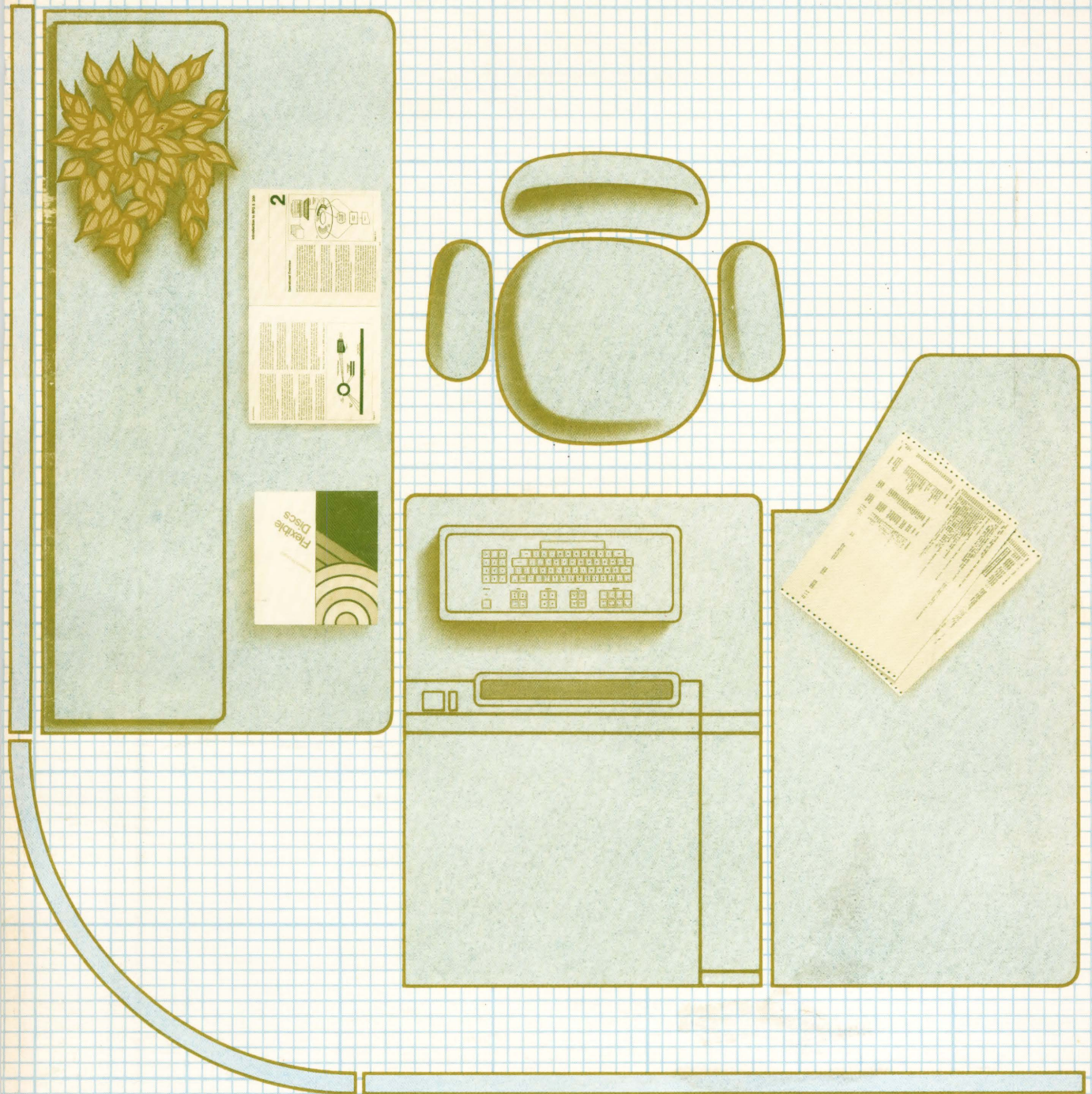


HP 300 Computer System General Information Manual



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5303 Stevens Creek Blvd., Santa Clara, California, U.S.A.

Part No. 31000-90002
5953-3704
Printed in USA September 1978

Preface

This manual contains general information about the HP 300 Computer System and its capabilities. It is divided into two major parts. Part I presents an overview of the system and its key features and concepts. Part II provides more detailed technical data, organized for easy reference.

Other HP 300 manuals and applications guides provide complete information on all aspects of system operation and programming. A full listing of the available HP 300 documentation can be found in Appendix A.

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Part 1



1

In today's business environment, sound business decisions demand rapid access to accurate information. The Vice-President examining month-to-date sales, the purchasing agent planning next month's purchases, the order processing clerk responding to a customer's telephone inquiry—all need accurate, timely information to do their jobs better. The HP 300 Computer System can help to provide this information, when and where it is needed.

The HP 300 is a full-capability computer system for dedicated business data processing applications. It includes powerful general-purpose features generally found only on much larger systems, yet it is designed for direct use in daily business activity. This unique combination of full capability and dedicated, locally controlled processing power makes the HP 300 the kind of system businesses need to solve their problems their way.

Key features of the HP 300 Computer System include:

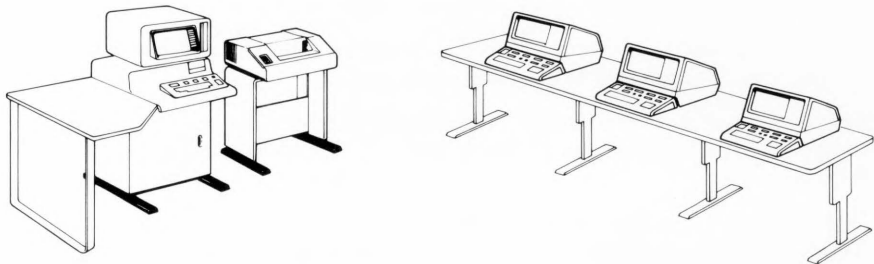
- **“Large System” Capability:** Powerful operating software and state-of-the art hardware provide unprecedented capability in a small, integrated system.
- **Sophisticated System Display:** An advanced system display provides significant new display capability and simplicity of system operation.
- **Data Management:** A comprehensive file system and the Image/300 Data Base Management System offer a complete range of data management alternatives.
- **Online Multiterminal Processing:** The HP 300 and its terminals offer a variety of application structures and display features for implementing efficient online applications.
- **Interactive Software Development:** Powerful programming tools and a unique online programming process simplify and streamline software development.
- **Dependability:** The HP 300 provides reliable, worry-free operation backed by a strong, worldwide support organization.
- **Expandability:** The HP 300 has dramatic growth potential in all dimensions, with smooth, modular expansion.

HP 300 systems can be used in a broad range of data processing environments, from small single-user configurations to large multiterminal systems. From any starting configuration, the system can be expanded in small, incremental steps to meet growing business needs.

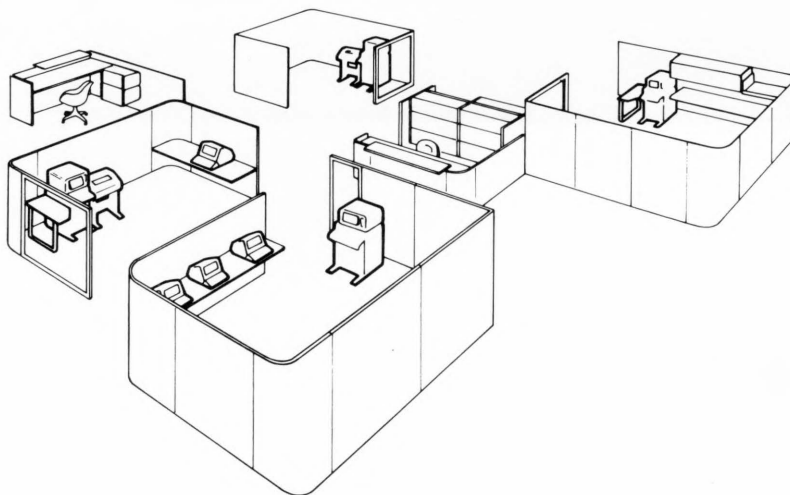
In smaller configurations, the HP 300 provides powerful capabilities in a very compact package. The system can process several jobs concurrently, interacting with you even while it is printing reports, processing data, or sorting files.



Larger HP 300 systems can be used in applications where several users need online access to the system. Each terminal can be independently used for interactive processing at the same time that new programs are being developed and other non-interactive jobs are proceeding.



HP 300 systems of various sizes can be distributed throughout an organization in individual operating departments. By dedicating each system to its own application, each manager has control over his own processing resource and data base. Data exchange via flexible discs allows the various applications and systems to work together.



The HP 300 is an ideal system for systems organizations who provide applications software, systems, and services. These computer professionals can use the unique features of the HP 300 to build capable, high-value applications systems. With their help, small and medium-sized companies can apply the HP 300 in areas such as order processing, accounting, inventory control, and many others.

Larger companies with their own data processing staff will find the HP 300 an excellent system for distributed locations such as sales offices and distribution centers, and for individual operating departments. Applications for these sites can be centrally developed and then loaded onto the individual systems for production work. The HP 300 offers each site the benefits of online access to its own data base, while maintaining the central control that is critical for accuracy and maintainability. Individual sites can augment centrally-developed applications with their own programs, to meet their own unique information needs.

The HP 300 also provides a solution for those dedicated applications where a system powerful enough to handle the job has not been economical until now. By focussing in on an inventory control or cash management problem, for example, an HP 300 system can rapidly save enough money to pay for itself. And it also provides the added benefit of tighter control in a critical business area.

In each of these application areas, and in many others as well, the HP 300 offers an ideal blend of full system capability and dedicated processing power. The remaining sections of this manual describe the specific capabilities that make the HP 300 a powerful computing resource, ideally suited to solving today's business data processing problems.

2

The HP 300 System can be applied in almost any area of a business where people generate, process and use data. This section gives an overview of the system's major components and how they are used in typical HP 300 applications.¹

HP 300 System Hardware

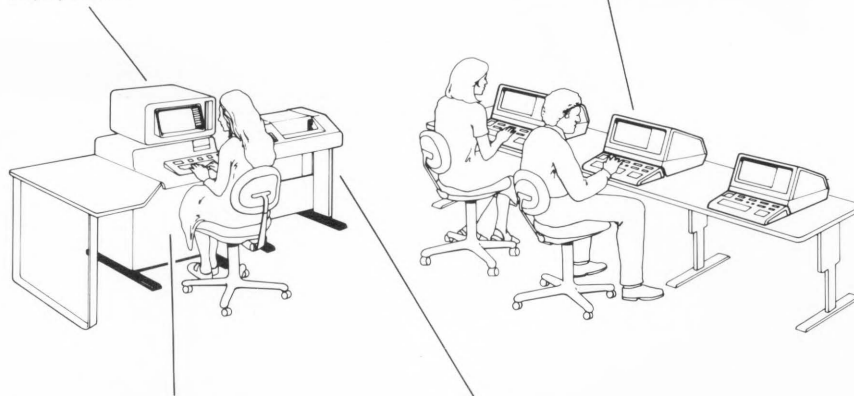
Figure 2-1 shows a typical HP 300 system in an order processing application. The major physical elements of the system are identified in the figure.

Integrated Display System

The lead clerk controls the system and answers management inquiries from this keyboard and display screen.

Application Terminals

Order processing clerks at these terminals enter orders and answer customer inquiries.



HP 300 Computer System

The HP 300 system processes the orders and stores order and shipment data.

Printer

Invoices and reports are printed on demand on the HP 300 printer.

Figure 2-1. A Typical HP 300 System

¹ The application examples in this section illustrate the capabilities of the HP 300 when properly programmed by an applications programmer. They are not a standard part of the HP 300 System.

System Unit

The central element in every HP 300 system is the HP 300 System Unit. The System Unit combines the HP 300's processing power, storage capability, and control functions into a single, compact, integrated package, as shown in Figure 2-2.

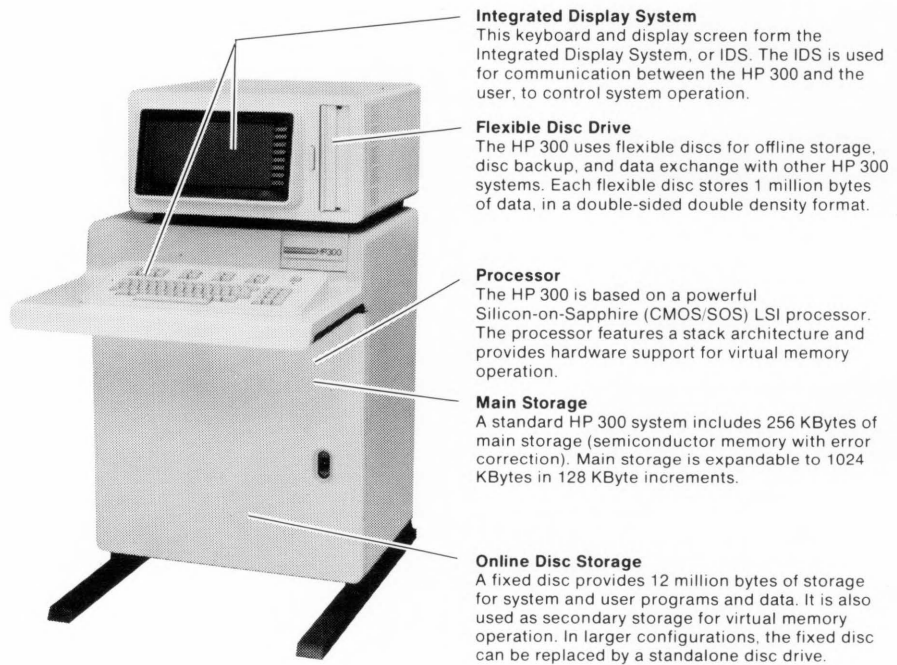


Figure 2-2. HP 300 System Unit

Integrated Display System



The HP 300 system is controlled from the Integrated Display System (or IDS) that forms the upper part of the System Unit. The IDS is specially designed to provide a highly interactive, easy to use environment for you as an HP 300 user. Its advanced display and editing functions and pushbutton-oriented operation give you direct, personal control over all aspects of HP 300 operation. The IDS also serves as a programming station for developing HP 300 applications software. Application programs can also use it as an applications terminal.

The IDS keyboard includes a main typewriter key group, a numeric keypad, and separate control key clusters for editing and display control. The screen displays 1920 characters in a 24 row x 80 column format. A full 128-character upper/lower case character set is standard, and you can add optional character sets to display international and mathematical symbols, large characters, and line-drawn forms. For formatted screen displays, the IDS includes display enhancements for blinking, half-bright, underlined and inverse video (black-on-white) fields. These can be combined with special IDS format modes for forms-oriented screen processing.

In addition to these basic features (which it shares with the HP 300 application terminals), the IDS incorporates a set of advanced display features that offer significant new display capability. Through its "windowing" feature, the display screen can be divided into multiple sections (called "windows") for greater display flexibility. Using several windows, the IDS can simultaneously display several different kinds of information on a single screen. Or, windows can be used to perform several different functions at once on the IDS, with each function handled in its own separate window. Each window is independently controlled as a "mini-display screen", so even complex, dynamic displays can be effectively presented.

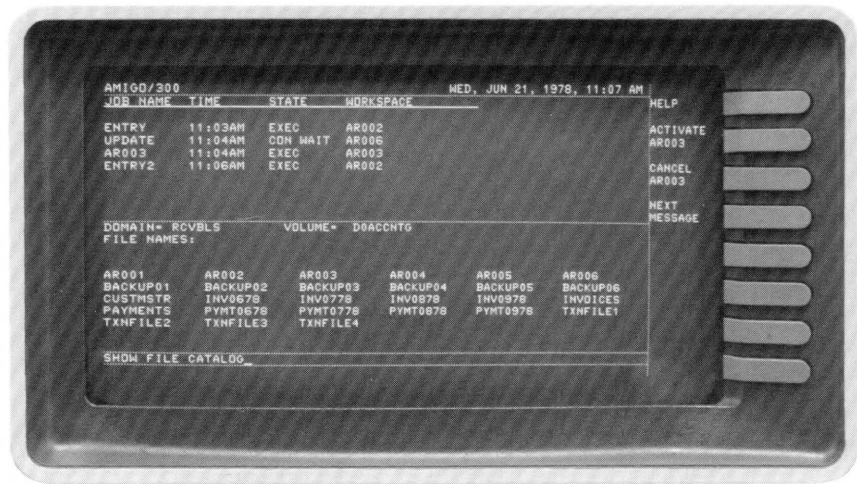


Figure 2-3. IDS windows and softkeys

Figure 2-3 is an example of how windows are used in system operation. One large window displays a list of jobs currently running in the system, while the other shows a list of files. At the same time, the smaller window at the bottom of the screen is being used to enter a command.

Eight “softkeys” bordering the right side of the IDS screen provide a pushbutton choice capability for the IDS user. The softkeys are used in a variety of ways to represent alternative actions or special functions that can be invoked at the press of a button. One of the IDS windows is used to label each softkey on the adjacent screen area, indicating its function. Each label can be individually and dynamically changed, allowing the softkeys to be used over and over again for many different choices.

Figure 2-3 shows how the softkeys operate. A job named “AR003” has been temporarily suspended, and two of the softkeys offer a choice between re-activating or cancelling the job. Two other softkeys provide pushbutton access to an online reference manual (HELP), or to a message that is waiting for the user.

The HP 300 system software extensively uses windows and softkeys to simplify system operation. These same features can be used by HP 300 applications, to make the IDS a powerful “management terminal” for supplying management information. While these applications are somewhat more complex to develop, the results can be well worth the effort, as shown in Figure 2-4.

This example shows a sophisticated management inquiry application. In response to an entered customer number, general customer information from a customer master file is displayed in the upper window. Then, softkeys are used to select information

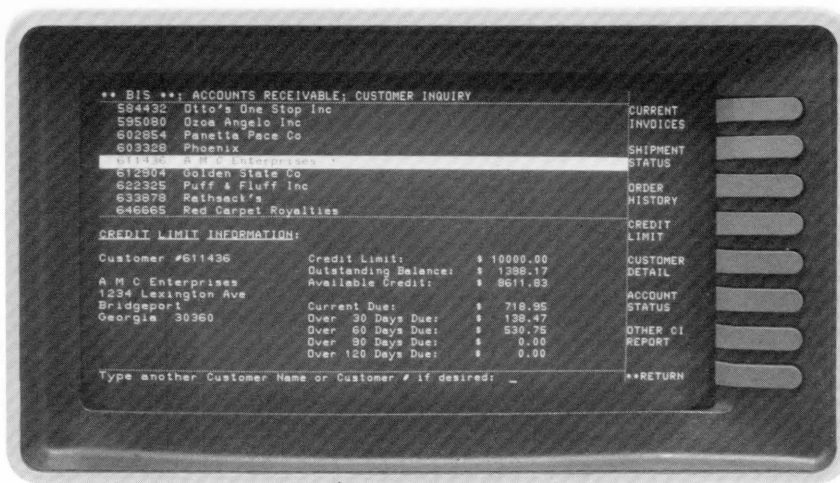


Figure 2-4. Windows and softkeys in a sample application

from credit, order, and shipment files for display in the lower window. In this way, several different types of information are simultaneously and clearly presented on the same display.

Section 3 describes these and other capabilities of the IDS in greater detail, and gives additional examples of how they are used in system operation and for applications processing.

Application Terminals

The HP 300 system is designed for online, multiterminal applications processing, and up to sixteen application terminals can be included in an HP 300 configuration.² These application terminals are dedicated to application processing—they cannot control system operation as the IDS can. Instead, they operate totally under the control of HP 300 applications programs.

Application designers can use this terminal control to simplify interaction with the terminal user. Using the terminal's display features, and terminology that is familiar to the user, the application can be made easier to understand and use. The terminal user is not confused by system prompts, messages, and operating conventions. System security is also enhanced because the application strictly controls the functions that are available at each terminal. Access to sensitive information can be effectively limited through operator passwords and security features embedded in the application.

