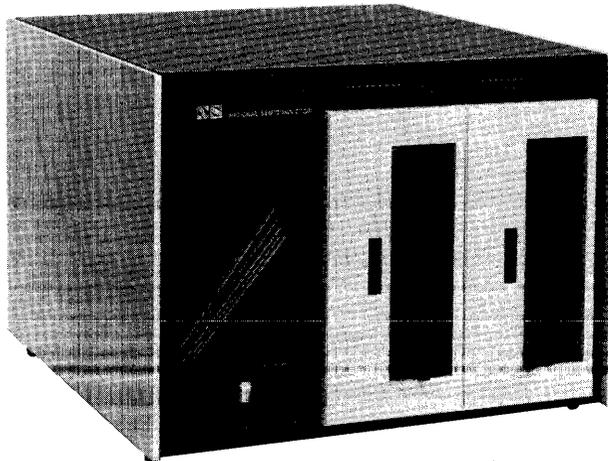




NATIONAL  $\mu$ SPEC 3

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## FLOPPY DISC OPERATING SYSTEM (and CRT Interface)



### FEATURES

- **CONVENIENT MASS STORAGE** — each diskette stores nearly 158k 16-bit words of data (more than ½ mile of paper tape).
- **SPEED** — data transfer rate is 250k bits per second.
- **POWER** — full complement of system software is instantly available via the Disc Operating System (DOS).
- **SIMPLICITY** — operator chores are reduced to the minimum through the powerful DOS command repertoire.
- **LOW COST** — DOS effectively expands system memory and you get about 252k bits per dollar.
- **CUTS DEVELOPMENT TIME** — DOS does the clerical work, 1000 times faster than a programmer can.
- **CUTS PROGRAMMING COSTS** — fewer operator errors and faster access to programming aids mean lower programming costs.

### INTRODUCTION

The Floppy Disc Operating System, an option for the IMP-16P Development System, provides a new level of power and speed to the microprocessor system engineer while greatly simplifying his operator-oriented tasks.

The convenient mass storage capability of the floppy disc allows the elimination of unwieldy paper tape, cards, and other source media. The Disc Operating System (DOS) software adds throughput, capabilities, and flexibility previously unavailable with microprocessor systems.

A CRT Interface is provided with DOS and allows the user to connect a variety of terminals to the IMP-16P Development System to maximize the speed of operator communications.

## SYSTEM DESCRIPTION

The Floppy Disc Operating System consists of the following items.

- Dual Floppy Disc Drives to provide more than 5 million bits of easily accessible data storage.
- Interface Card, which mounts in the IMP-16P card cage and provides the firmware to control the disc drives and the transfer and formatting of data exchanged between the microprocessor and discs.
- DOS software, which includes the following:
  - Assembler (Relocating)
  - Linking Loader
  - DEBUG program
  - Editor
  - Full complement of utility and diagnostic programs.

## CRT INTERFACE

The CRT Interface firmware is contained in two ROMs on the Interface PC card. This firmware allows a CRT terminal to be connected to the IMP-16P and provides data transmission rates of 300 or 1200 baud. The baud rate is selectable from the control panel of the IMP-16P Development System. Interconnection is via a standard EIA-type cable and allows attachment of a broad range of widely available terminals. Implementation of this CRT interface, when coupled with the power of DOS, provides the user with an extremely fast and flexible tool, thus freeing him to concentrate on program development and problem solving.

## DOS CAPABILITIES

An operating system relieves the user of tedious, non-productive tasks. It provides simple, easy-to-use commands to initiate and control such operations as loading and executing programs, transferring control and information between programs, and similar tasks. The Floppy Disc Operating System provides all these capabilities and also expands the power of the user's system by effectively extending system memory. Programs stored on disc can be quickly loaded into memory and executed under control of DOS. Access to and storage of programs and data is fast and simple.

The Floppy Disc Operating System allows the user to write and edit source programs at the system keyboard, then to store them directly on floppy disc using the Source Editor. The stored source program may then be assembled instantly, under DOS control, by issuing a single command. Assembled (object) programs may be stored on disc in binary form via the DOS Linking Loader, then loaded into the processor using the Disc Bootstrap routine. The DEBUG program can be used quickly and easily to debug the user's program.

The entire program development and checkout process can be accomplished without ever using paper tape or cards, and without loading source programs more than once. The software modules available under the control of DOS, provide easy-to-use, conversational-mode instructions and commands to further simplify program development. Error checking and recovery procedures are also included in the DOS software modules to enhance design and checkout of microprocessor programs.

## DISC OPERATING SYSTEM SOFTWARE MODULES

Included with DOS are all the supporting software modules required to allow the user to take full advantage of the Dual Floppy Disc Operating System. The software described below can be considered as part of the system and is all contained on a single diskette.

- IMPASM — an 8k, Resident Assembler that accepts free format source statements and produces relocatable load modules for storage on disc or paper tape.
- EDIT16 — a Source Editor program that enables editing of previously prepared source programs and generation of new text.
- DSCLDR — a Linking Loader that loads and relocates load modules, resolves external linkages, and writes memory images to the disc in a format suitable for bootstrapping into memory for execution.
- DEBUG — a supervisory program that allows the user to checkout his programs from the terminal keyboard. DEBUG allows the user to start, stop or change a program and to examine the contents of memory, registers and the stack.
- A full complement of utilities, diagnostics and PROM Development software is also included with DOS.

