



# Software Operating system

## ND 10048 SINTRAN III/VS Operating System ND 10174 SINTRAN III/VSE Operating System ND 10175 SINTRAN III/VSE-500 Operating System

### INTRODUCTION

SINTRAN III is a family of general purpose, multi-mode, disk based operating systems.

Under SINTRAN III, the virtual memory, the multi-programming and the resource sharing capabilities of the ND-500 series, the ND-100 series and the NORD-10 series of computers are fully utilized.

SINTRAN III allows the execution of many different user and system programs concurrently in a multi-lingual environment.

Depending upon available resources, up to 64 timesharing terminals may be supported simultaneously, along with real-time processes, local and remote batch tasks.

Up to 255 different priority levels may be assigned to the different processes, ensuring that critical programs receive the necessary services from the operating system.

SINTRAN III is delivered in binary form on floppy disk (or magnetic tape) ready for use, according to the actual hardware configuration and the customer's special software requirements. The user does not have to do any system generation.

#### SINTRAN III/VS:

Operating system for the NORD-10 series and the ND-100 series of computers with memories up to 1 MByte.

#### SINTRAN III/VSE:

Operating system for the ND-100 computer series with up to 32 Mbytes of memory.

#### SINTRAN III/VSE-500:

Operating system for the ND-500 computer series.

### FEATURES

- Simultaneous time-sharing, real-time, local and remote batch
- Reentrant subsystems and real-time segments
- On-line program development
- Easy command language with parameter prompting and line editing facilities
- All commands and programs may be referred to by any unique abbreviation
- File management system with security and back-up facilities
- Exchangeable, selfcontained disk volumes
- Interprocess communication systems, ND-NET on SINTRAN III/VS and COSMOS on SINTRAN III/VSE and SINTRAN III/VSE-500
- Resource sharing – all peripherals available for all users both from terminals and programs
- Output spooling
- Collection of accounting information and usage reports
- Virtual storage system with dynamic memory allocation of up to 32 Mbytes physical memory
- Hardware controlled user/system protection
- Fast context switching
- Power fail detection and automatic restart
- Full range of terminals, printers, disks, floppy disks, magnetic tape stations and a variety of special peripherals



# PRODUCT DESCRIPTION

## Operating Modes

The SINTRAN III system allows programs to be executed in three different modes, depending upon the application's requirements.

### Real-Time

Real-Time processing is primarily used in applications where the data gathered during a physical process must be handled so rapidly that the results may influence the current process.

The design philosophy of SINTRAN III has to a great extent been to support users in the implementation of the real-time applications. The operating system takes full advantage of the advanced architecture of the ND range of computers.

- Programs may be scheduled for execution either by
- external events
  - program call
  - operator command
  - time of day, down to seconds

Programs are given a priority ranging from 1 (lowest) to 255 (highest) and may be set

- by operator command
- by program call (from another or same program)
- during program compilation
- by program loading and segment building

The real-time processing environment may also be used for a variety of other application types where fast response are required, for example in:

- data acquisition
- data communication
- on-line terminal applications

### Time-sharing

Time-sharing operation allows a number of users to interact conversationally with the computer. Through timeslicing, each user gets an equal share of processor time. This is experienced as if all the available computer resources were reserved for that user.

Time-sharing facilities may be used for on-line program development, information retrieval, computer aided instruction, and other applications where the user needs to access the system directly.

On-line program development allows the individual programmer to edit a program, to compile it using the appropriate language processor, and to test it directly without interfering with other users. In this way the time and cost of implementing an application system are reduced.

### Batch

The SINTRAN III time-sharing users may also submit jobs from their terminals for batch processing. Real-time and time-sharing jobs will execute independently of any batch jobs.

Batch operations under SINTRAN III include both multiple local batch streams, and remote batch emulator packages for large-scale computers from Control Data, Honeywell Bull, IBM and Univac.

Local batch processing may be activated by reading jobdecks through the card reader. During a time-sharing session, the disk file containing necessary commands and data may be edited. Then the command APPEND-BATCH-QUEUE should be given.

All commands and facilities available for the time-sharing user are also available in local batch mode. Remote batch processing may be activated by the command APPEND-REMOTE-QUEUE which is used to specify the host computer.

For installations where several local and remote batch processors are in use simultaneously, an INPUT-CARD-SPOOLER program transfers jobdecks from the card to the specific batch queue.

### Command language

The simplicity of the command language makes the system very easy to use. For example, the user does not have to remember all the parameters in a command, since the operating system will simply ask for the missing parameters.

Example (user input is underlined>:

```
@ LIST-FILES
  FILE-NAME: A
  OUTPUT-FILE: L-P
```

which produces a list on the line printer of all files in the user catalogue starting with A.

### File Management System

The File Management System allows different types of mass storage devices, such as drum, disk, and magnetic tape, as well as floppy disk and other types of peripheral units to be handled in a uniform manner. Users may access files and peripheral units by using installation selected names, both from their terminals and programs. This gives a high degree of device independence.

File-sharing capabilities allow data and programs to be used by different users simultaneously. On the other hand, the file protection capabilities give the user the means of avoiding unauthorized and unintended use of common resources. Files may be allocated on the mass storage devices in several ways, depending on the requirement of the application.