² The exact number of terminals supported depends upon application characteristics and system configuration. An HP Systems Engineer will help you analyze your application and determine its requirements.

2640 Series Interactive Display Terminals



The HP 2640 series is a compatible family of interactive display terminals. All models in the 2640 series share the same basic keyboard, display, and editing features. In addition, each model offers specialized capability, such as local mass storage, user programmability, or local graphics.

The 2640 displays 1920 characters on a 24 row x 80 column display screen. In addition to displayed data, local terminal memory can be expanded to include up to several pages of off-screen data storage. This data is brought onto the screen through control keys on the 2640 keyboard. The 2640 keyboard is detached and can be positioned for operator convenience. It is comprised of familiar typewriter keyset and separate control keys for editing and display control. Most models also include a numeric keypad for high-speed numeric input.

To make HP 300 applications easier to use, the 2640 includes several features for terminal display formatting. Blinking, half-bright, underlined, and inverse video (black-on-white) display enhancements can be used to call operator attention to important information. They are also useful for organizing the display, as the example menu screen in Figure 2-5 shows.

The 2640 can operate in a special “formatted mode” for creating data entry forms on the display screen. In this mode, data input is restricted to designated fields on the display. The user simply “fills in the blanks” to enter and modify data. Figure 2-6 shows a typical data entry form that can be created on the HP 300.

More elaborate displays can be constructed by adding optional character sets to the 2640. Using these sets, you can display mathematical symbols, and construct large characters and line-drawn forms on the screen. Figure 2-7 shows how the optional line drawing set can be used to make the screen closely resemble paper business forms, for ease of operation and user training.

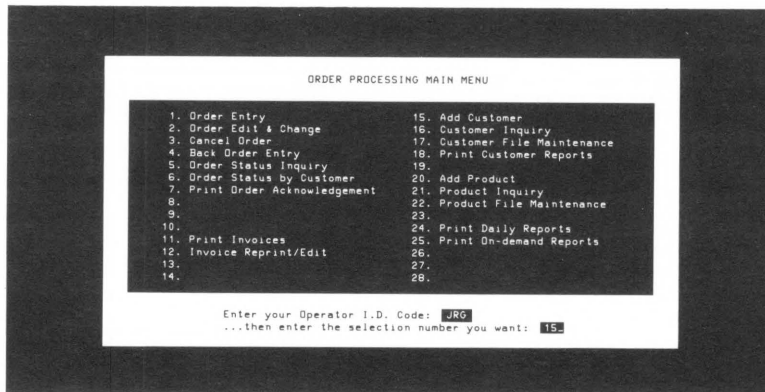


Figure 2-5. 2640 menu display

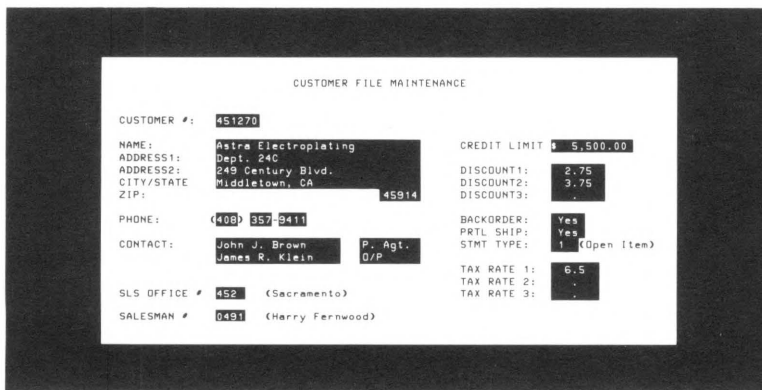


Figure 2-6. 2640 data entry form

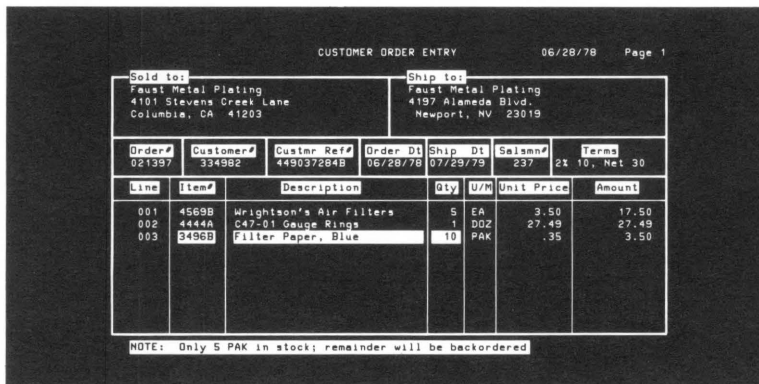


Figure 2-7. A form using the optional line drawing set

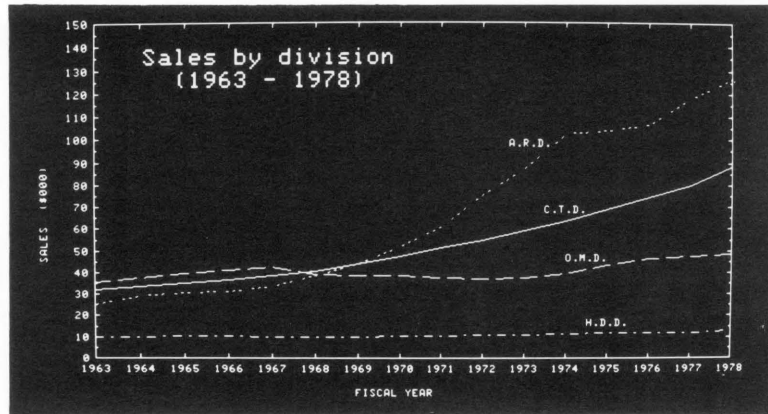


Figure 2-8. 2640 Series graphics display

Two members of the 2640 family offer local graphics display capability. Data entered at the terminal or transmitted from the computer can be automatically translated into graphs, bar charts, and pie charts by the terminal with the press of a few keys. The graphics capability is a local, key-controlled feature of the terminal, and does not use any special graphics language support from the HP 300 system or its programming languages. Figure 2-8 shows the kinds of displays that can be constructed using this feature.

Many of the 2640 series terminals can include optional dual mini-cartridge tapes for local mass storage. Local printers can also be attached to provide printed copies of the display screen for a permanent record. For detailed information about each model in the series, see Part II of this manual.

Printers

An HP 300 system may optionally include one or more printers. In addition to the periodic reports that are a part of almost every business application, the system can also provide printed information on demand throughout the business day. Report programs can be initiated through commands entered at the IDS, or reports may be structured directly into the application.

The HP 2631A is a serial dot matrix printer that prints bidirectionally at a rate of 180 characters per second. It prints up to 136 characters per line, at 6 or 8 lines to the inch. A full 128-character upper/lower case character set is standard, and an international character set may be optionally added. Multi-part business forms up to 6 copies, and of various lengths and widths, can be accommodated.



In addition to its standard printing features, the 2631 can horizontally expand and compress text. Print expansion is useful for printing large headings or calling attention to important information in a report. Print compression allows a full 132-column line to be printed on ordinary 8-1/2" paper. These special 2631 features are illustrated in the sample report that follows.

```

          CUSTOMER ORDER HISTORY          7/13/78

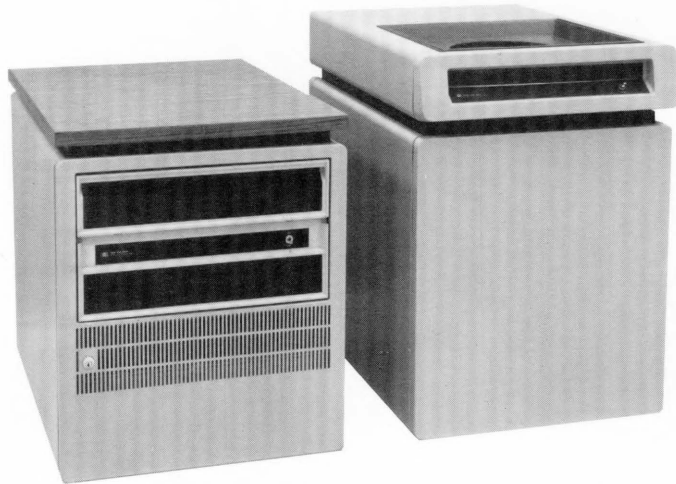
CUSTOMER #: 02358          CUSTOMER:  TRANS-GEORGIA CORPORATION
                               1051 FORTUNATA AVENUE
                               MIDDLETOWN, GA 78493

ORDER#   ORDER DT   AMOUNT   STATUS   COMMENTS
-----
145680   12/31/77   $ 127.42  SHIPPED   Ship-date: 03/31/78
146735   2/27/78   987.62   SHIPPED   Ship-date: 05/25/78
148904   3/14/78   250.56   I-I-O-L... I>  Parts due 8/30/78
150721   5/29/78   498.30   SHIPPED   Customer reports shipping damage
151053   6/12/78   300.42   I-I-O-L... I>  Partial shipment O.K. Parts avail. 10/78
152004   7/01/78   429.32   PROCESSING
152305   7/04/78   100.43   PROCESSING
153478   7/11/78   250.00   PROCESSING

TOTAL:           $ 2593.64
  
```

Figure 2-9. Sample 2631A report

Additional Mass Storage



HP 7906, HP 7920/7925

The minimum HP 300 system includes a 12 MByte fixed system disc, which may be optionally replaced by a 20 MByte disc drive for a larger starting configuration. This mass storage capacity can be increased by adding one or two additional disc drives. Three different disc models are available.

The HP 7906 is a 20 MByte cartridge disc drive. Half of the 7906 capacity is stored on its removable disc cartridge, and the other half is stored on a fixed disc within the 7906 cabinet. The 7920 is a 50 MByte drive that uses a removable disc pack for data storage. The 7925 also stores data on a disc pack, with a capacity of 120 MBytes.

The HP 300 system supports high speed disc-to-disc backup for all three discs. In addition, the 7920 and 7925 disc packs can be used as removable private disc volumes. With this capability, several different sets of data on different disc packs can share the same disc drive on a mutually exclusive basis. Data can also be physically removed from the system where security is a prime concern.

HP 300 System Software

HP 300 System Software controls the operation of the HP 300 hardware and helps you make the maximum use of your HP 300 system. Each system software component performs a specific function to support overall system operation:

Operating System

Amigo/300

The Amigo/300 Operating System provides the basic HP 300 operating environment. It supervises program execution, manages data storage, performs input and output, and generally controls system operation.

Language Subsystems

Business Basic/300
RPG II/300

HP 300 Language Subsystems incorporate all the software development tools needed to develop and maintain HP 300 application programs.

Utilities

Image/300
Sort/Merge
Typist
System Build

HP 300 Utilities provide service and support functions for managing data bases, sorting data files, editing text documents, changing system configurations, etc.

Figure 2-10 shows how these system software components relate to one another.

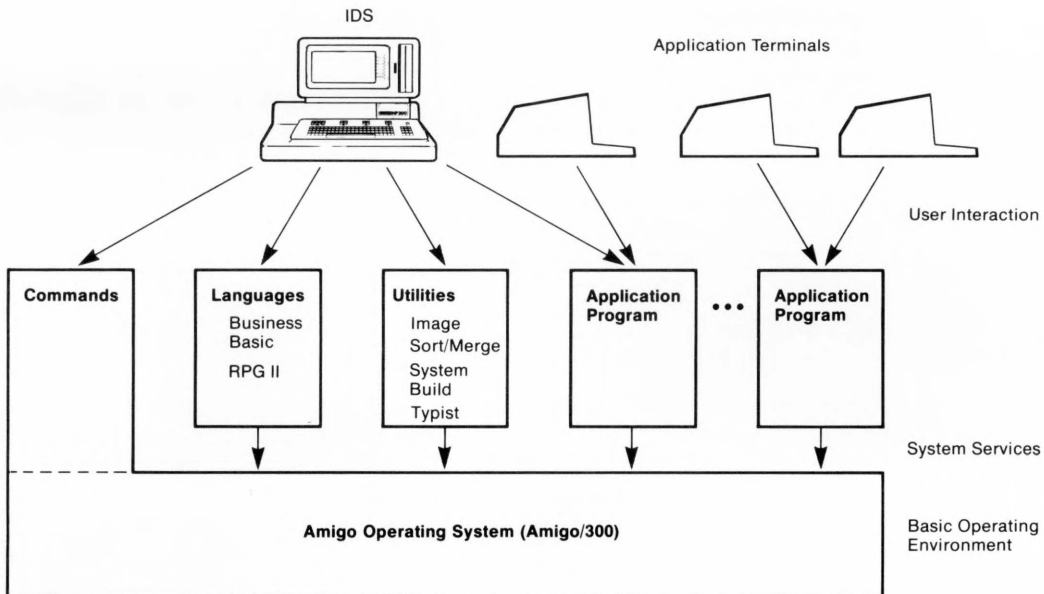


Figure 2-10. System Software Overview

Amigo/300 Operating System

Amigo/300 is an advanced, multiprogramming, multitasking, virtual memory operating system, with extensive data management and online processing facilities. In dedicated, terminal-oriented applications, Amigo/300 supports rapid terminal response and substantial interactive processing in addition to concurrent non-interactive jobs. It also includes a highly interactive command interface that significantly simplifies system operation. Key capabilities of Amigo/300 include:

- **Multiprogramming:** Many independent programs can execute concurrently on the HP 300 system, without interference.
- **Multitasking:** A single HP 300 program can be comprised of many independent processing “tasks”, each performing its own function within the program and executing in parallel with the others.
- **Virtual memory:** Advanced virtual memory techniques are used for efficient main storage utilization. Using a demand segmentation scheme, only a small portion of a program is required in main storage at any time. As a result, many programs can effectively share limited main storage, and even very large programs can execute on small-memory configurations.
- **Large addressing space:** Amigo/300 provides a potential addressing space of over 260 million bytes for each HP 300 program. Practical limits on program size are dictated by available mass storage.
- **Data management:** Amigo/300 features both a file management system and data base management for flexible data storage. The Amigo/300 file management system provides high-level file and device access and a rich variety of file structures. For more highly structured data, the Image/300 Data Base Management System offers an integrated data base structure with powerful data storage and retrieval capabilities.
- **Priority scheduling:** The HP 300 processor and main storage are scheduled using a priority scheduling scheme. This assures that input and output requests are serviced as rapidly as possible, for low response times as well as good throughput.
- **Single-step startup:** Amigo/300 automatically begins execution when HP 300 power is turned on, without further operator action.
- **Callable system services:** A comprehensive set of system services provides programmatic access to Amigo/300 capabilities. Through these services, applications programs can invoke system features that are not directly accessible through the HP 300 programming language constructs.³
- **Backup and recovery:** HP 300 flexible discs, disc cartridges, and disc packs are used as backup media. The system supports both online and stand-alone backup operations.

³ System services cannot be called from applications programs written in RPG II/300.

Language Subsystems

The HP 300 Language Subsystems create a unique, highly interactive programming environment at the IDS, in which all HP 300 software development takes place. This environment, together with the powerful programming tools the Language Subsystems provide, streamlines and simplifies program development. The HP 300 supports programming in two languages that span a wide range of application needs:

- **Business Basic:** A language for online, terminal-oriented applications, with significant extensions for commercial data processing.
- **RPG II:** A business language for report generation and batch-oriented processing, with extensions for multiterminal interactive data entry.

The HP 300 programming languages and program development process are explained in more detail in Section 4.

Utilities

Sort/Merge

Sort/Merge is a utility for sorting and merging HP 300 data files. As an interactive utility, Sort/Merge accepts commands entered at the IDS to control sorting and merging operations. It can also be invoked by applications programs through callable system services. Sort/Merge accepts up to 16 input files of various organizations, with either fixed-length or variable-length records. Up to 16 sort and merge keys can be specified, and a variety of output options are available.

Typist

Typist is the text and document editor for the HP 300 system. It can be used to prepare program documentation, write letters, store and retrieve text, and for other text processing applications. Typist uses the advanced “on-screen editing” capability of the IDS for character and line editing. This allows direct updating of a text document by modifying its displayed image on the IDS screen. On-screen editing is fully described in the next section of this manual.

To complement on-screen editing, Typist includes editing commands for moving, deleting, inserting, and modifying entire blocks of text. Other commands control titles, page numbering, centering and other aspects of text formatting. Text can also be saved in named modules for repetitive use in form letters, contracts, etc.

System Build

System Build is the HP 300's online system configuration utility. It is used to add, delete and modify the hardware and software components of an HP 300 system quickly and simply. System Build leads the user step-by-step through the configuration process, using clear prompting messages and presenting major alternatives through the IDS softkeys. It operates in an incremental fashion, adding and subtracting from an existing HP 300 configuration to arrive at a new one. New components can be added in just a few steps, without respecifying the entire system.

The HP 300 Interactive Display System is an advanced, microprocessor-based display station that provides significant new display capabilities. Through the IDS, you can view many separate collections of data at the same time, or simultaneously perform several different tasks. You can also examine reports and files that are too large to be viewed on conventional displays, and edit information directly on the display screen. This section describes the capabilities of the IDS, and how they are used in system operation and in HP 300 applications.

The IDS in System Operation

The IDS plays a central role in almost every aspect of system operation. It serves as a system console, a program development station, a text editing terminal, a diagnostic tool, and in many other capacities. In each of these functions, the HP 300 system software uses IDS display features to simplify system operation.

System Display

The windowing feature of the IDS is used to create a standard system display format for system/user communication. Figure 3-1 shows an example of this display. Each window on the screen is used for a single, consistent purpose throughout all phases of system operation. For example, a prompt in the command window always indicates that system is waiting for a command, and errors in commands are always reported in the error window. This consistency makes the system easier to understand and operate.

The IDS softkeys are used to provide many commonly used system functions in pushbutton form. As the system presents different choices and functions, it changes the softkey labels dynamically so that they always indicate the current function of each key.

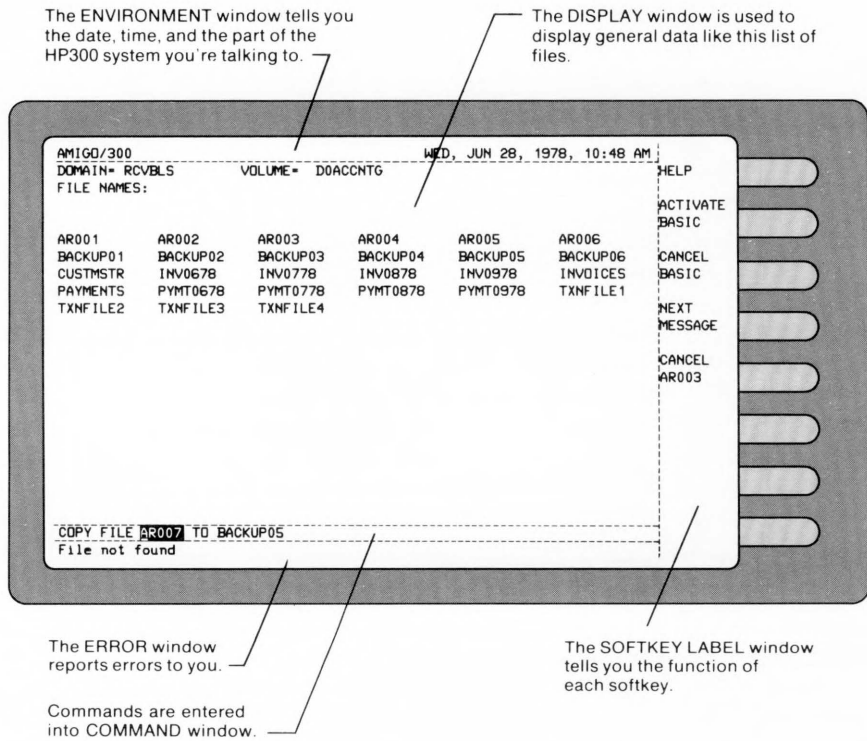


Figure 3-1. Standard system display

Commands

Just as the HP 300 uses a standard display format, it also uses a uniform command language, with the same structure, punctuation and conventions, throughout all phases of system operation. The commands resemble natural sentences in their structure, so they can be easily remembered. For example:

RUN PAYROLL	runs the program named PAYROLL
CREATE FILE ORDERS	creates a file named ORDERS
SHOW STATUS OF FILE ORDERS	shows status information for the file named ORDERS
PURGE FILE ORDERS	PURGES (deletes) the same file

Commands are free-form in spacing and phrasing, so you don't have to remember the exact form of the command you want. The HP 300 automatically corrects simple spelling mistakes in commands. For example, each of the following commands will correctly copy the file named "ORDERS1" to the file named "ORDERS2"

```
COPY FILE ORDERS1 TO ORDERS2
COPY FILE ORDERS1 TO ORDERS2
DUPLICATE FILE ORDERS1 TO ORDERS2
COPY FILEE ORDERS1 TOO ORDERS2
DUPLICATE FIEL ORDERS1 T ORDERS2
```

You can also abbreviate commands to reduce typing as you become more familiar with the system. The system accepts almost any abbreviation that uniquely identifies a command, so you can create your own short forms of commonly used commands, such as:

```
DUPLICATE FILE ORDERS1 TO ORDERS2
DUP F ORDERS1 T ORDERS2
DPLCT FILE ORDERS1 T ORDERS2
DUPLI FL ORDERS1 TO ORDERS2
```

If an error results from a command you enter, the HP 300 reports it with a clear, natural message in the error window. The cursor is also positioned to the word in the command where the error occurred (see Figure 3-1 for an example). To correct the error, you can use the IDS editing keys to delete, insert and type over characters. There is no need to retype the entire command.

