n/STAR diskette.

8. Enter a carriage return, leaving SYSGEN and booting from the n/STAR diskette.

9. Enter:

> **PIP**

followed by:

> **A: = B: SUBMIT.COM**
> **A: = B: XSUB.COM**
> **A: = B: PIP.COM**

followed by a carriage return, leaving the PIP program.

10. Type "SUBMIT GENSTAR", loading n/STAR onto the A: drive of the Winchester Disk Drive.

11. Remove the floppy disk from the diskette drive.

12. Press CONTROL/BREAK at the terminal. This resets the File Processor. The following message should appear:

> **255 RESTART**

13. Disconnect the terminal cable from the File Processor, and connect it to an Application Processor.

14. Press CONTROL/BREAK, booting the n/STAR system from the Winchester Disk Drive.

The CP/M standard configuration is now installed.

To install the Data Security system, proceed with the following instructions:

1. While running under n/STAR, enter:

> **MAINT**

once the program loads, it will request a system password.

Press RETURN (the system password has been pre-initialized to blanks.) The main menu for the MAINT program will be displayed.

2. Two volumes are reserved by the system for system maintenance. These are SYSTEM (drive A:, user 0) and MAINT (drive A:, user 15). Create them as follows:

Enter: **"6"**   "Create a volume".

Enter: **"SYSTEM"**   (The volume name), followed by 2 RETURNs

Enter: **"6"**   "Create a volume".

Enter: **"MAINT"**   (The second volume name), followed by 1 RETURN.

Enter: **"USR:=15"**   (This associates the MAINT volume with user 15), followed by RETURN.

The two volumes have now been created. For maximum system security the volume SYSTEM should be given a write password, and the volume MAINT should be given both a read and a write password. It is assumed that MAINT initially has no files and that SYSTEM has only *.COM files and other read only files.

3. To create a USER ID for system maintenance personnel:

Enter: **"2"**   "Create a user id".

Enter: **"MAINTUSR"**   The user name.

Enter:**"A:=SYSTEM; pw1"** Where 'pw1' is the write password (if assigned) for the volume SYSTEM.

Enter: **"B:=MAINT; pw2"** Where 'pw2' is the write password (if assigned) for the volume MAINT.

For maximum security, the USER ID should be accompanied by a password.

Enter: **"PW:=password"**   Where "password" is the desired password.

This completes the minimal installation requirements. Continue to install the rest of the user and volume names and passwords as desired for your system.

When all of the USER IDs and VOLUMEs have been installed, enter RETURNs until you get the command prompt.

This terminal is now ready for production use. All other terminals should be initialized by pressing the CONTROL/BREAK key.

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 (as above, steps 1-3)

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.

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.

- Version 2.241 of 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 involving 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 select error will occur if the system tries to look at the directory. For that reason, the floppy disc should be last in the chain.

Version 2.241 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.

SECTION VIII
n/STAR PRINTER OPERATION

8.1 INTRODUCTION

The n/STAR Network Operating System provides two modes of printer operation. These are the Local Print Option and the Print Spooling option.

8.2 LOCAL PRINT

When in "Local Print" mode, print output is directed to a printer attached directly to the user's Application Processor (a local print device). This operation is transparent to the user and occurs automatically.

8.3 PRINT SPOOLING

Print spooling is available to application programs which are written to direct print output to the disk. The spooler is a program which runs in a dedicated Application Processor. One or two printers may be connected to the AP, and any number of Application Processors may be installed to do spooling.

8.3.1 INSTALLATION OF THE PRINT SPOOLER

The system maintenance personnel can install the print spooler on any Application Processor using the MAINT utility. This is done by installing an initial AP command using option 9 from the main menu under MAINT. The initial command for the AP assigned to be the spooler must be "SPOOLER param1 param2" where param1 and param2 are as described below. The first set of parameters (param1) describes the printer on port A of the spooler Application Processor (the left-hand part as viewed from the rear of the system) and param2 describes the printer on port B. If param2 is omitted then it is assumed that there is no printer on port B.

The format for the parameter strings param1 and param2 is (name, rate, mode) where:

Name is the logical name for the printer. This is the name that will be used in the LIST command.

Rate is the BAUD rate coded as follows:

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

Mode determines which line protocol to use while communicating with the printer. Mode is encoded as follows:

```
0 ==> EXT/ACK PROTOCOL
1 ==> X-ON/X-OFF PROTOCOL
2 ==> DTR READY LINE
3 ==> CTS READY LINE
```

The parameters may be changed at any time using the MAINT program. When spooler has finished with a file, it will use the latest parameters for printing the next file.

More than one printer may be assigned the same name. In that case, output directed to that name will go to any printer with that name. For more information on the logical names, see the following description of the list command.

8.3.2 THE LIST COMMAND

The list command has been expanded to allow printing using the print spooler. The list program is initiated by typing one of the following commands:

```
LIST filename.type
LIST filename.type device
```

where filename.type is the name of the text file to be printed and device is the name of a logical print device. If a device is not specified then it will default the value of LST: as shown in the user profile (see ASSIGN). If the device name is blank then the local printer is assumed. If the device name is not blank then the text file is placed in a fifo queue for the specified device. The file will be printed on any physical printer with the specified logical device name.

Example: Suppose that Application Processor #254 is to be the spooling processor and that it has a matrix printer on port A and a word processing printer on port B. Using the MAINT program set the initial command of AP

#254 to "SPOOLER (MATRIX,6,2) (DAISY,3,1)". This associated the name "MATRIX" with the printer on port A, and the name "DAISY" with the printer on port B.

When the command "LIST TEST.PRN MATRIX" is executed from a terminal, the file TEST.PRN will be sent to AP #254 port A to be printed on the matrix printer.

Specifying an undefined device name will cause the file to be queue up waiting for the device to be assigned to a physical printer. This feature could be used to implement special forms handling.

8.4 ADDITIONAL CAPABILITIES

Future releases of n/STAR will include the capability to automatically route print data to the local print device or to any spool printer. The "PROPTION" command will be used to specify the print output device which is desired. Also, a "SYSTEM PRINT" option will be provided, allowing a printer to be directly attached to the File Processor and accessed by any user.

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 attributes shared, unlocked, system, and read only.

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, while maintaining all the data and registers in the user application area. 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.

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 "FILE PROCESSOR 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 InfiNET System.

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.

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 <u>ONLY</u> 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:

1) Remove the rear panel.

2) Inspect the Bus Busy Indicator Light on each of the Application Processors.

3) Remove the Application Processor with the indicator light "ON".

Note: If the Application Processors in the system do not have the Bus Busy Indicator Light, it is necessary to remove the Application Processors one at a time in order to clear the condition.

Repeat the procedure above for resetting the File Processor, and the system should return to normal operation.

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

1) The File Processor is "hung" in the middle of a Bus operation, or

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

3) Some part of the hardware has failed.

In the first case, the File Processor "hang" may be cleared as follows:

1) Turn off system power at the emergency power-off breaker switch at the rear of the system.

2) Wait 5 (five) minutes.

3) Re-apply power at the breaker switch, and depress the power-on button on the front of the system.

In the second 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.