The File Management System also provides functions like on-line back-up and retrieval of file versions or old copies, and copying of file directories and individual files.

Each file-directory, which may reside on a removable disk-pack, contains a list of the users whose files are present in it, along with the file protection information assigned to the individual files. File directories may easily be entered and released, and may be transported to and used on other installations.

The File Management System includes the Spooling System which allows several users to simultaneously output data from their programs to printing devices. The buffering on disk and the physical printing is automatically handled by the operating system. The user's own data files may also be printed by the Spooling System, and the number of desired copies specified. Utility commands to list the files in the spooling queues, delete entries in the queues, restart and back-space printing of spooling files, and to start and stop the Spooling System are included.

### Memory Management for the ND-100 and NORD-10 computers

The physical memory is divided into pages of 1 Kword (2048 bytes), which are assigned to active programs. The Virtual Memory System allows the logical address space of each user program to be as large as 64 Kwords or 128 Kbytes. This may also be extended to 128 Kwords or 256 Kbytes by separating code and data into two different address areas.

The system allocates pages in either demand or non-demand mode.

In demand-mode only active pages reside in the memory during program execution. The system detects and activates missing pages from the mass storage swapping area. User programs may be larger than the physical memory available, and the number of active programs is increased.

In non-demand mode, all pages are brought into memory before program execution begins.

In both cases, program pages may be scattered throughout the memory. The logical to physical address translation is automatically done by the hardware Paging System. This optimizes the use of physical memory. The programs themselves are kept on mass storage files.

The user may choose to keep the instructions and data of the program on separate segments, and also to share segments with other programs.

The memory allocation procedure uses a «least-recently-used-page» detection technique taking both the overall system and the local program's page table into account when selecting pages to be replaced. A hardware «written-in-page» flag indicates those pages that must be written back to the mass storage system, thus reducing the number of pages that must be saved before replacement can occur.

The hardware Memory Protect System uses two different protection methods, each operation on every 1 kword page in physical memory.



The Page Permit Protection controls the usage of individual pages, allowing a program to read, write, or fetch instructions from a page.

The Ring Protection prohibits a program from interfering with other active programs, subsystems, or operating systems.

## DISTRIBUTED DATA PROCESSING

COSMOS is a communication system for computer networks enabling users to communicate with other ND-computers in a network. COSMOS is available on SINTRAN III/VSE and SINTRAN III/VSE-500.

ND-NET is a similar communication system with less functions. It is available on SINTRAN III/VS.

The system allows many users or programs to utilize the same communication facilities in a simple yet efficient manner.

- Direct data transfer between programs in different computers
- Terminal connection to the time-sharing facilities in another system
- Remote file access, using files and peripheral units in another system as if they were locally connected
- Remote loading of programs to satellite systems

All buffering, queueing, transmission control, etc., is fully automatic allowing the programmers to treat the communication lines as any other sequential I/O device.

In case of terminal connection, the procedures are the same as if the terminals were connected directly to another system. In addition, the terminal user may alternate easily between the local and remote resources.

## HARDWARE REQUIREMENTS

The SINTRAN III operates on ND computers with a variety of peripherals and mass storage devices.

The minimum hardware configuration required is:

- Main memory of 128 kBytes
- Disk with controller
- Floppy disk
- Console terminal

Optional hardware may include:

- Error correcting memory of enhanced reliability
- CACHE memory for increased computing speed
- Main memory of up to 256 Kwords with multiport access
- High speed DMA channels
- Up to 4 mass storage controllers of different types
- Cartridge disk units, up to 40 Mbytes in removable and fixed packs of approx. 5 Mbytes each or up to 180 Mbytes in removable or fixed disk packs of approx. 15 Mbytes each
- Removable disk packs, up to 296 Mbytes using 37 Mbyte disk packs, 600 Mbytes using 75 Mbyte packs or 2300 Mbytes using 288 Mbyte packs
- MagTape system, 9 track 45/75 ips, 800/1600/6250 bpi
- Floppy disks
- Card readers, 285 or 600 cpm
- Line printers, 300 to 1000 lpm
- Electrostatic printer/plotters
- Matrix printer
- Terminals of various types, from 10 cps hardcopy to 960 cps CRT displays
- Graphic plotters and displays
- ND Colour Terminal for semi-graphic colour display systems
- Paper tape reader and punch
- ND-500 32 bit CPU
- CAMAC
- Various communication adapters (including HDLC and Megalink)
- Special peripherals on request

## REFERENCES

- ND-60.125 SINTRAN III Introduction
- ND-60.132 SINTRAN III Time-Sharing/Batch Guide
- ND-60.151 SINTRAN III Utilities Manual
- ND-60.128 SINTRAN III Reference Manual
- ND-60.051 SINTRAN III Real Time Loader
- ND-60.133 SINTRAN III Real Time Guide
- ND-60.072 SINTRAN III Real Time Loader - System Documentation
- ND-60.062 SINTRAN III System Documentation
- ND-30.003 SINTRAN III System Supervisor
- ND-60.082 SINTRAN III User's Guide



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