Natural command format, spelling correction, abbreviation, and error reporting combine to create a very forgiving environment for the HP 300 user. And if you forget the form of a command, or don't remember the specific one you need, the HP 300 HELP facility can provide the information.

HELP Facility

The HP 300 HELP facility is an indexed online reference manual that contains general information on system operation and commands. You can use HELP to look up a command or answer a question simply by typing a question instead of an HP 300 command. For example, you can type:

```
HOW DO I CREATE A FILE?
```

and HELP will respond with appropriate information about the CREATE FILE command (Figure 3-2). While viewing the HELP text, you can build the command you need in the command window. HELP also tells you which HP 300 manual gives more extensive information, if you need it.

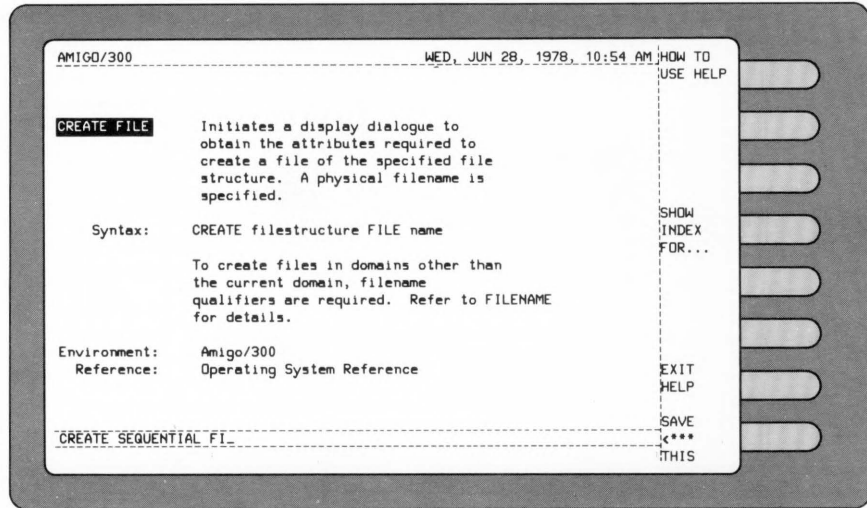


Figure 3-2. The HELP facility

HELP includes an index that you can browse to find topics of interest. The IDS display window presents 21 lines of the index at a time, as shown in Figure 3-3. Using special “scrolling” keys on the IDS keyboard, you can move the entire index up and down through the window until the desired entry is in the enhanced row. Pressing the “SHOW TEXT FOR” softkey then brings the text for that entry into view, as in Figure 3-2.

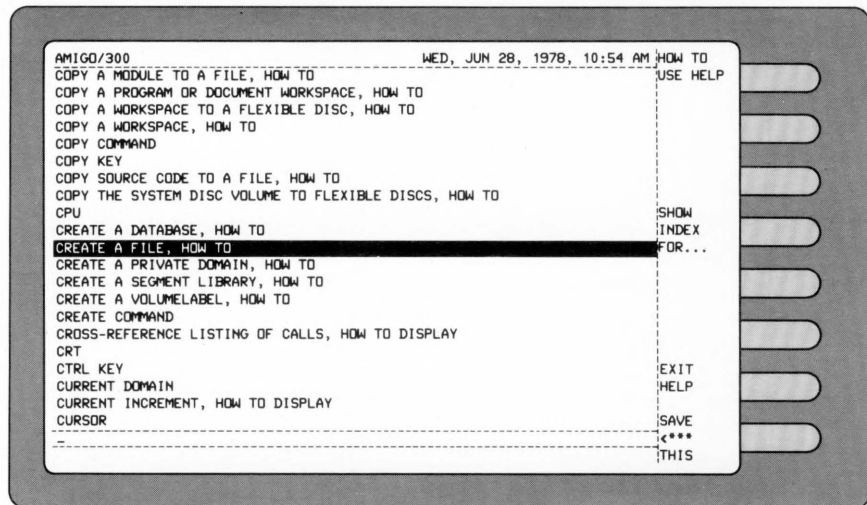


Figure 3-3. HELP index

Text and Program Editing

The HP 300 also uses the IDS windowing capability for text and program editing. The text or program to be edited is “attached” to the large display window on the IDS screen for viewing. (Figure 3-4 shows how text is displayed for editing by Typist, the HP 300 text editor.) To see parts of the text that are not displayed, you can use the IDS scrolling keys to move the text up and down past the window until the desired text is in view. In this way, you can view the entire contents of the text file, even though it may be many thousand lines long. In addition to vertical scrolling, the text can be scrolled horizontally, to view lines up to 160 characters long.

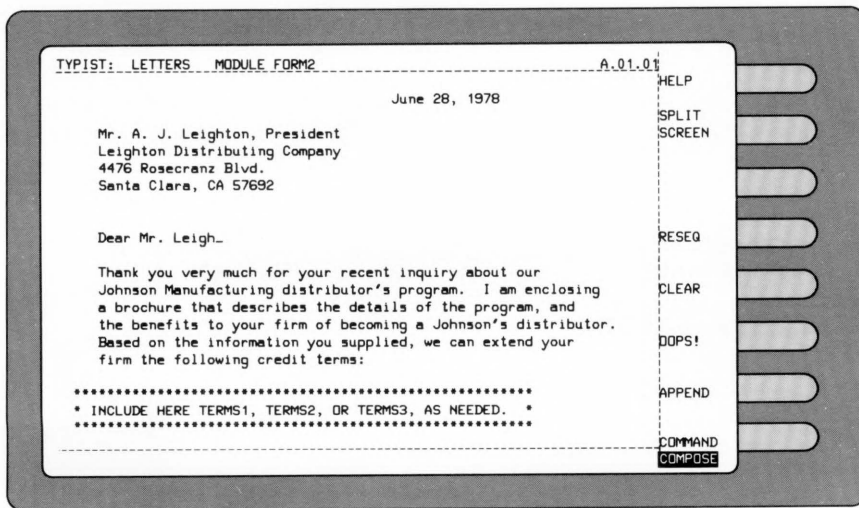


Figure 3-4. Editing text using Typist

The HP 300 also allows you to modify text as it appears in the display window. Using the IDS cursor control and scrolling keys, you can move the cursor to any character position in the file. Then, you can type over characters, or use the IDS editing keys to insert and delete characters or lines as they appear on the screen. Every editing change that you make to the screen image is automatically made to the “attached” text file by the HP 300 system. So you can edit the text simply by moving the cursor about the screen and modifying it, much as you would use a pencil to edit a printed listing. The text you see on the screen always reflects every editing change you have made, and exactly agrees with the text stored in the system. This unique capability is called On-Screen Editing, and it provides extremely natural, direct editing for HP 300 programs and text.

The IDS in Applications

The same advanced IDS capabilities that are used by the HP 300 system software can also be used by HP 300 application programs. With these features, the application can use the IDS as an advanced “management terminal” for providing management information and answering complex inquiries. Application programs access the IDS through a set of callable HP 300 system services. Although programming at this level requires more skill than straightforward terminal use, the benefits of having the IDS as a capable, effective management tool can easily justify the programming effort.

Softkeys

The IDS softkeys can be used to provide a natural pushbutton choice capability for the IDS application user. Each softkey can be individually labelled on the adjacent screen area with up to three lines of label information. The labels can be changed dynamically under program control to constantly indicate the function each key performs. As Figure 3-5 shows, the softkey label window can be made as wide as necessary to accommodate lengthy labels.

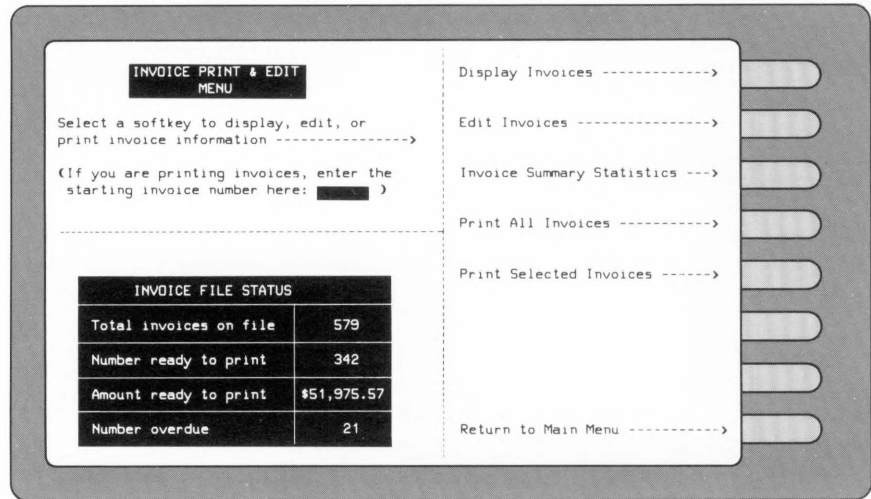


Figure 3-5. Applications use of softkeys

Softkeys can be used for selecting one of several choices (as in this example), or they may allow multiple responses. In the latter case, the keys are set into a “non-terminating” mode that allows many of them to be pressed in response to a single input request. The application can then determine which keys were pressed, and in what order. Softkeys operate totally under control of the application program, which calls system services to label them and accept softkey input.

Windows

Customer Data Inquiry ----- 6/28/78 1:48 PM

Enter Customer Number here: [REDACTED]

Name & Address: Markham Distributing Co.
4395 Merrimack Way
Fl. Compton MD 95748

Phone: (497) 345-5674

Contact: Mr. J. K. Ellis

Class.: 8E

Salesman: H. Johnson

Discount: 5.5%

Tax rate: 4.5%

**** FOR DETAILED INFO. ABOUT THIS CUSTOMER, SELECT A SOFTKEY ---->

SHIPMENT STATUS

Order #	Date	Status	Comments
0473873	05/31/77	Shipped 06/14/78	
0497382	06/12/78	BACKORDERED	Awaiting 2037A Flanges
0499345	06/16/78	Awaiting Shipment	Do not ship before 7/15
0529473	06/25/78	Shipped 06/27/78	
0530384	06/19/78		

Softkey menu on the right:
CREDIT SUMMARY
CREDIT STATUS
PAYMENT HISTORY
ORDER STATUS
ORDER HISTORY
SHIPMENT STATUS
PRINT
RETURN TO MENU

Figure 3-6. Applications use of windows

HP 300 applications can use the IDS windowing capability to present information from many different sources in a straightforward way on the IDS screen. This is a frequent requirement in complex inquiry applications, such as the one illustrated in Figure 3-6. In this example, the user is first asked to enter a customer number, and in response, general customer information is displayed in the upper large window. Then, by pressing the appropriate softkey, detailed information on credit, payments, orders, and shipments for the customer can be viewed in the lower window. Together, softkey selection and windowing make this relatively complex inquiry easy to use and understand.

Windows are visually indicated by dotted-line borders on the IDS screen. These are automatically generated by the IDS between character positions, and do not reduce the number of available display positions. Each window is independently controlled, and functions like a “mini-display screen”, with its own input and output capabilities. This allows even complex, dynamically changing displays to be constructed, as illustrated in Figure 3-7.

In this example, the IDS is used as a dispatcher’s screen in a shipping/receiving department. As trucks come and go at the various docks, clerks enter and retrieve data at HP 300 terminals located there. The display on the IDS constantly shows the status of each dock in the window on the left, while an inquiry and scheduling function is performed on the right side of the screen.

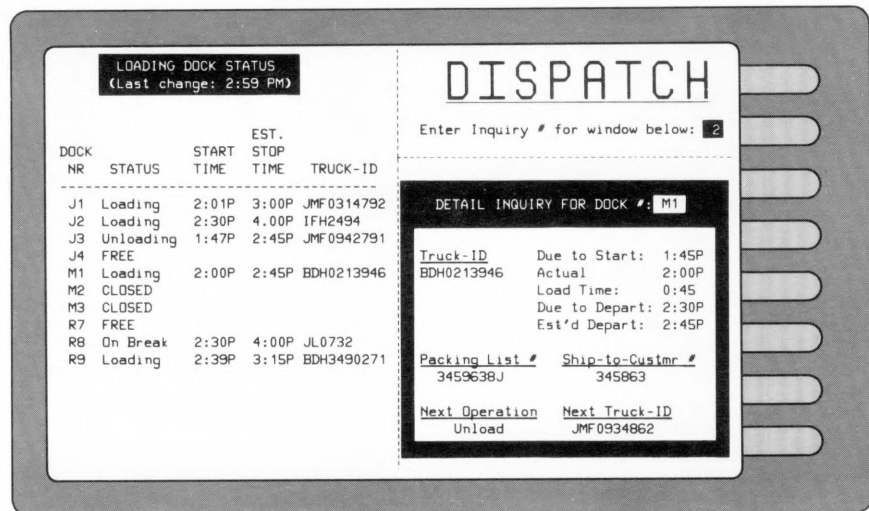


Figure 3-7. Windows in a real-time application

Up to 32 windows can be created in the IDS at any one time. Each window is either “open” (displayed) or “closed” (not displayed), with the restriction that concurrently open windows may not overlap one another. Output is permitted to both open and closed windows. For example, a new display can be readied in a closed window while waiting for a user response to the current display. All windowing functions—including setting window boundaries, creating, destroying, opening and closing windows, and input and output to windows—are under the control of the applications program, which calls system services to manipulate the IDS.

Viewing Data Files

Another major IDS feature is the ability to view HP 300 data files through IDS windows. Relative and keyed sequential files with type DOUBLE keys can be directly “attached” to a window, with the records of the file displayed in consecutive rows of the window. The window thus becomes an actual “window into the file”, displaying data exactly as it appears there (see Figure 3-8).

Scrolling

Files that are too long to fit in an IDS window can be viewed by vertically “scrolling” them past the window. Using keys on the IDS keyboard, you can move the window “up and down” over the attached data file a line at a time, bringing into view records “above” or “below” the displayed section of the file. Other keys move the window forward and backward a page at a time, or directly to the beginning or end of the file.

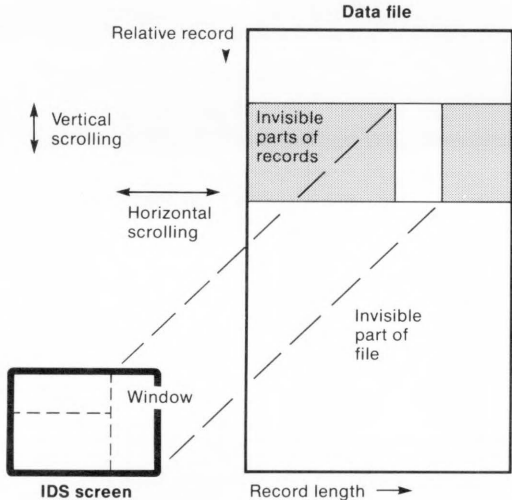


Figure 3-8. Viewing a data file

File viewing and vertical scrolling allow even lengthy files or reports to be viewed directly at the IDS. They can also be combined with more extensive applications programming for sophisticated inquiry applications like the one in Figure 3-9.

In this example, an inventory information file is attached to the upper window for viewing. To see more detailed information on a product, you can scroll that product into the enhanced row and select the appropriate softkey, resulting in the display in the lower half of the screen.

Product Inventory Inquiry					6/28/78	1:59 PM	SHOW
							DETAIL
ITEM #	DESCRIPTION	UNIT PRICE	U/M	QTY-ON-HAND			SHOW
00023B	Die Stocks	475.00	EA	10			USAGE
00106A	Medium Duty Casters	45.95	EA	1,000			
01998C	Wrightson's Air Filters	35.95	EA	45			SHOW
02004F	V278 Support Sheeting	358.86	PKG	10			HISTORY
02013D	Forthright Gaskets	25.00	DOZ	3			
02015A	Ruffwood Keyseat	175.00	EA	5			SHOW
02015B	Ruffwood Keyseat Cutter	25.00	EA	5			VENDORS
02045D	Keyway Bushings	45.00	PKG	24			
02073S	Carbon Steel Hex Nuts	525.00	CASE	10			SHOW
02156D	Gage Block	35.00	EA	2			PURCH'S
02148E	Pneumatic Wheel Set	234.50	EA	1			
02201F	Die Stocks	175.00	PAIR	3			SHOW
							ON ORDR
DETAIL INVENTORY INFORMATION							
ITEM #	UNIT PRICE	U/M	QTY-ON-HAND	ON-HAND VALUE	USAGE/MD		
02013D	\$25.00	DOZ	3	\$75.00	15		
<u>QN ORDER</u>	<u>ORDERED</u>	<u>QTY ORDERED</u>	<u>EXPECTED</u>	<u>VENDOR</u>	<u>EXIT</u>		
Yes	5/21/78	50	6/30/78	Forthright Mfg. Co.			

Figure 3-9. Application use of scrolling

JOHNSON MANUFACTURING COMPANY, INC.						
PAYROLL REGISTER						
(For Pay-ending-date: 6/30/78)						
EMPLOYEE#	EMPLOYEE NAME	HOURS-1	HOURS-2	D/T HOURS	GROSS PAY	FE
002139	John Jacobson	40.00			360.00	
002145	Mary Asterson	35.00			262.50	
002156	Paul Rasmussen	36.00	4.00		396.00	
002238	Adam Roberts	30.00			210.00	
002290	Marcia Danvers	32.00	6.00	5.00	420.00	
002291	Paula Morrison	40.00			300.00	
002316	John Paulson	30.00			270.00	
002329	Harry Michaels	39.00			234.00	
002331	Daniel Adams	40.00		10.00	440.00	
002346	Nancy Williams	40.00			400.00	
002354	John Muncie	40.00			280.00	
002456	Michael Polanski	40.00	3.00		210.00	
002478	Robin Detman	40.00		10.00	302.50	
002494	James McMasters	38.00	2.00		275.50	

Figure 3-10. Using scrolling to preview a report

Horizontal scrolling is used to view files that are “wider” than an IDS window. Using keys on the IDS keyboard, you can move a window “left and right” through an attached file to directly view records up to 160 characters long. As Figure 3-10 shows, horizontal scrolling is useful for presenting more information than a single screen can hold, or for previewing printed reports.

Horizontal and vertical scrolling are both available whenever a file is attached to an IDS window by an applications program. The program has complete control over attaching files, enhancing window rows, selecting windows for scrolling, etc.