## DOS COMMAND REPERTOIRE

The value of an operating system depends upon the range and simplicity of its command repertoire. A powerful set of commands is provided by the Floppy Disc Operating System in the form of simple, easy-to-remember mnemonics. These commands, listed below, provide operator control of DOS. Additionally, each software module (Assembler, Editor, and others) has a set of commands associated with its particular functions.

### Assembler Commands

- DI Disc Input, causes a source file to be read from disc into memory.
- DT Disc Temporary, allows temporary storage on disc of source programs read from cards or paper tape. The source can then be edited without the need to re-read cards or paper tape.
- DO Disc Object, allows the user to store object modules on disc instead of paper tape.
- DE Disc Editor, transfers control to the source Editor program.
- DL Disc Loader, transfers control to the Disc Loader program.

### Editor Commands

- AS Transfers control to the Assembler.
- DC Disc Copy, allows a range of sectors to be copied from one portion of disc to another or from one diskette to another.
- DE Disc Edit mode, allows the user to edit large source files within a small edit buffer in memory by editing only a portion of a file at a time. The remainder of the file resides on disc and all the housework of maintaining exactly where the user is working in his program is handled by the Editor.
- DI Disc Input, allows the user to read a designated number of text lines or sectors from the disc into the edit buffer.
- DO Disc Output, allows the user to move a designated number of text lines or sectors from the edit buffer to the disc.
- ED End Disc Edit, terminates the disc edit mode and performs all required clean-up procedures.
- AD Abort Disc Edit, terminates the disc edit mode immediately without performing housecleaning.

### Disc Loader Commands

- MP Main Program Load, causes a set of relocatable load modules to be linked into a main program and written to a designated area of disc.

RLM Relocatable Load Module identifier, causes an LM to be read into memory from a designated area of disc or from paper tape.

XEC Execute, causes a main program to be read into memory from disc and executed.

GO Causes the last program (group of LMs) loaded into memory to be written to the disc at the correct sectors and assigns an entry point address.

## SPECIFICATIONS FOR DUAL FLOPPY DISC DRIVES

### Dual Floppy Disc Drives

- Dimensions: 17 inches high, 21½ inches wide, 22½ inches deep
- Weight: 50 pounds
- Input Power: 110 ± 10% VAC @ 1.5 A (DC power supplies internal to drives) (220 VAC, 50 Hz option available)
- Performance Characteristics:
  - 256 16-bit words per sector
  - 8 sectors per track
  - 77 tracks per diskette
  - 157.7k words per diskette (2.52 Mbits)
  - 135.4 msec. average latency to obtain 256 words
  - 0.250k bits per second transfer rate
  - 30.2k bits per second effective data transfer rate with latency

### Interface PC Card

- Dimensions: 8½ inches high, 11 inches long
- Input Connector: 144 pins on 0.125-inch spacing
- Output Connectors: Disc — 30 pins  
CRT Interface — 6 pins
- Input Power: +5 V @ 1.2 A, -12 V @ 0.2 A
- Card Cage Slot: A2-J4

### CRT Interface

- Standard TTY-type firmware subroutines for data send/receive
- Asynchronous data transmission at 300 baud (30 characters per second) or 1200 baud (120 characters per second)
- Baud rate selectable from IMP-16P control panel
- Standard EIA interface cable and connector

**ORDERING INFORMATION**

The IMP-16P/840 Floppy Disc Operating System can be used with any IMP-16P Development System that has 8k or more words of memory. Although DOS requires only a floppy disc and a TTY for operation, it can support a variety of peripheral devices, including high-speed paper tape reader, card reader, CRT terminal, and line printer. Since the addition of the Floppy DOS to existing IMP-16P Prototyping Systems requires some minor modifications to the hardware, separate order numbers are assigned to options that are to be installed as field retrofits.

For additional information on this product, contact the nearest National Semiconductor Sales/Service Representative or communicate directly with our World Headquarters:

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 2900 Semiconductor Drive  
 Santa Clara, California 95051  
 (408) 732-5000 / TWX (910) 339-9240

**Order Number:**  
 IMP-16P/840A(E)  
**Description:**  
 CRT/Dual Disc Field Retrofit  
**Package Includes:**  
 Interface PC Card  
 Dual Disc Firmware  
 CRT Interface Firmware  
 Dual Floppy Disc Drives  
 DOS Software (on diskette)  
 CRT Interface Cable  
 Retrofit Kit  
 Documentation (Hardware & Software)

**Order Number:**  
 IMP-16P/840C(E)  
**Description:**  
 CRT/Dual Disc  
**Package Includes:**  
 Interface PC Card  
 Dual Disc Firmware  
 CRT Firmware  
 Dual Floppy Disc Drives  
 DOS Software (on diskette)  
 CRT Interface Cable  
 Documentation (Hardware & Software)

NOTE: All units are available in 110 VAC, 60 Hz or 220 VAC, 50 Hz "E" versions. To order the 220 V/50 Hz version, append "E" to the Order Number (for example, IMP-16P/840AE).

Manufactured under one or more of the following U.S. patents: 3062262, 3189758, 3231797, 3302956, 3317671, 3322071, 3391071, 3408542, 3421025, 3426423, 3440490, 3518750, 3519897, 3557431, 3560765, 3566218, 3571630, 3575609, 3579059, 3593099, 3597640, 3607469, 3617859, 3631312, 3633052, 3638131, 3648071, 3651565, 3683248.

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