Automatic File Update

Files can also be attached to windows in an “automatic update” mode that permits not only direct viewing, but direct modification of the data in the file. In this mode, the user can respond to input requests from the applications program by scrolling the file past the screen, moving the cursor about, and directly modifying the displayed data with the IDS editing keys. The HP 300 system automatically updates the attached data file, record by record, as the screen image is changed. The application program is also informed of the identity and contents of each record, as it is modified.

Automatic file update provides a natural editing capability that is especially useful in text processing applications, because it assures that the screen image always exactly matches the data in the attached file. This same concept is used by the HP 300 Language Subsystems and Typist to create their “On-Screen Editing” environment. To prevent unauthorized file modifications, automatic file update must be explicitly invoked by the application program.

Sharing the IDS

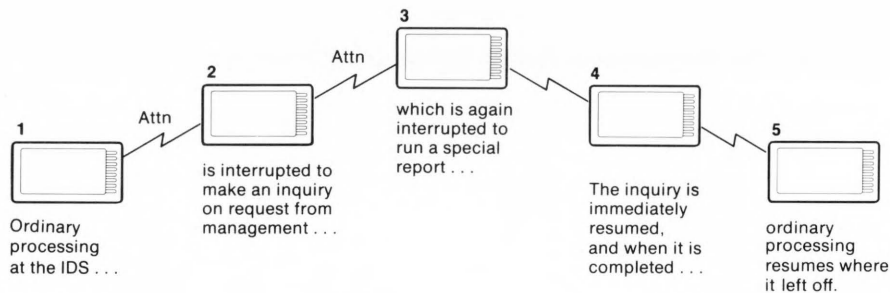


Figure 3-11. The ATTENTION key

The “Attention” feature of the IDS makes it ideal for responding to special requests that come in the form of interruptions to normal processing. An application running on the IDS or a long-running command can be interrupted at any time simply by pressing the ATTENTION key on the IDS keyboard. This key returns IDS control to the Amigo/300 Operating System, where you can enter commands, start new programs, or use the IDS for another application as required. The attention facility can be invoked repeatedly (up to three times), allowing interruptions to interruptions, as shown in Figure 3-11.

When an application or command is interrupted with the ATTENTION key, it continues to execute so long as it does not attempt to use the IDS for input or output. (That is, the ATTENTION key only takes away IDS “ownership”; it does not automatically suspend execution). This allows several different commands or jobs to execute in parallel. Later, the IDS can be reconnected to the interrupted command or job with no loss of data.

The attention feature can also be used to share the IDS among several different jobs which use it infrequently. This is especially useful in applications that require supervisor intervention at the IDS only in exceptional circumstances or for a short “startup” dialogue. When the IDS is being used and another job requests it, the HP 300 lights the message light on the IDS keyboard to inform the user. The user can interrupt current processing (using the ATTENTION key) to determine which job is requesting the IDS, and then decide to communicate with that job or resume his prior work. The HP 300 automatically manages the contention among jobs for the IDS and assures that no data is lost in shifting from one job to another.

4

The HP 300 is a true “programmer’s system”, with a unique online programming process that simplifies and streamlines software development. Through the Integrated Display System, the HP 300 creates a highly interactive, personal programming environment that makes the system more accessible to the programmer. Behind this programming interface, a powerful complement of software development tools make program entry, editing, testing and optimization more efficient. This unique blend of programming ease and powerful development tools allows both novice and experienced programmers to quickly become proficient in programming the system.

The Language Subsystem Concept

The key to the HP 300 programming process is the “Language Subsystem” concept. A Language Subsystem is a combination of system software, advanced editing capability, and sophisticated display features that manages all aspects of the HP 300 programming environment. Its role is most easily understood in contrast to “traditional” online programming, as illustrated in Figures 4-1 and 4-2.

In “traditional” online software development (Figure 4-1), the programmer was directly responsible for managing his programming environment. As his program was entered, edited, tested and debugged, he dealt with a variety of programming tools—editors, compilers, linkers, etc.—each with their own commands and conventions to be learned. He also managed an assortment of programming files—source files, edit files, relocatable files, execution files—one set for each program. As a result, the programmer was always one step removed from his program, spending much of his time in programming overhead operations, and little time actually programming.

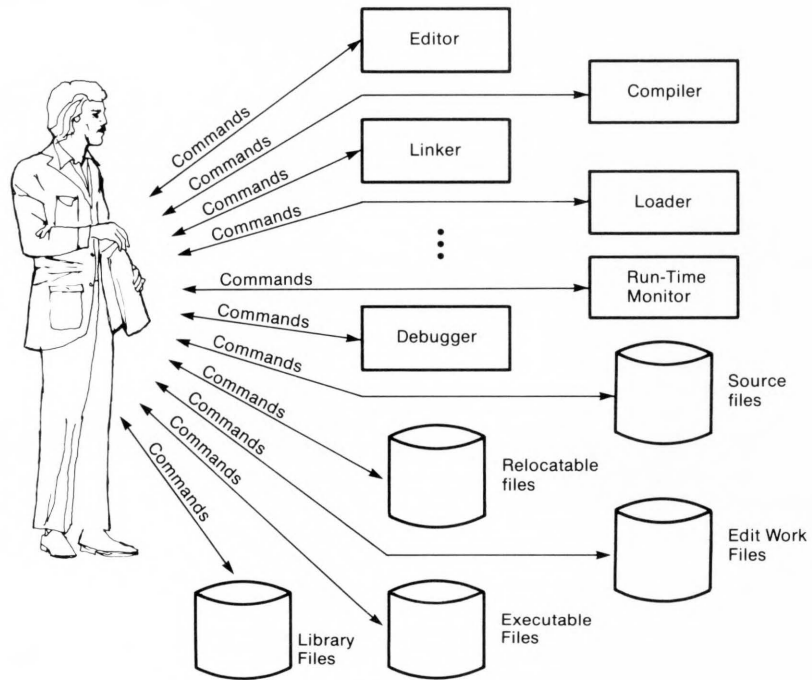


Figure 4-1. Traditional program development

On the HP 300, the Language Subsystem manages the programming environment, eliminating most programming overhead and breaking down the barriers between the programmer and his application (Figure 4-2). The Language Subsystem acts as a kind of switchboard, connecting the programmer to the tools he needs, while presenting a single, uniform programming interface. The same command set and editing features are used throughout all phases of program development, and many command functions are available as key-controlled “pushbutton” functions. The programmer is given direct, natural access to his program, editing it directly on the IDS screen much as he would edit a printed program listing with a pencil. The Language Subsystem thus removes much of the “mystique” of traditional programming, making the system more accessible to the programmer and systems analyst.

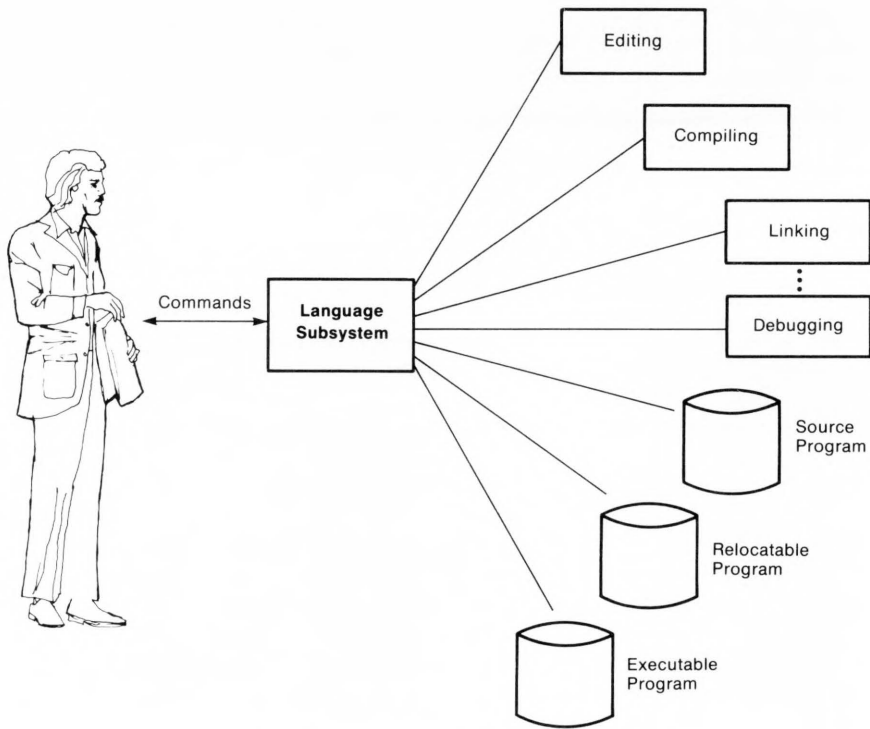


Figure 4-2. HP 300 program development

Major Language Subsystem features include:

- **Integrated programming environment:** All programming activities take place in a single programming environment using a single, uniform command set. Programming tools and files are managed by the Language Subsystem.
- **On-screen editing:** All IDS editing keys (including cursor control, character insert/delete, line insert/delete and scrolling) are fully integrated with the Language Subsystem. Program changes are made by directly editing the screen image with these keys.

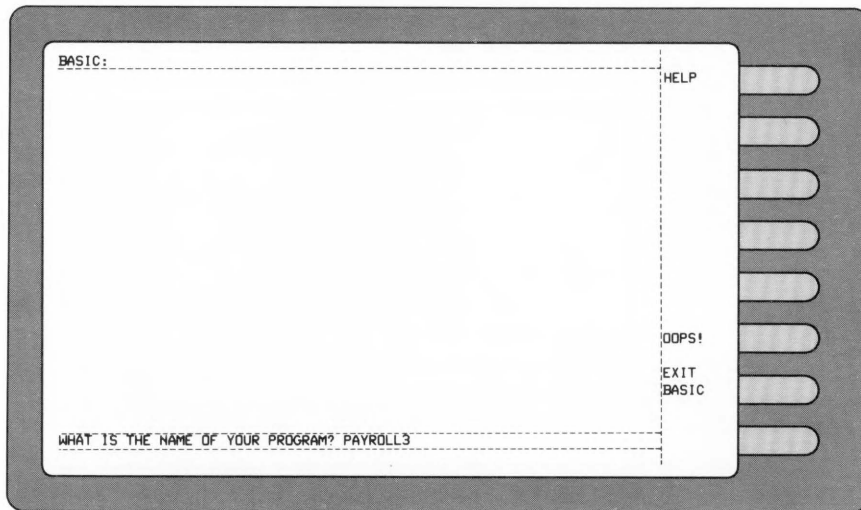
- **Powerful editing commands:** Natural, sentence like commands manipulate entire blocks of program text for bulk copying, moving, deleting, appending, inserting, changing, and finding of text.
- **Online syntax checking:** Program lines are checked for syntax errors as they are entered. Errors are immediately reported for interactive correction.
- **Interactive error correction:** Syntax and compile time error messages are simultaneously displayed with the section of the program containing the error. The error can be immediately corrected without a printed listing.
- **Compiled languages:** HP 300 languages are fully compiled into HP 300 machine instructions, for maximum program execution efficiency.
- **Single-key program testing:** Program test execution is initiated by pressing a single “TEST” key. The HP 300 automatically performs the steps required to bring the program into test execution (compilation, binding, linking, etc.).
- **Program libraries:** Frequently used routines can be saved in segment level libraries for common use by many programs. Common program source text can also be saved and copied as needed from program to program.
- **Partial compilation:** Individual subprograms can be compiled independently, so minor program changes often do not require complete program recompilation
- **Symbolic debugging:** Programs can be interactively debugged during test execution using source language variable names and statement labels. Capabilities include variable examination, variable modification, and setting break and trace points for tracing program flow (Business Basic only).

There is a separate Language Subsystem for each HP 300 programming language, tailored to meet its unique programming requirements. In addition, Typist and the Image/300 schema processor (DBSCHEMA) are modified Language Subsystems for text and schema editing, respectively.

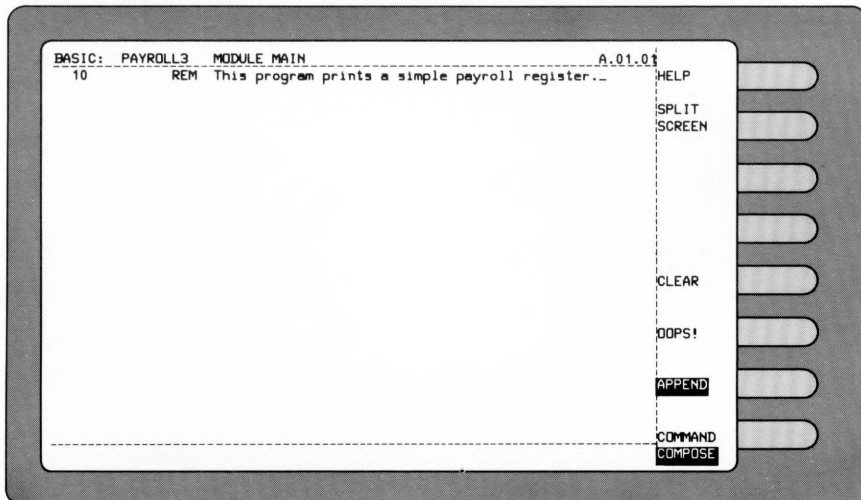
Program Development Example

The sample program development sequence that follows illustrates many of the Language Subsystem features.

To start programming in Basic, you enter the command "BASIC". The Business Basic/300 Language Subsystem takes control of the IDS screen, and asks for the name of your program, as shown here.



Basic now asks you to enter your new program in the large (display) window. (If you had named a program already stored in the system, it would now be displayed on the screen, ready for editing). Program lines can be entered in any order, and Basic automatically inserts them at the proper place on the screen.



Basic immediately syntax checks each line as it is entered, as shown here. (The error message and cursor position tell you that the colon in line 70 should be an equal sign or a comma.) To correct the error, you use the IDS editing keys to insert, delete or type over characters until the line is correct. There is no need to retype the entire line.

```

BASIC: PAYROLL3  MODULE MAIN  A.01.01
10      REM This program prints a simple payroll register.
20 !
30 !
40 !      *****DECLARE VARIABLES TO BE USED:
50      COM Empl_name$(25), DECIMAL Hourly_rate
60      DECIMAL Empl_numbr, Reg_hours, Gross_pay, Total_gross_pay
70      LET Total_gross_pay : 0

```

HELP
SPLIT SCREEN
CLEAR
DOOPS!
APPEND
COMMAND
COMPOSE

, ' OR '=' is expected

Mistakes in lines that have already been entered can be corrected the same way. Simply move the cursor to the line (line 60 in this example) and edit it with the IDS editing keys. This **On-Screen Editing** capability lets you edit your program by making changes directly to the screen image. The screen always displays the program in its latest form, including all changes.

```

BASIC: PAYROLL3  MODULE MAIN  A.01.01
10      REM This program prints a simple payroll register.
20 !
30 !
40 !      *****DECLARE VARIABLES TO BE USED:
50      COM Empl_name$(25), DECIMAL Hourly_rate
60      DECIMAL Empl_numbr, Reg_hours, Ot_hour, Gross_pay, Total_g
70      LET Total_gross_pay = 0
80 !
90 !      *****PRINTER OUTPUT FORMATS:
100 Detail: IMAGE 3X,25A,3X,MDDD,6X,MDDD,3X,DD,DD,3X,MDDCDDD.DD
110 Total:  IMAGE //29X,"Total Gross Wages = ",MDDDCDDD.DD
120 !
130 !
140 !      *****OPEN FILES AND PRINT HEADING:
150      ASSIGN #1 TO "TIMECRDS"
160      ON END #1 GOTO End_of_report
170      PRINT "      Name                Reg Hrs   O/T Hrs   Re
180

```

HELP
SPLIT SCREEN
TEST
CLEAR
DOOPS!
APPEND
COMMAND
COMPOSE

Line insertion and deletion are also key-controlled editing functions. To insert a line, you move the cursor to any line on the screen and press the **INSERT ENTRY** key. Basic opens up a line on the display (complete with line number, as shown in line 151 here), and lets you insert the line in place. Lines are deleted in the same way with the **DELETE ENTRY** key.

```

BASIC: PAYROLL3  MODULE MAIN  A.01.01
10      REM This program prints a simple payroll register.
20 !
30 !
40 !      *****DECLARE VARIABLES TO BE USED:
50      COM Empl_name$(25), DECIMAL Hourly_rate
60      DECIMAL Empl_numbr, Reg_hours, Ot_hours, Gross_pay, Total_
70      LET Total_gross_pay = 0
80 !
90 !      *****PRINTER OUTPUT FORMATS:
100 Detail: IMAGE 3X,25A,3X,MDDD,6X,MDDD,3X,DD.DD,3X,MDDCDDD.DD
110 Total:  IMAGE //29X,"Total Gross Wages = ",MDDDCDDD.DD
120 !
130 !
140 !      *****OPEN FILES AND PRINT HEADING:
150      ASSIGN #1 TO "TIMECRDS"
151 _
160      ON END #1 GOTO End_of_report
170      PRINT "      Name                Reg Hrs   O/T Hrs   Ra
HELP
SPLIT
SCREEN
TEST
CLEAR
DOOPS!
APPEND
COMMAND
COMPOSE

```

When the program becomes too long to fit on the screen, the IDS scrolling keys are used to move it up, down, left and right. In this way, you can view the entire program, no matter how long or wide it is. (Program lines can be up to 160 characters wide, as shown here.) The cursor can be moved to any character position in the program for editing.

```

BASIC: PAYROLL3  MODULE MAIN  A.01.01
FORMATS:
,6X,MDDD,3X,DD.DD,3X,MDDCDDD.DD
ross Wages = ",MDDDCDDD.DD

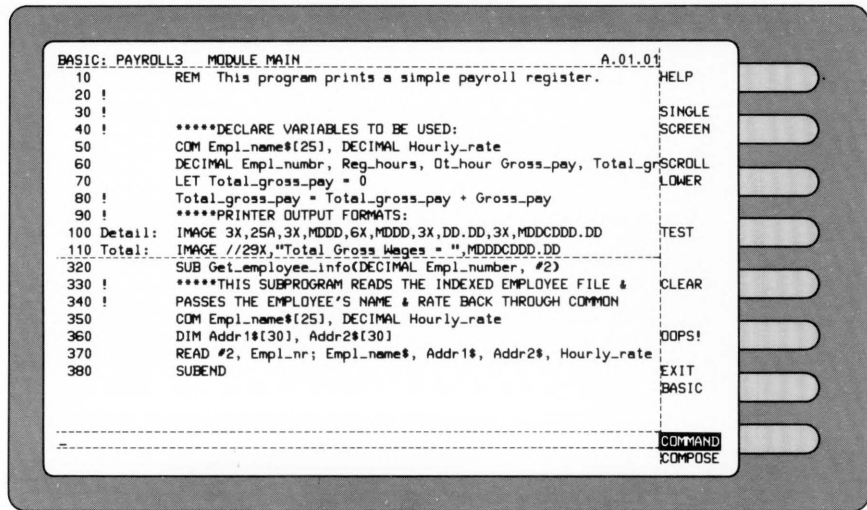
PRINT HEADING:
DS"
EE"
f_report
      Reg Hrs   O/T Hrs   Rate   Gross Pay"-

GET EMPLOYEE INFO, & PRINT REPORT LINE:

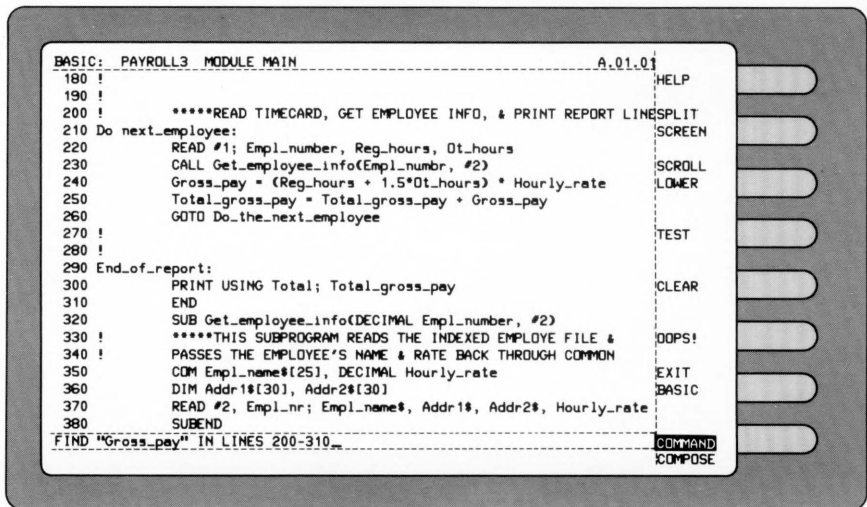
, Reg hours, Ot_hours
fo(Empl_numbr, #2)
rs + 1.5*Ot_hours) * Hourly_rate
tal_gross_pay + Gross_pay
HELP
SPLIT
SCREEN
TEST
CLEAR
DOOPS!
APPEND
COMMAND
COMPOSE

```

To compare two parts of your program, you can split the display window in half by pressing the **SPLIT SCREEN** softkey. Now, you can scroll either the upper or lower copy of the program, to see any two parts simultaneously. The full IDS editing features are still available in the lower window, for corrections or additions.



Basic also offers a full complement of editing commands to move, copy, delete, insert, change, and resequence entire blocks of text. Like other HP 300 commands, they feature natural sentence structure, spelling correction and abbreviation. Commands are also used to include source text from another program, or to find a string of text, as shown here.



When you have finished editing the program, you can test it by pressing the TEST softkey. Basic automatically performs all the required steps that are needed to bring the program into test execution, without any further instruction.

```

BASIC: PAYROLL3  MODULE MAIN                                A.01.01
10  REM This program prints a simple payroll register.      HELP
20  !
30  !
40  !      *****DECLARE VARIABLES TO BE USED:
50  CDM Empl_name$(25), DECIMAL Hourly_rate
60  DECIMAL Empl_numbr, Reg_hours, Dt_hours, Gross_pay, Total
70  LET Total_gross_pay = 0
80  !
90  !      *****PRINTER OUTPUT FORMATS:
100 Detail: IMAGE 3X,25A,3X,MDDD,6X,MDDD,3X,DD,DD,3X,MDDCDDD.DD  TEST
110 Total:  IMAGE //29X,"Total Gross Wges = ",MDDDCDDD.DD
120 !
130 !
140 !      *****OPEN FILES AND PRINT HEADING:
150 ASSIGN #1 TO "TIMECRDS"
151 ASSIGN #2 TO "EMPLOYEE"
160 ON END #1 GOTO End_of_report
170 PRINT "   Name                Reg Hrs   O/T Hrs   Ra
180 !
190 !
200 !      *****READ TIMECARD, GET EMPLOYEE INFO, & PRINT REPORT LINE
210 Do_next_employee:
COMPILATION IN PROGRESS

```

Compile-time errors are reported immediately, with a split screen that simultaneously displays the compiled listing with error message (upper window), and the source line in error (lower window). You can edit this or any other part of the program while viewing the error, eliminating the need for a printed listing in many cases. The NEXT ERROR softkey brings the next error and its corresponding source line into view in the same format.

```

BASIC: PAYROLL3  MODULE MAIN                                A.01.01
ERROR IN LINE 260 OF MODULE MAIN
Label Do_the_next_emp is not in this program unit
270 !
280 !
290 End_of_report:
300 PRINT USING Total; Total_gross_pay
310 END
320 SUB Get_employee_info(DECIMAL Empl_number, #2)
330 !      *****THIS SUBPROGRAM READS THE INDEXED EMPLOYEE FILE &
180 !
190 !
200 !      *****READ TIMECARD, GET EMPLOYEE INFO, & PRINT REPORT LINE
210 Do_next_employee:
220 READ #1; Empl_number, Reg_hours, Dt_hours
230 CALL Get_employee_info(Empl_numbr, #1)
240 Gross_pay = (Reg_hours + 1.5*Dt_hours) * Hourly_rate
250 Total_gross_pay = Total_gross_pay + Gross_pay
260 GOTO Do_the_next_employee_
270 !
280 !

```

When the program successfully compiles and begins test execution, you can use Basic's Symbolic Debug facility to find run-time errors and correct them. Here, execution has been interrupted to examine variable values in the lower window. The upper window displays the source code of the program, for reference. Either window can be scrolled.

The screenshot shows a BASIC debugger window with two main sections. The top section displays source code for a program named 'PAYROLL3'. The code includes comments and calculations for employee pay. The bottom section displays the current state of variables during a break at line 250. On the right side, there is a vertical menu with several options.

```

BREAK IN PAYROLL3 AT 250                                     A.01.01
180 !
190 !
200 !      ****READ TIMECARD, GET EMPLOYEE INFO, & PRINT REPORT LINE
210 Do_next_employee:
220     READ #1; Empl_number, Reg_hours, Dt_hours
230     CALL Get_employee_info(Empl_number, #2)
240     Gross_pay = (Reg_hours + 1.5*Dt_hours) * Hourly_rate
250     Total_gross_pay = Total_gross_pay + Gross_pay
260     GOTO Do_next_employee
270 !
280 !
-----
BREAK IN PAYROLL3 AT 250
EMPL_NUMBER = 1045
REG_HOURS = 40
DT_HOURS = 5
HOURLY_RATE = 5.5
GROSS_PAY = 261.25
-----
PRINT Total_gross_pay_

```

Right-side menu options: HELP, SCREEN, SCROLL LOWER, VIEW ROUTINE, USER SCREEN, STEP -1, CANCEL, ACTIVATE.

After editing, you can retest the program by striking the **TEST** softkey again. This time, the program successfully begins execution.

The screenshot shows the output of the payroll program. It displays a table with five columns: Name, Reg Hrs, O/T Hrs, Rate, and Gross Pay. The data is as follows:

Name	Reg Hrs	O/T Hrs	Rate	Gross Pay
John J. Adams	40	0	9.00	360.00
Martha Q. Buletter	40	5	8.00	380.00
Nancy J. Calmes	10	0	6.50	65.00
Robert N. Coleman	1	0	6.50	6.50
James R. Colfax	40	4	9.00	414.00
Paula Demerus	31	0	10.50	325.50
John A. Eastland	40	0	8.00	320.00
Marsha E. Evans	40	0	8.75	350.00

RPG II program development shares many of the interactive features of Business Basic. In addition, RPG II/300 uses screen templates to simplify program entry and editing. Each field of the RPG specification is separately identified and labelled in the template, eliminating the need to count columns and spaces as you enter the program. Forward and backward tabbing and the IDS editing keys are used to edit data in the template. As each line is entered, it takes its place in sequence in the display window.

```

RPG: MAILIST  MODULE MAIN  FORM TYPE : J  A.01.01
HELP
CHANGE
FORM
COMPAC
EXPAND
TEST
CLEAR
ODPS!
APPEND
MODIFY
CMD
EDIT

4*
10H          S
12*
20INPUT IPE F 10 CONSOLE
25FCUSTOMERIC F 128R 6AI 2
30FOUTPUT O F 80 OF PRINTER
35*
40IINPUT NS 01 1 C1
45I          1 1 RID
50 J FORM PAKED/BIN FROM POS TO POS DEC POS FIELD NAME CONTROL LEV
R1CH/CHN FLD CODE FIELD REC REL PLUS IND MINUS IND ZERO/BLK IND COMM

```

There is a different template for each different type of RPG II specification. To switch templates, you press the **CHANGE FORM** softkey and select a different type, as shown here. Each program line is syntax checked as it is entered. Errors are reported immediately in the error window, and can be corrected directly in the template.

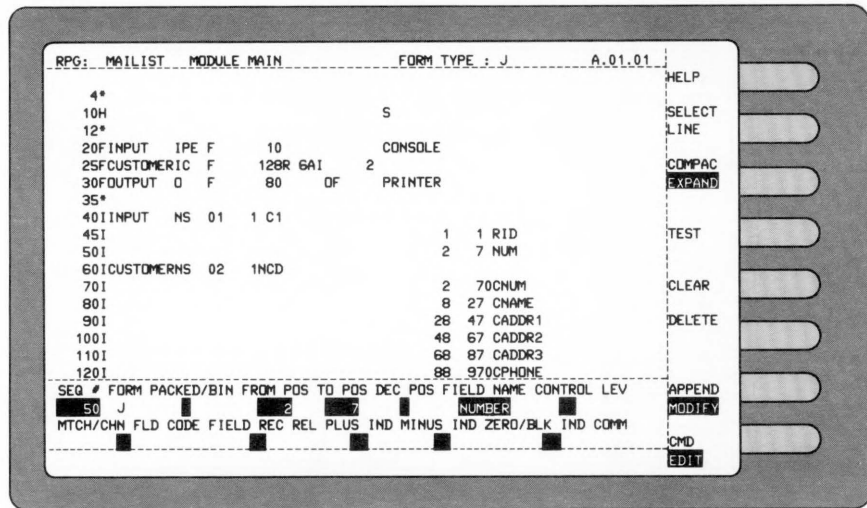
```

RPG: MAILIST  MODULE MAIN  FORM TYPE : J  A.01.01
HELP
CHANGE
FORM
COMPAC
EXPAND
TEST
CLEAR
ODPS!
APPEND
MODIFY
CMD
EDIT

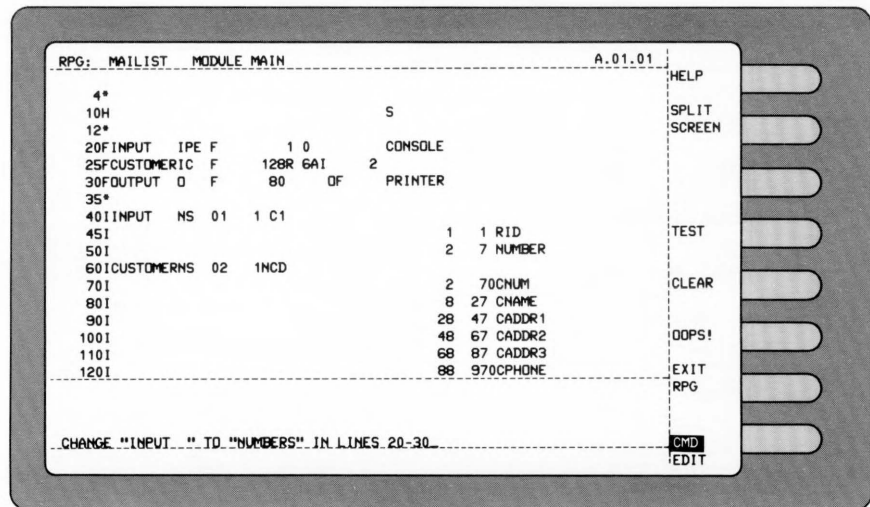
4*
10H          S
12*
20INPUT IPE F 10 CONSOLE
25FCUSTOMERIC F 128R 6AI 2
30FOUTPUT O F 80 OF PRINTER
35*
40IINPUT NS 01 1 C1
45I          1 1 RID
50I          2 7 NUM
60I CUSTOMERNS 02 1NCD
70I          2 70CNUM
80I          8 27 CNAME
90I          28 47 CADDR1
100I         48 67 CADDR2
110I         68 87 CADDR3
120I         88 970CPHONE
ENTER FORM TYPE: (*,H,F,K,E,L,I,J,C,O,P,A,X)

```

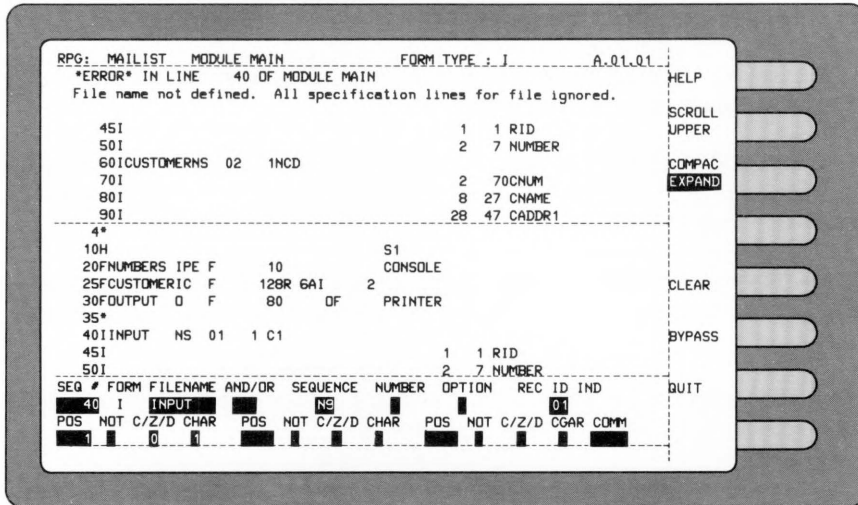
You can edit a previously-entered line by typing its sequence number and pressing the **SELECT LINE** softkey. The line appears, displayed in the appropriate template, ready for editing. Line deletion is handled in the same way, using the **DELETE** softkey. To insert a line, you type it and its intended sequence number into the template, and RPG automatically inserts it in place on the screen.



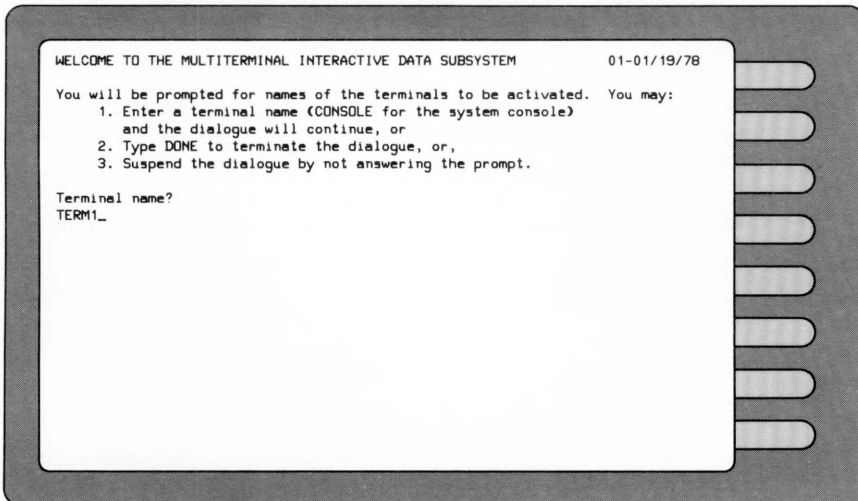
In addition to the IDS editing keys, RPG features a set of editing commands much like those in Basic. Commands are used to manipulate entire blocks of program lines, as shown here. They can also copy text to and from other programs. This is especially useful for standard file definitions, record layouts, subroutines, etc., that are included in many different programs.



To test the program, you press the **TEST** softkey. RPG automatically begins compilation, and discovers a compile-time error in this example. The split screen displays the program listing and error message in the upper window, and the line in error in the lower and template windows. You can correct the error, or **BYPASS** it temporarily. The **NEXT ERROR** softkey brings the next error into view in the same format.



After all errors are corrected, the **TEST** softkey can be pressed again. This time, the program successfully begins test execution. The screen shown is the control screen used by RPG II/300's multiterminal data entry extension, asking you which terminals are to be used by the program. As soon as a terminal is designated, the program begins requesting input from it, as dictated by the input and file specifications.



Business Basic/300

Business Basic/300 is an extension of the popular Basic programming language that has found wide acceptance for educational, scientific and commercial data processing. Basic's simple statement format permits rapid development of simple, straightforward programs. In addition, its flexible input/output capabilities make it well suited to interactive, terminal-oriented applications.

To these features, Business Basic/300 adds powerful capabilities that are important for business data processing, including:

- **Commercial data types:** Business Basic/300 supports decimal arithmetic and character strings in addition to 16- and 32-bit integers and 32- and 64-bit floating point numbers.
- **Powerful, compact string handling:** Language constructs provide string concatenation, substrings, character string extraction and deposit, and substring searching.
- **Formatted output:** The PRINT USING statement allows easy construction of printed reports and formatted terminal displays.
- **Extensive file capabilities:** Serial, direct and indexed file access and programmatic file creation and purging are available through language constructs.
- **Meaningful variable names:** Alphanumeric variable names and statement labels up to 31 characters long make programs more descriptive and understandable. (Names must be unique to the first 15 characters.)
- **Subprograms and Common:** Independently defined subprograms allow a more modular, structured approach to Basic programming. Subprograms can have their own local storage and passed parameters, in addition to sharing data through COMMON storage.
- **System services:** The Basic programmer has full access to the HP 300 file system, Image/300, the IDS, multiprogramming, multitasking and other advanced HP 300 features through callable system services.

The short Business Basic/300 program excerpt in Figure 4-3 illustrates many of these features.

```

10      REM  This program prints a simple payroll register.
20 !
30 !
40 !      *****DECLARE VARIABLES TO BE USED:
50      COM Empl_name$(25), DECIMAL Hourly_rate
60      DECIMAL Empl_numbr, Reg_hours, Ot_hours, Gross_pay, Total_gross_pay
70      LET Total_gross_pay = 0
80 !
90 !      *****PRINTER OUTPUT FORMATS:
100 Detail: IMAGE 3X,25A,3X,MDDD,6X,MDDD,3X,DD,DD,3X,MDDCDDD.DD
110 Total:  IMAGE //29X,"Total Gross Wages = ",MDDDCDDD.DD
120 !
130 !
140 !      *****OPEN FILES AND PRINT HEADING:
150      ASSIGN #1 TO "TIMECRDS"
151      ASSIGN #2 TO "EMPLOYEE"
160      ON END #1 GOTO End_of_report
170      PRINT "      Name                Reg Hrs   O/T Hrs   Rate   Gross Pay"
180 !
190 !
200 !      *****READ TIMECARD, GET EMPLOYEE INFO, & PRINT REPORT LINE:
210 Do_next_employee:
220      READ #1; Empl_number, Reg_hours, Ot_hours
230      CALL Get_employee_info(Empl_numbr, #2)
240      Gross_pay = (Reg_hours + 1.5*Ot_hours) * Hourly_rate
250      Total_gross_pay = Total_gross_pay + Gross_pay
260      GOTO Do_next_employee
270 !
280 !
290 End_of_report:
300      PRINT USING Total; Total_gross_pay
310      END
320      SUB Get_employee_info(DECIMAL Empl_number, #2)
330 !      *****THIS SUBPROGRAM READS THE INDEXED EMPLOYEE FILE &
340 !      PASSES THE EMPLOYEE'S NAME & RATE BACK THROUGH COMMON
350      COM Empl_name$(25), DECIMAL Hourly_rate
360      DIM Addr1$(30), Addr2$(30)
370      READ #2, Empl_nr; Empl_name$, Addr1$, Addr2$, Hourly_rate
380      SUREND

```

Figure 4-3. Business Basic/300 program excerpt

RPG II/300

RPG II (Report Program Generator II) is a popular high level language for business data processing. The language is well-suited for producing printed reports, and also contains extensive features for creating and maintaining data files and performing calculations on stored data. RPG II is relatively easy to learn and code. Programmers describe the format of input data, output reports and calculations using simple specifications that are coded on special RPG coding forms and entered into the HP 300 system.

RPG II/300 includes several special features that make the programmer's job easier:

- **Industry standard RPG II language:** Programmers already familiar with RPG II can use RPG II/300 without extensive retraining.
- **Source language compatibility:** RPG II/300 is highly compatible with HP 3000 RPG and with RPG on the IBM System/32 and System/34, allowing existing programs to be easily adapted to the HP 300 system.
- **Interactive source entry with RPG screen templates:** RPG II/300 programs are entered online, using RPG screen templates modelled after the RPG coding sheets. Individual specification fields are clearly delineated in each template, making RPG program entry and editing more efficient and error free.
- **Online syntax checking:** RPG syntax errors are detected as they are entered, and the programmer can immediately correct them.
- **Interactive error correction:** Syntax and compile-time errors are displayed simultaneously with the line in error (in the appropriate RPG programming template), permitting program debugging without printed listings.

RPG II/300 also features an interactive multiterminal data entry extension that significantly expands the terminal accessing capability of RPG. Using this extension, an executing RPG program can accept data entered from one or more HP 300 application terminals or the IDS. At the start of program execution, the system enters into a dialogue at the IDS to determine which terminal(s) the program is to access. Terminals can also be dynamically added to and taken away from an executing RPG program using this capability.

Terminal operation is transparent to the RPG program, which views the terminal(s) as a conventional input file with the special name "CONSOLE". Terminal formatting, and prompting for data on a field-by-field basis are handled automatically, based upon the file and input specifications in the RPG program. Record sequencing and grouping of records from each terminal are also automatic, without special RPG coding.

This special RPG capability can be especially useful in bridging the gap between conventional batch-oriented RPG processing and the more interactive environment of the HP 300 system. Terminal-oriented data entry can be interfaced directly with existing RPG batch processing programs. Later, new applications can make fuller use of the system's interactive capabilities.

5

This section describes the data management facilities provided by the Amigo/300 File System and Image/300 Data Base Management System.

Amigo/300 File System

The Amigo/300 File System manages HP 300 data storage and controls access to all HP 300 files and devices. The file system automatically handles all low-level file management tasks such as disc management, buffering, blocking, device handling and device allocation. It offers the programmer a broad set of high level, device-independent capabilities for data storage and access, from which he can choose those that best match his application's requirements.

A subset of the Amigo/300 command language is used to manage files and devices from the Integrated Display System. Programmatic access is provided by the input/output structures of the HP 300 programming languages, or through callable HP 300 system services. In addition to these online capabilities, the HP 300 Diagnostic and Utility System provides a stand-alone environment for disc formatting, system volume restoration and other offline functions.

File System Organization

The file system uses the following concepts to manage access to data and devices on the HP 300:

- A **file** is a named collection of records, such as a file of timecards or accounting transactions.
- A **file domain** is a collection of files that are grouped together for reference, such as all the files for a given application. File domains can be protected with passwords to prevent unauthorized access.
- A **device** is a physical unit for data storage, input or output, such as a disc drive, terminal or printer.
- A **volume** is a piece of physical storage media (such as a flexible disc) that resides on a storage device.

Every file, domain, device, and volume on an HP 300 system is identified by its user-assigned name. These names can be combined together into a “fully qualified” filename that uniquely identifies a file or device. Figure 5-1 shows an example of a fully qualified filename and its interpretation.

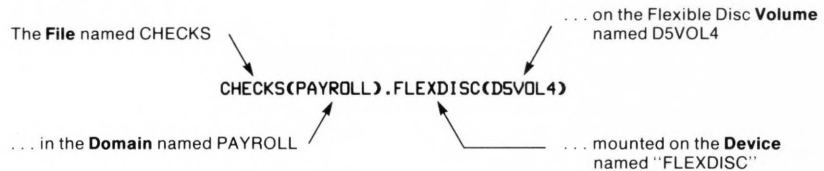


Figure 5-1. Fully qualified filename

For non-file-structured devices (such as printers or terminals), only the “device” portion of the fully qualified filename is needed (e.g., “.PRINTER” or “.TERMNL4”). In practice, fully qualified filenames are almost never used. Instead, the system assumes default values for omitted parts of the name, so files can generally be referenced with simple names such as “CHECKS” or “ORDERS”.

As this example shows, the HP 300 has a unified naming scheme for files and devices. There is also a uniform set of procedures for accessing both files and devices, and a uniform set of commands for file and device management. The result is a high level of file and device independence that simplifies both application design and system operation.

File and Device Access

The file system provides both serial and keyed file access:

- **Serial access:** Records are processed “in order”, in a forward or backward direction. Serial access is used to process a file in sequence and to access sequential devices such as printers and terminals.
- **Keyed access:** Records are accessed randomly, based on a key associated with each record. Keyed access is used to selectively retrieve records from a file.

Both access methods can be used to input, output, add, delete and replace records as needed, limited only by the characteristics of the file or device being used.

File Structures

The file system offers a choice of seven different file structures for storing data. Each structure meets a unique application need (such as rapid random access or simple sequential retrieval), so you can choose the best one for each application file.

- **Sequential files** provide rapid serial access to the records in the file. Records are stored in chronological order as they are entered, and are also accessed serially. Sequential files are efficient for data that is always processed in a fixed sequence, such as transaction files.
- **Relative files** provide access to records based upon their relative record number within the file. Records are stored in order by relative record number and access is either serial or random by relative record number. Relative files are often used to store data that is accessed through “pointers” in other files.
- **Keyed sequential files** provide access based upon a record key associated with each record. Records are stored in order by key, together with a key index that is used to access them. Access is serial in record key order or random by record key. Keyed sequential files are used to store data that must be processed both randomly and serially in key order, such as a customer master file.
- **Direct files** provide rapid access based on a record key associated with each record. Records are stored by applying a “hashing algorithm” to the record keys, which tends to distribute the records evenly through the file. Access is random by record key, or serial in physical storage (not record key) order. Direct files are used for data that requires rapid keyed access and little or no serial processing.
- **Library files** allow collections of logically related files to be stored together in one common file (a “library”). A library file is composed of one or more named modules that are accessed randomly by name. Each individual module has the storage and access characteristics of a sequential file. Library files are generally used to store “collections” of things, such as a set of terminal screen formats.
- **Primitive files**⁴ provide low-level file access for sophisticated application programmers. In a primitive file, records correspond to logical disc sectors within the file. Access is random by relative record (i.e., sector) number and data is transferred in sector multiples. Primitive files are especially useful for programmers who want to augment the HP 300 file structures with a customized structure of their own.
- **Memory files** provide efficient program-to-program communication between one or more “sending” programs and a “receiving” program. Records are stored in a circular first-in-first-out buffer in virtual memory. Access is serial for both writing data into the file and reading data from the file. Memory files are used for communication and synchronization among multiple programs or tasks in an application system.

⁴ Primitive files cannot be accessed by Business Basic or RPG II programs.

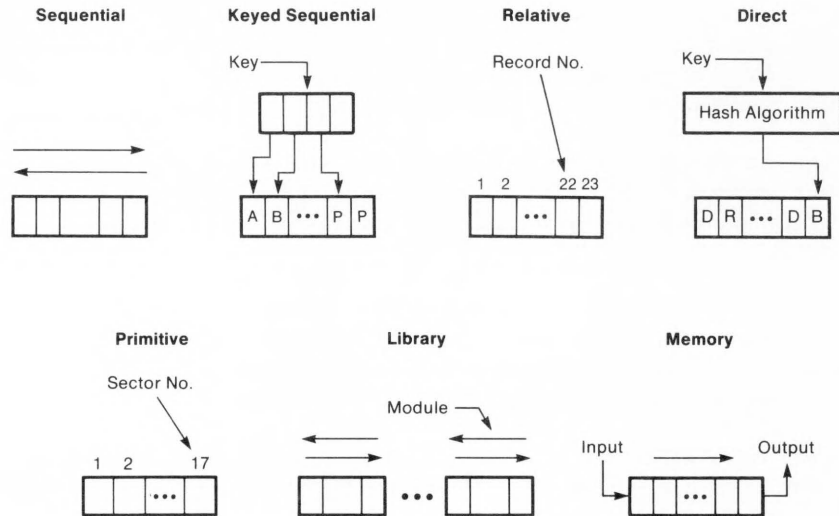


Figure 5-2. HP 300 file structures

In addition to these seven file structures, the file management system offers the following capabilities for storing and accessing data:

- **Variable length records:** Records may vary from 1 to over 2,000 characters in length for efficient disc space utilization. The file system automatically manages and recovers space when records are replaced or deleted.
- **Domain security:** Passwords on private file domains prevent unauthorized entry into the domain.
- **Dynamic file allocation:** Storage space is automatically allocated for data files as they need it.
- **Private volumes:** Removable private disc volumes can be used to transport files to other HP 300 systems or to share a single storage device among several sets of data.
- **File sharing:** Programs can obtain exclusive access to a file, or multiple programs can concurrently access the file in a read-only sharing mode or an update sharing mode (with file locking and unlocking).
- **File equation:** HP 300 programs can specify the files and devices they use as logical file names. These logical names are associated with actual physical files or devices through file equations that can be changed independently from the program. File equations can be stored with the program as default file assignments, and they can be entered as commands at execution time.
- **Input/output without wait:** Using “nowait” input/output, a program can initiate an I/O operation (such as input from a terminal) and then continue with other processing before the I/O is complete (e.g., before the user types in his response). Sophisticated programmers can use this technique to increase performance in I/O intensive applications by overlapping I/O and processing.

Image/300 Data Base Management System

Image/300 is the data base management system for the HP 300 computer system. Image offers an alternative to conventional file systems, and can help to reduce data redundancy and promote consistency, timeliness, and integrity of data, allowing it to be more responsive to your needs. Using Image, the data for an entire application can be stored in an integrated, highly structured data base. Application programs use this structure to access the data and derive information about relationships among the data items. In addition, the Image Data Base Inquiry facility allows you to directly access and inquire into the data base, without application programming.

Image/300 is comprised of several components:

- A **schema processor** that translates a data base schema (a formal data base description written in the Image data base definition language) into an internal data base representation.
- **Commands** for creating, purging, erasing, storing and restoring the data base.
- **System services** that are used by applications programs to access the data base.
- A **Data Base Inquiry facility** for making impromptu data base inquiries and for data base testing and debugging.

Image/300 Data Base Structure

An Image data base consists of data items, data entries, and data sets:

- A **data item** is a single piece of data, such as an employee number or employee name.
- A **data entry** is an ordered set of related data items, such as all the information about a particular employee.
- A **data set** is a named collection of data entries, such as the set of all information on all employees.
- A **data base** is a named collection of related data sets, such as all the data sets that relate to a payroll application.

Figure 5-3 shows how data items, data entries, data sets relate to one another, using a payroll application as an example.

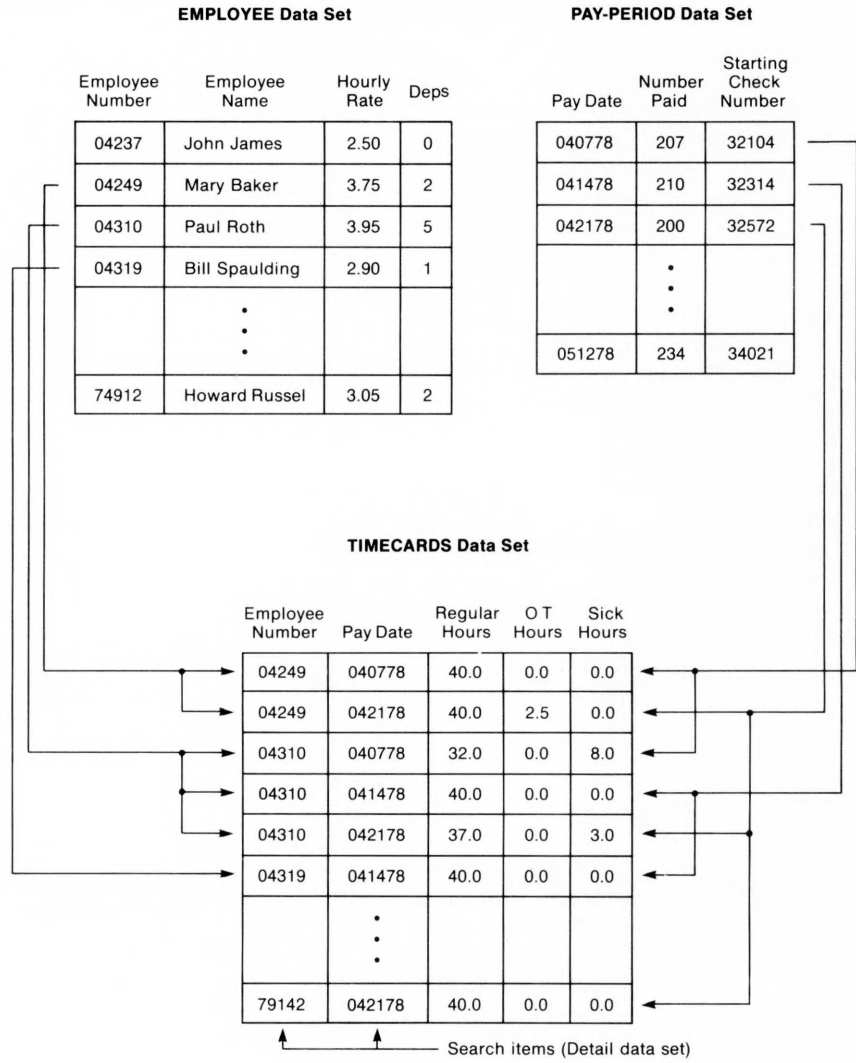


Figure 5-3. Image data base relationships

Data entries in the data base are related to one another by the two different types of Image data sets:

- **Master data sets** are used to store data entries that represent uniquely identifiable entities. One of the data items in each entry is designated the search item, and serves as the primary identification for that entry. The search item also relates the master data set to detail data sets that contain the same search item. In the example above, **EMPLOYEE** and **PAY-PERIOD** are master data sets, with **EMPLOYEE NUMBER** and **PAY DATE** as their respective search items.
- **Detail data sets** are used to store data entries that represent related events. Detail data sets are related to master data sets through search items that they share with the master set. In this way, a detail data set may be indexed by one or more master data sets. In the example above, **TIMECARDS** is a detail data set that is indexed by both the **EMPLOYEE** and **PAY-PERIOD** data sets.

To represent data relationships, master and detail data sets are combined in a network of data sets that forms an entire data base. This network not only stores data, but represents relationships among pieces of data as well. The data can then be retrieved based on these relationships. Figure 5-4 expands the simple payroll example of Figure 5-3 to show a typical network of data sets.

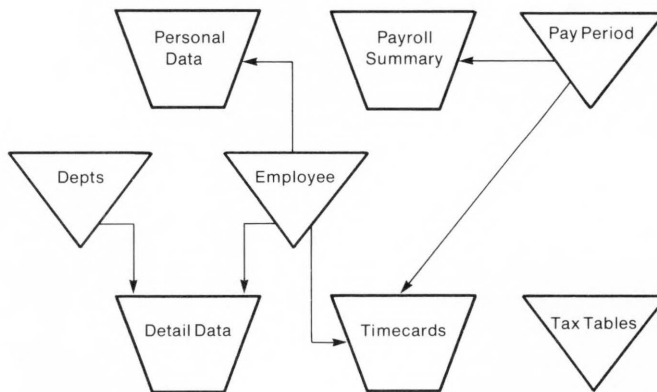


Figure 5-4. Master/Detail data set structure

Creating an Image/300 Data Base

To create an Image data base, you must first describe the data base structure to the HP 300 system. This description is called a schema, and it defines the data items, data entries, and data sets that comprise the data base, as well as other capacity and security information. The Image schema processor, **DBSCHEMA**, is used to enter the schema, as illustrated in Figure 5-5. The partial schema shown corresponds to the payroll data base example in Figure 5-3.

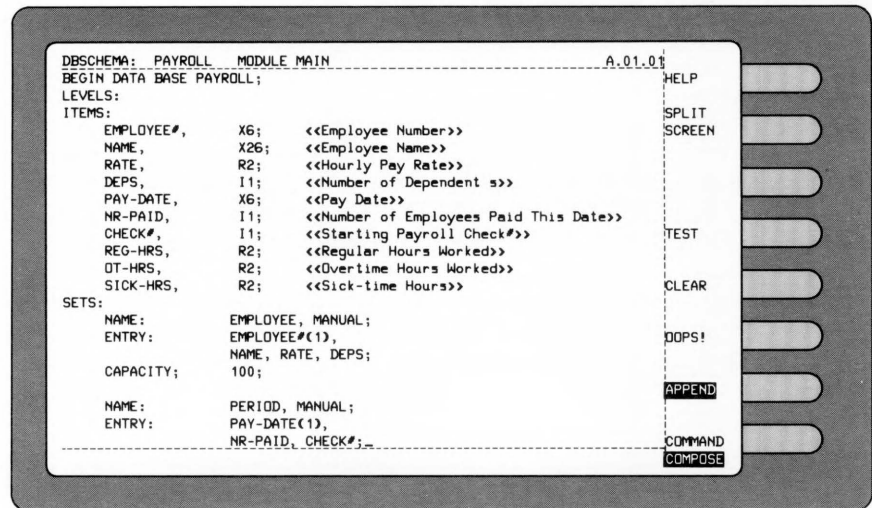


Figure 5-5. Entering a data base schema

The schema processor creates an interactive environment for entering and editing schemas that closely resembles the Typist text editing environment. When the schema has been entered, the TEST softkey compiles it into an internal form and reports any errors to you for immediate correction. After the schema has been defined, you can use Amigo/300 commands to create, purge, erase, store and restore the data base.

Image/300 Data Base Access

Applications programs access Image data bases through a set of Image system services. These services give the programmer high level, applications-oriented data base access, without concern for where the data is stored or how it is accessed. Services are available to:

- Open and close a data base for access.
- Obtain information about the data base.
- Read all or some of the data items in a specific data entry.
- Add a new data entry to the data set.
- Delete a data entry from the data set.
- Lock and unlock the data base or a subset of it for temporary exclusive access.

Using these services, programs can access the data base in one of four modes:

- **Serial access** retrieves successive data entries from the data set. It is often used to process an entire data set in one pass.
- **Directed access** retrieves data entries based upon their record locations within the data base. It is generally used when the application already knows the identity of the data entry it wants from some other information.
- **Calculated access** retrieves the data entries in a master data set based on their search item (key) values. For example, calculated access might be used to obtain the data entry for an individual employee, given his employee number.
- **Chained access** is used to successively retrieve all the data entries in a detail data set that share a common search item value. For example, chained access would be used to retrieve all the timecard data entries for a given employee. Data entries can be retrieved in either a forward or backward direction.

Image/300 data bases are protected against unauthorized access by several layers of security features. In addition to the file system's domain passwords, the data base can be protected with a "maintenance word" that must be supplied to gain access to the data base from outside its domain. Data bases are stored as privileged HP 300 files, and cannot be accessed through the normal HP 300 file management system services.

Within a data base, individual data entries and data items are protected through an access level security scheme. Each data entry and data item can be optionally assigned a read access level and a write access level. When a user or applications program opens the data base for access, they supply a "level word", which determines the read and write levels they are permitted. For example, in the payroll data base of Figure 5-3, certain users could be restricted to accessing only the PAY-PERIOD and TIMECARD data sets, others permitted to access all data items except employee names and hourly rates, and still others permitted to access the entire data base.

Data Base Inquiry Facility

The Data Base Inquiry facility (DBI) is used to access an Image data base without an applications program. It is particularly useful during application debugging to generate test data in the data base or examine data base contents. Data Base Inquiry is also useful for handling impromptu inquiries into the data base, to display and summarize the data stored there. Using it, you can:

- Display information about the data base structure.
- Add data entries to a data set.
- Delete data entries from a data set.
- Modify data item values in a data entry.
- Display the values of data items in selected data entries.
- Print Data Base Inquiry responses on the printer.

Inquiries to DBI take the form of natural, sentence-like commands. For example, to display the employee number and name of everyone in department 537 who is age 60 or older, you would enter:

```
DISPLAY EMPLOYEE# , NAME FOR DEPARTMENT = 537 AND AGE >= 60
```

Data Base Inquiry would then display the employee name and number for the employees who met the selection criteria.

Data entries are selected for display by specifying values or value ranges for one or more data items. DBI accepts all the standard comparison relationships, and multiple selection criteria can be combined with “AND” and “OR” connectives, to generate more complex inquiries. In response, DBI displays the contents of the qualifying data entries, or it can display only selected data items on request. All access through DBI is governed by Image’s standard security features, to prevent unauthorized access to sensitive information.

DBI is also a useful tool for data base maintenance. For example, if all the employees in job classification “J4” have just received a pay increase to \$3.60 per hour, you can make the change with a single DBI command:

```
REPLACE RATE WITH 3.60 FOR JOB_CLASS = J4
```

Or suppose you want to delete from the data base all employees who terminated their employment over one year ago. Again, a single DBI command can do the job:

```
DELETE EMPLOYEE FOR TERMINATION_DATE < 771231
```

DBI can also be used to add new data entries to the data base. For example, to add a new employee, you would enter:

```
ADD EMPLOYEE
```

DBI requests a value for each data item in the data entry, by name, on the screen. The data you supply in response is checked for validity before being stored in the data base.

Many business data processing applications involve “online multiterminal processing”, where several people concurrently use the system to process business transactions such as orders, payments, or inventory receipts. The HP 300 is well suited for this type of application, which generally has the structure shown in Figure 6-1.

When developing a multiterminal application, the designer must consider many different factors, such as ease of use for the application user, execution efficiency and speed, utilization of system resources, difficulty of programming, and maintainability. These factors typically trade off against one another—a design that provides maximum execution efficiency, for example, may also be relatively difficult to program and maintain. As a result, different design approaches are appropriate for different applications, depending on the relative importance of each factor in the application.

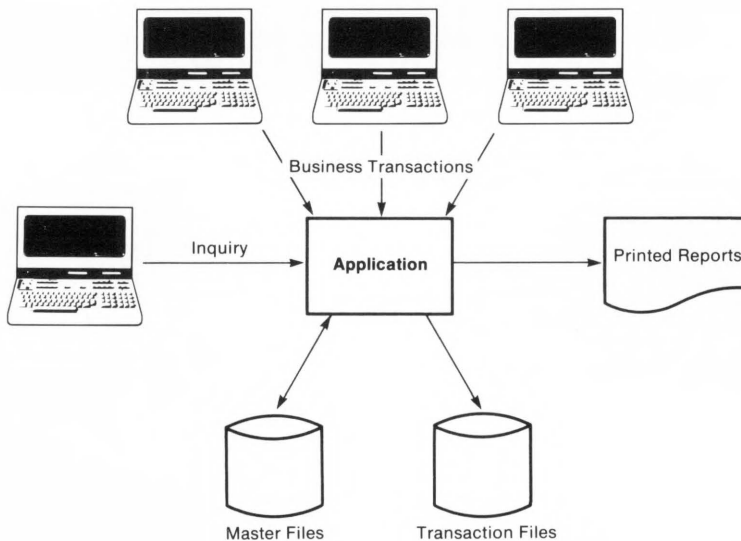


Figure 6-1. Structure of a typical multiterminal application

The HP 300 and its Amigo/300 Operating System offer the multiterminal application designer a complete spectrum of design approaches, supported by powerful programming structures and features. By giving the designer a choice of techniques rather than confining him to a single, system-dictated approach, he is free to choose the approach that best matches his application needs and programming staff. This section describes the Amigo/300 capabilities that support online multiterminal processing on the HP 300 system.

Multiprogramming

Amigo/300 features a full multiprogramming capability that supports the concurrent, independent execution of many different programs. In its simplest form, multiprogramming can be used to devote a separate program to each job to be performed. Figure 6-2 shows an example of this structure, where each terminal and non-interactive job has a separate program to serve its needs. All programs operate independently, and are individually controlled from the IDS.

This structure simplifies program development, since each program is written to service only one terminal at a time. It is most appropriate for applications with a few terminals, or where a few constantly executing programs comprise the bulk of the application.

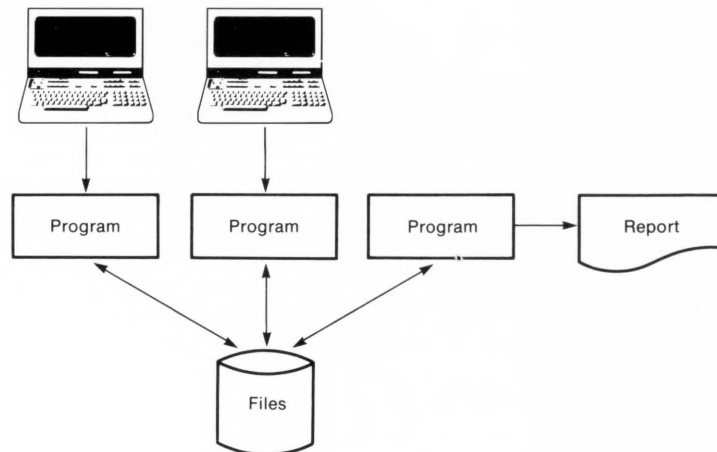


Figure 6-2. Example of simple multiprogramming

Multiprogramming System Services

Applications can programmatically use the HP 300 multiprogramming capabilities through a set of Amigo/300 system services.⁵ Using these program management services, an application program can start, stop, and control the execution of other “subordinate” programs. Figure 6-3 shows a menu-driven reporting application that uses these services. In response to user input, the menu program starts one or more report programs. Parameters are passed to the report programs when they are started, and they can return status information to the menu program upon their completion.

When a program starts other programs in this way, the result is a hierarchy of programs that execute as a single “job” on the HP 300 system. Programs within the job structure can start, suspend, restart and terminate subordinate programs as required by the application. The entire job is controlled from the IDS as a single entity, not as many separate programs. This simplifies system operation for the user, who can start an entire multiprogramming application with a single RUN command.

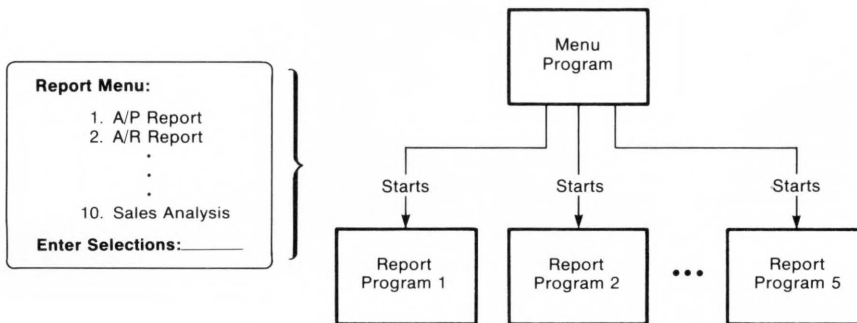


Figure 6-3. Example of program management services

Program-to-Program Communication

Programs within an application can communicate with each other on an ongoing basis using the Amigo/300 memory file feature. Memory files act as one way message paths between one or more “sending” programs and a single “receiving” program. They are used to create “systems” of cooperating programs, as illustrated in Figure 6-4. In this application example, a single program manages all files, retrieving data from them on request from other programs. Memory files are used to send the requests and replies back and forth among the programs.

⁵ These and other callable system services described in this section are accessible from Business Basic/300 programs. RPG II/300 programs cannot access HP 300 callable system services.

Application programs access memory files just as they would any sequential file—opening and closing them by name and using standard I/O operations to read and write data. This is extremely useful for program testing and debugging, since sequential data files can be substituted for memory files (without changing the program) to provide a fixed sequence of input data or a record of the program's output.

Memory files are implemented as circular buffers in HP 300 virtual memory. Programs can access the files asynchronously, with Amigo/300 automatically providing file synchronization and queueing of requests for the receiving program. Figure 6-5 shows the detail structure of a memory file.

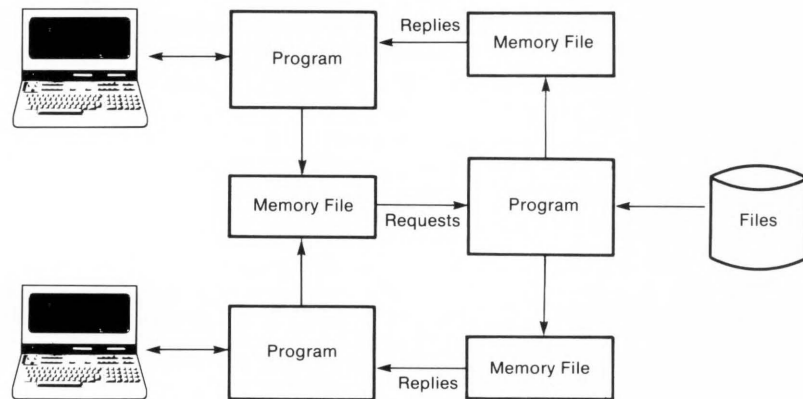


Figure 6-4. Example of memory file

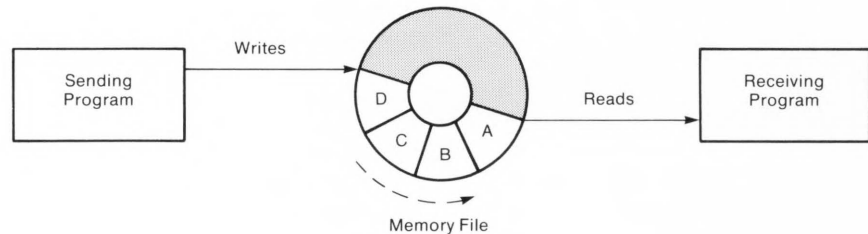


Figure 6-5. Memory file implementation

Multitasking

The Amigo/300 multitasking capability offers an excellent structure for applications where several terminals are dedicated to performing the same functions. With multitasking, a single application program can consist of multiple “tasks”, each executing in parallel with the others. Each task behaves as an independent “virtual processor”, pursuing its own execution path through the program.

Figure 6-6 shows a typical multitasking application program. Each task within the program performs a specific function—managing a terminal, accessing files, controlling the printer, etc. The tasks cooperate with one another to perform the work of the application, requesting services from the other tasks when necessary.

Multitasking applications generally offer superior execution efficiency, because they involve fewer programs for the system to manage and use memory very effectively. All tasks within a program share the same code (instruction) storage and common (global) data storage. In addition, each task has its own local storage for private data. Common data storage can be used for shared tables and variables, or for high-speed task-to-task communication. Memory files can also be used for communication among tasks. Figure 6-7 graphically illustrates the shared and private resources in a multitasking program.

The multitasking capabilities of Amigo/300 are accessed through a set of multitasking system services. These services are used to create tasks, and to start, suspend, and otherwise control their execution.

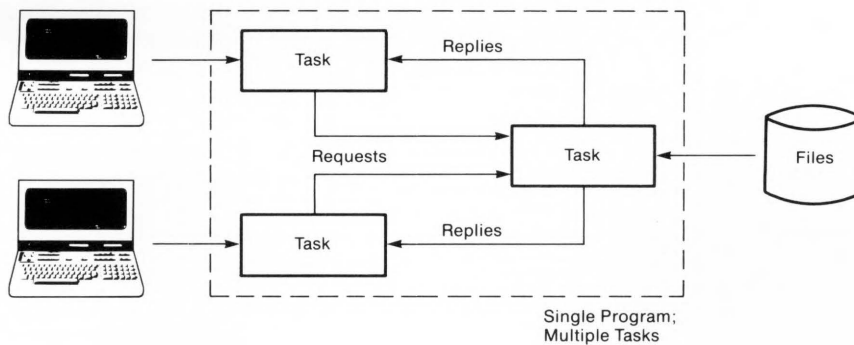


Figure 6-6. Example of multitasking

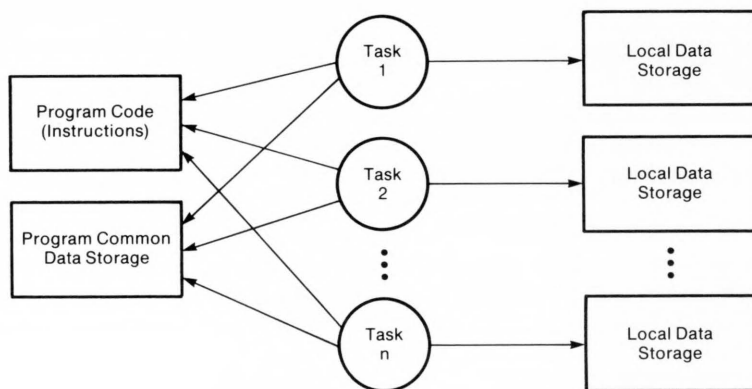


Figure 6-7. Multitasking structure

Event-Driven Processing

For applications with very high performance requirements, Amigo/300 provides several applications structures that support event-driven programming techniques. This type of programming can be significantly more complex than simple multiprogramming or multitasking methods, but all the required capabilities are available through Amigo/300 system services.

Nowait Input/Output

Input/Output intensive applications can use Amigo/300's "I/O without wait" feature to overlap I/O and processing for increased performance. Using nowait I/O, a program can request an I/O operation (e.g., input from an application terminal) and then proceed with other processing while the I/O operation completes (e.g., while the user types his reply). Later, the program will explicitly "WAIT" for the I/O to complete before proceeding further. (The program may or may not actually have to wait at this point, depending on whether the I/O has completed).

Nowait I/O techniques are especially useful for multiterminal applications, where many terminals can be serviced by a single task, using minimal memory resources. Figure 6-8 illustrates this type of application. Nowait I/O can also be selectively used in combination with other techniques to optimize time-critical portions of an application.

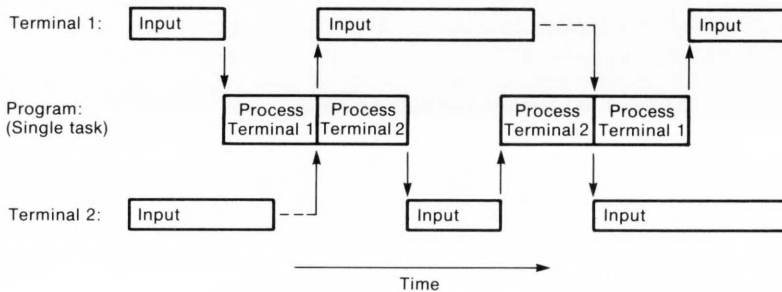


Figure 6-8. Example of Nowait I/O

Synchronization and Coordination Services

In any application where multiple programs or tasks share access to a common resource (such as a table in memory, a file, or a printer), they must coordinate their use of the resource. The Amigo/300 file system and Image/300 data base management system each provide shared access, along with a locking/unlocking capability to synchronize access. A set of Amigo/300 system services provide the same capability for applications programs (in the form of user resource semaphores), to protect shared tables and data with a locking/unlocking scheme.

Cooperating tasks and programs within an application may also require notification of external “events” that effect their processing. Amigo/300 uses the system-wide concept of an “ID” that symbolizes an event for event-driven processing. Tasks that depend on completion of an event can “WAIT” on the corresponding ID, and their execution is temporarily suspended if the event has not yet occurred. Amigo/300 uses ID’s to signal system events (such as program terminations and I/O completions) to tasks that are waiting for them. Through a set of system services, applications programs can also use their own user ID’s, to signal and wait for events that have significance within the application.

Virtual Memory

The HP 300’s Virtual Memory feature provides the applications programmer with a very large addressing space that significantly simplifies applications development. Even small-memory HP 300 configurations can support the execution of very large programs. (Programs can potentially address over 2 million bytes of instruction storage and 268 million bytes of data storage). All memory management is automatically handled by the Amigo/300 operating system, eliminating programming concerns over limited partition sizes, complex overlay structures, program chaining and the like. Virtual memory also allows many concurrently executing programs to efficiently share main memory resources.

The HP 300 uses a demand segmentation virtual memory system. Under this scheme, programs are broken down into small, variable-length pieces, called “segments”. Each code segment contains one or more subprograms, procedures, or a main program. Each data segment contains storage for variables, an array, or part of a large array.

Most of a program’s segments are kept on secondary storage as it executes, and are brought into main memory only when they are needed. Amigo/300 keeps track of the usage of segments in memory, and dynamically moves segments back and forth between memory and secondary storage to keep the most frequently used segments in memory. Because a program tends to use the same segments over and over again, segments must be fetched from secondary storage relatively infrequently. Execution can thus proceed while using a fraction of the main memory the entire program would require.

For applications where execution efficiency is not critical, virtual memory allows the application programmer to construct his program as if he actually had access to over 200 million bytes of real memory. Where execution efficiency is a critical concern, Amigo/300 provides programming tools that can be used to make virtual memory work to the programmer’s advantage. The programmer can explicitly control program segmentation so that subprograms and procedures that are generally used together are located in the same code segment. Similarly, data areas can be grouped so that data generally accessed in groups falls within the same set of data segments. By “localizing” a program in this way, the programmer can help Amigo/300 to use memory in the most efficient way possible, improving application performance.

Scheduling

Amigo/300 schedules the HP 300 processor and memory resources on a task-by-task basis, using a priority scheduling scheme. The scheduling algorithm determines which tasks will execute in what sequence, and also controls the movement of program segments between memory and mass storage under the HP 300 virtual memory system. In normal operation, Amigo/300 dynamically adjusts task priorities to assure rapid servicing of I/O-intensive tasks. This is appropriate for most business application mixes, where rapid terminal response and access to data files is more important than bulk computation.

Sophisticated application programmers can use Amigo/300 system services to specify optional scheduling parameters that modify the default scheduling algorithm. Task priorities and execution time quanta can be explicitly set, to favor important time-critical tasks. The scheduling algorithm for each task can also be altered to preserve relative task priorities (round-robin scheduling within priority levels) rather than dynamically adjust them (priority degradation). This control over scheduling, coupled with explicit control over program segmentation, gives the sophisticated programmer unusually high flexibility to fine-tune and optimize application performance.

7

The HP 300 system is designed to provide lasting value as it serves your data processing needs. In addition to its operational features, other factors such as lifetime ownership costs, ease of expansion, and dependability in daily operation have been carefully considered in its design. This section describes the system features and Hewlett-Packard services that support you as an HP 300 owner.

Cost of Ownership

The HP 300's low initial purchase price plays a major part in reducing its lifetime cost of ownership. But as initial system costs decline, the costs of physical facilities, personnel, system maintenance and expansion play an increasing role. The HP 300 is specifically designed to reduce these costs as well.

Physical Requirements

The HP 300 makes very modest demands on physical facilities. A basic system occupies about six square feet of floor space and needs no special "computer room" environment. It uses standard 115 volt power, and does not require air conditioning or raised flooring under normal office conditions. It is quiet in operation, and should require little or no modification to existing office facilities.

System Installation

HP 300 installation is a straightforward operation that generally takes less than two hours. The system includes a set of rear wheels, so you can move it into position easily without heavy moving equipment. Most system components are already integrated within the system unit, and other peripherals (such as printers and terminals) arrive ready for connection to the system. System software is also fully integrated before shipment. As a result, the HP 300 can go to work very shortly after it arrives.

Personnel

The HP 300 is easy to operate. A clerk or supervisor can typically learn the basics of system operation with a few hours of study. This person can then assume responsibility as a “key operator” for the system on a part-time basis. With proper applications design, other employees who use the HP 300’s application terminals can interact directly with the application, and do not need to understand system commands or control procedures.

Programming

The HP 300’s programming features are designed to reduce the costs of software development and maintenance. Through its natural programming environment, the HP 300 streamlines software development to make programming more efficient. A powerful complement of programming and debugging tools further improve programmer productivity.

To rapidly bring programmers up to speed, the HP 300 includes a comprehensive set of documentation. Most user manuals include a “Guided Tour” section that leads the reader step-by-step through common operating procedures. Other tutorial and quick-reference sections serve programmers as they become more experienced. A second level of documentation, the HP 300 Applications Guides, contain in-depth “how-to-do-it” information about advanced system capabilities. For a complete listing of the HP 300 documentation, see Appendix A.

System Dependability

As a business grows to depend more and more on data processing, the dependability of its computer system becomes increasingly important. The HP 300 maximizes dependability through consistently reliable operation and rapid recovery from any failures that may occur.

Reliability Features

The basic HP 300 system requires virtually no preventative maintenance, and moving parts of the HP 300 peripherals need only infrequent inspection or adjustment by an HP Customer Engineer. In addition, several hardware features are included to detect errors and correct them if possible:

- Memory error correction circuitry detects and corrects all single-bit errors automatically.
- Error recovery and retry mechanisms for mass storage provide transparent recovery from most disc errors.
- Thermal sensing protects the system against overheating.

- Self-tests of key system components (processor, low memory, fixed disc, flexible disc drive, and the IDS) are performed each time system power is turned on, to verify proper operation.
- Peripheral self-tests (on printers and terminals) can be manually invoked to verify proper peripheral operation.
- Non-critical peripherals (such as printers and terminals) can be placed offline if they fail, and system operation can continue during repair.

Error Logging

The HP 300 automatically logs several kinds of detected errors in a disc data file. Many of these errors can be automatically corrected when they occur, allowing system operation to continue. Later, on a scheduled maintenance call, the HP Customer Engineer can access the error log and repair or adjust the system to permanently correct the errors. The log can also provide failure trend information that helps the Customer Engineer anticipate failures and take corrective action before they occur.

Diagnosis and Repair

If a system failure does occur, the HP 300's diagnostic tools help the HP Customer Engineer rapidly isolate and correct it. Key system components and many of the HP 300 peripherals include pushbutton-invoked self-tests that verify proper operation in a matter of seconds. In addition, a comprehensive set of diagnostic programs are used to pinpoint the cause for failures.

All of these tools are simple to use, so you can perform significant diagnosis yourself, or under the telephone guidance of the Customer Engineer, if you prefer. This can provide the Customer Engineer with better information before he arrives, resulting in more rapid repair. Together, the HP 300's reliability features, error logging and diagnostic tools help to prevent failures, minimize their impact, and permit rapid recovery. The result is a highly dependable system that is very economical to maintain.

HP Support Services

The HP 300 system is backed by a comprehensive set of support services from Hewlett-Packard. Training, consulting, and system maintenance are provided by a worldwide team of HP sales, service, and support personnel who are dedicated to your continuing success with your HP 300 system.

Training

HP 300 training courses are offered at frequent intervals at HP training centers around the world. These courses cover a spectrum of topics from basic HP 300 operation and programming to in-depth information about advanced system features. On-site courses can also be arranged, and can be customized to meet your particular needs. For information about currently available courses and schedules, consult your HP Sales Representative.

System Maintenance

HP system maintenance services are designed to keep your HP 300 system running smoothly. Standard maintenance contracts provide scheduled maintenance and responsive repair service at a low, fixed monthly charge. Custom maintenance services can also be arranged to meet special customer needs. All HP maintenance services are backed by HP's worldwide service team, with over 172 offices in 65 countries.

Software Support

HP offers a comprehensive software support service for the HP 300 system software. Software support services include:

- *The Communicator*, a periodic publication that keeps you informed of outstanding and corrected software problems and workarounds.
- Periodic updates to system software and the HP 300 manuals.
- A phone-in consulting service that puts you in touch with an HP System Engineer to clarify software questions and resolve potential software problems.
- On-site assistance when the Systems Engineer determines that a potential HP software problem cannot be resolved over the phone.

Consulting Services

As you develop HP 300 applications, you may find it useful to call on HP Systems Engineers for consultation and assistance. Systems Engineers are highly trained in the application and operation of the HP 300 system. They can consult with you on application design, conversion from other systems, performance optimization, and other topics to help you make the best use of the system and its features.

System Expansion

As your data processing requirements grow and change, the HP 300 system can expand to meet them, with minimum impact on daily processing. Each dimension of system expansion offers modular, step by step growth:

- **Main storage** expands from a minimum of 256 KBytes to 1024 KBytes, in 128 KByte increments.
- **Mass storage** expands to 260 MBytes with additional 20, 50, or 120 MByte disc drives.
- **Additional printers** provide greater printing capacity and flexibility.
- **Application terminals** allow up to 16 users to concurrently use HP 300 applications.
- **System software** options (such as additional languages or data base management) can be added to the system at any time.

If your HP 300 expands to include many new applications, you may want to consider adding a second HP 300 system. Multiple HP 300's offer the advantages of local processing and data storage at each system site. Data and programs can be exchanged among the sites with flexible discs or removable disc volumes as needed. In this way, distributed HP 300 systems can grow into a closely-knit processing resource that meets many different applications needs.

Part 2

HP 300 System Summary

The HP 300 is an advanced, low cost computer system for dedicated, online business data processing applications. The system includes a powerful complement of operating software, with features that are generally found only on much larger systems. Through extensive use of HP's CMOS/SOS integrated circuit technology, these capabilities are offered in a compact, integrated system package.

The HP 300 is designed for dedicated application processing as an integral part of business operations. Its Integrated Display System provides an advanced user/system interface for simplified system control, highly interactive program development, and sophisticated applications display capability. The system also features exceptional growth, spanning a range from a minimal single-user system to a large multiterminal system with auxiliary mass storage and peripherals.

Features

- Virtual memory with a very large addressing space
- Multiprogramming
- Multitasking (parallel task execution within a single program)
- Multiterminal application processing on up to 16 terminals
- Comprehensive file management system
- Image/300 Data Base Management System
- Integrated Display System with sophisticated display capabilities
- Straightforward system/user interface for ease of operation
- Online, interactive software development with powerful programming tools
- Exceptional growth capability
- Compact, integrated system packaging
- Design and styling for the office environment
- CMOS/SOS integrated circuit technology for reliability, performance, and low cost.



HP 300 System

Specifications

Minimum HP 300 System includes:

- Processor and 256 KBytes of main storage
- 12 MBytes of fixed disc storage
- 1 MByte capacity flexible disc drive
- Integrated Display System
- Amigo/300 Operating System
- System Utilities

(The fixed disc may be optionally replaced by a 7906M 20 MByte disc drive in the minimum system).

System Expansion

- Additional main storage to 1024 KBytes, in 128 KByte increments
- Add-on 20, 50, or 120 MByte discs for up to 260 MBytes of online storage
- Up to 16 application terminals
- Up to 2 printers

Additional Software

- Business Basic/300
- RPG II/300
- Image/300 Data Base Management System

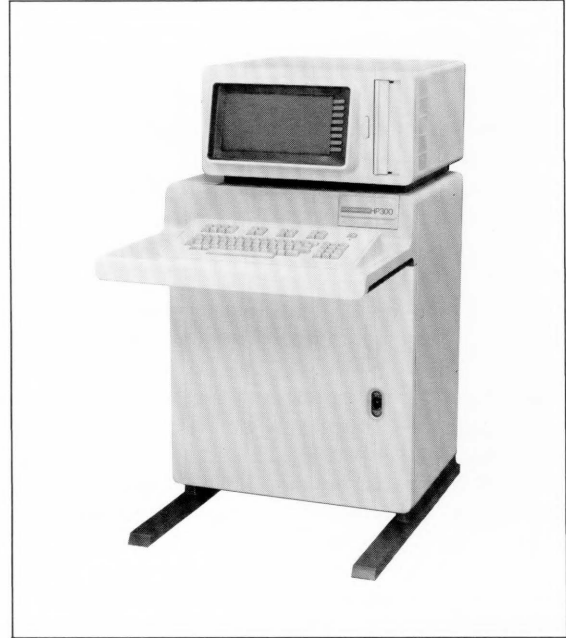
HP 300 System Unit

The HP 300 System Unit is the central element in every HP 300 system configuration. It combines into a single, compact, integrated package all the hardware components necessary for system operation:

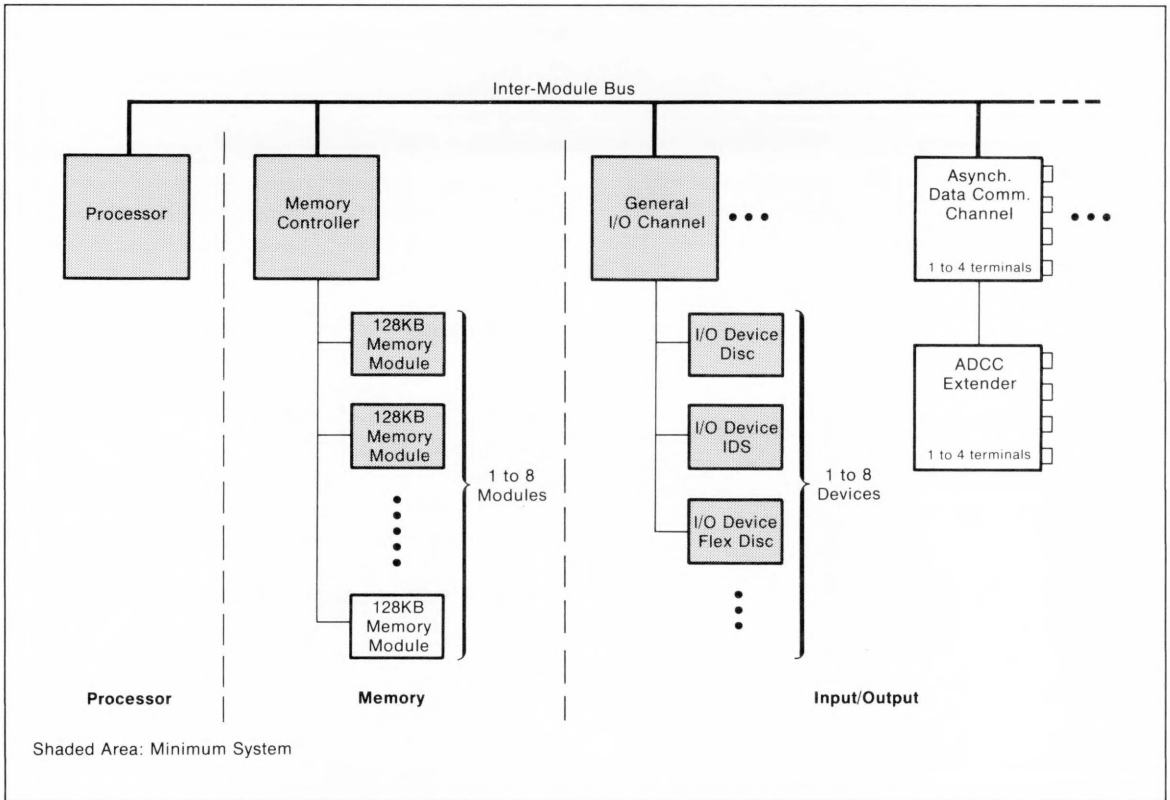
- Processor
- Main Memory
- Input/Output Channels
- 12 MByte Fixed Disc (optional)
- 1 MByte Flexible Disc drive
- Integrated Display System
- Power Supply

The logical hardware organization of the System Unit is illustrated in the figure below. The three main system elements—processor, memory, and I/O channels—communicate over a 4 MByte/second Inter-Module Bus. A minimum HP 300 system includes a processor, 256 KBytes of memory, and a single General I/O Channel. Additional memory modules and I/O channels plug directly into the System Unit card cage to expand the system.

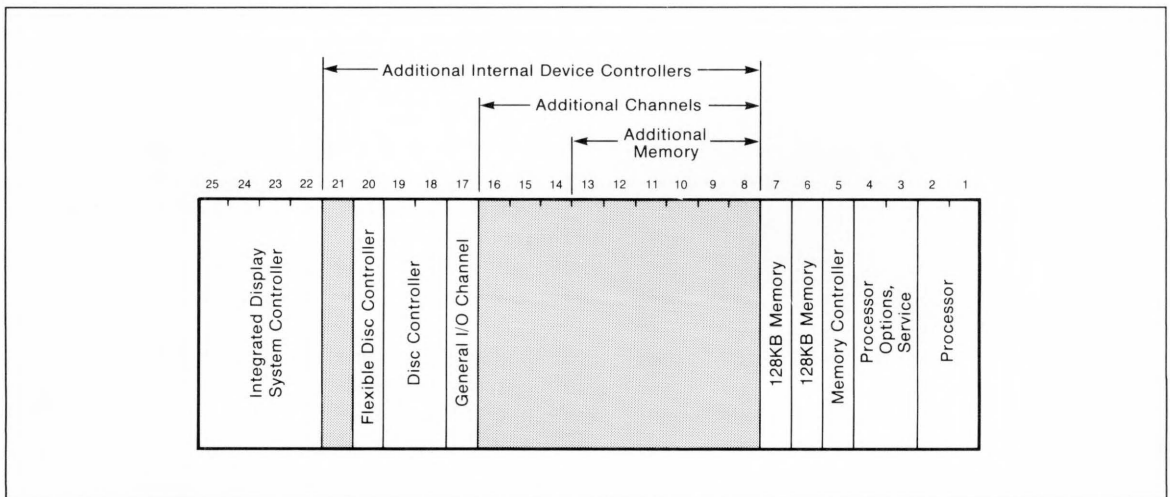
A minimum HP 300 system also includes a fixed disc, flexible disc drive, and Integrated Display System, all housed within the System Unit. These are “internal devices” which occupy the same logical position as other HP 300 peripherals in the hardware organization. However, they are essential to system operation and tightly integrated into the design of the System Unit. Their controllers physically occupy positions in the System Unit card cage.



HP 300 System Unit



HP 300 Logical Hardware Organization



HP 300 System Unit Card Cage Organization

Processor

The HP 300 is based on a microprogrammed, stack architecture processor that provides control and processing functions for the system. The processor executes system programs and user programs, and under the control of specialized microcode, executes HP 300 channel programs that direct the operation of the HP 300 I/O channels. The HP 300 addressing structure and register support provided by the processor are illustrated in the figure.

Features

- 195 powerful instructions, including specific support for commonly-executed system and user functions such as procedure calls/exits, loop processing, string manipulation, and list searching
- Stack architecture, with hardware stack registers for improved stack performance
- Separation of code and data
- Hardware register support for the HP 300 code and data segmentation virtual memory scheme
- Bounds checking on memory references through hardware limit registers
- Extensive use of HP's CMOS/SOS (Silicon-on-Sapphire) LSI circuitry, for excellent performance, high reliability, compactness, and low cost
- Automatic self-test of processor, low memory, and I/O channels at power-on; also pushbutton invokable

Specifications

Instruction set: 195 instructions

Data types:

Bit

Byte

Integer (2- and 4-byte)

Floating Point (4- and 8-byte)

Packed Decimal (1 to 14 bytes)

User program addressing space:

Code: 2,064,384 bytes maximum (up to 63 code segments of up to 32,768 bytes each)

Data: 268,369,920 bytes maximum (up to 4096 data segments of up to 65,536 bytes each)

Minor cycle time: 270 nanoseconds; variable micro-cycle timing

Levels of interrupt priority: 15

Memory

The HP 300 features a semiconductor memory system consisting of a memory controller and two to eight memory modules. The memory system automatically detects and corrects all single bit memory errors, and detects all double bit and the vast majority of multi-bit errors. Error detection/correction is transparent to the remainder of the system.

Specifications

Word length: 22 bits (16 data/6 error correction)

Cycle time: 500 nanoseconds

Memory module: 128 KBytes

Minimum memory: 256 KBytes (2 modules)

Maximum memory: 1024 KBytes (8 modules)

Memory technology: 16 Kbit MOS RAMs

General Input/Output Channel (GIC)

The General I/O Channel is a general-purpose channel that provides a standard method of attaching peripheral devices to the HP 300 system. A single GIC can attach up to 8 devices or device controllers (to which multiple devices may in turn be attached). (Consult the HP 300 Price/Configuration Guide for detailed configuration guidelines.) The GIC transfers data via direct memory access (DMA).

Specifications

Capacity: 8 devices per GIC, maximum; 2 GIC's per system, maximum

Data transfer rate: 1 MByte/second maximum

Cable length: 15m (50 ft.) maximum per GIC

Interface: General-purpose byte-parallel interface bus

Devices supported:

Integrated Display System

Fixed Disc

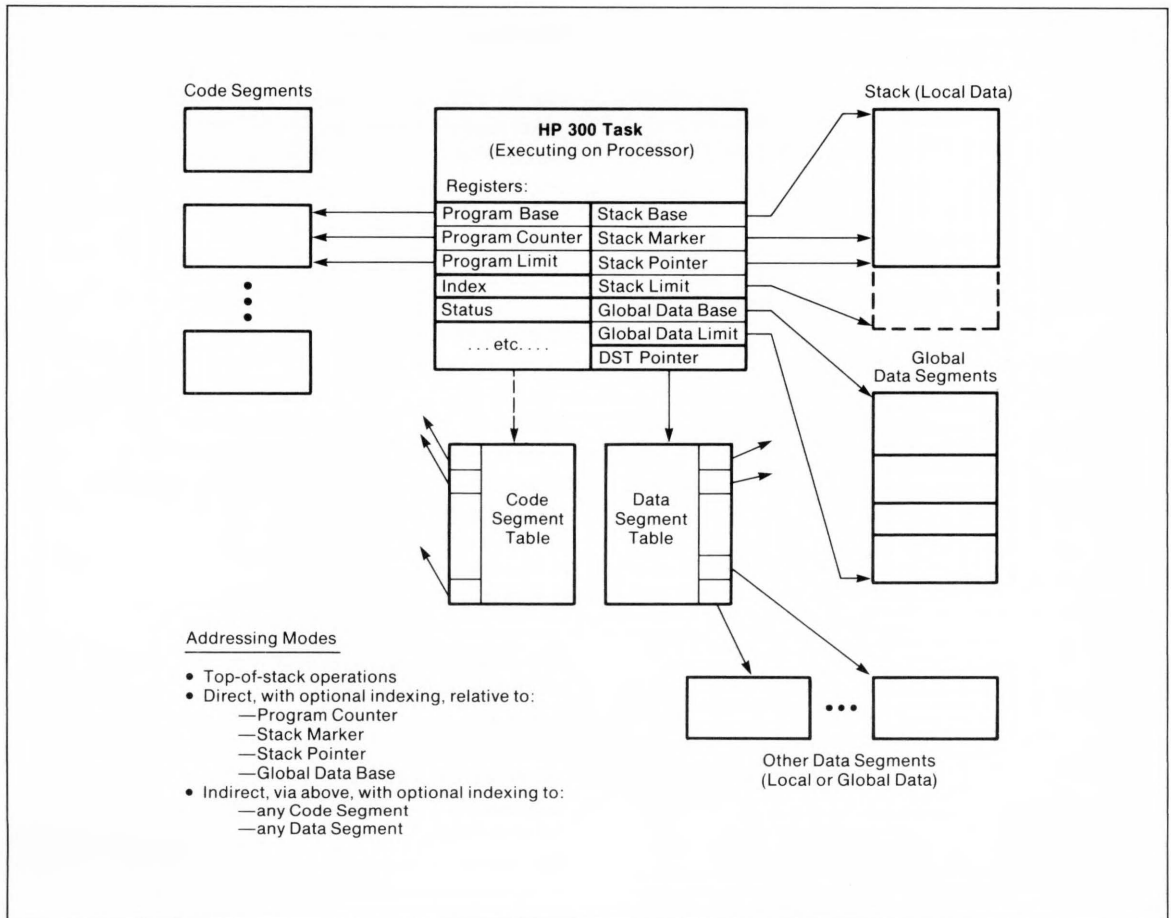
Flexible Disc Drive

2631A Serial Printer

7906M/S Disc Drive

7920M/S Disc Drive

7925M/S Disc Drive



HP 300 Addressing Scheme

Asynchronous Data Communication Channel (ADCC)

The ADCC is an optional channel for attaching terminals to an HP 300 system. It provides eight independent ports for device attachment, in two stages—an ADCC-MAIN circuit board provides the first four ports, and an ADCC-EXTENDER circuit board expands the ADCC to its full 8-port capacity. The MAIN/EXTENDER pair function as a single channel, and an ADCC-MAIN may be used as a 4-port channel without the EXTENDER.

Specifications

Capacity: 8 devices per ADCC, maximum (4-MAIN, 4-EXTENDER); 2 ADCC's per system, maximum (total of 16 devices per system)

Data rates: 50, 75, 110, 134.5, 150, 200, 300, 600, 1200, 2400, 4800, 9600 baud

Cable length: 15m (50 ft.) maximum per device

Interface: RS-232C/CCITT v.24 asynchronous, bit serial interface

Devices supported:

- 2640B Interactive Display Terminal
- 2645A Display Station
- 2647A Intelligent Graphics Terminal
- 2648A Graphics Terminal

Fixed Disc

The HP 300 System Unit includes an integrated 12 MByte system disc for online storage of system and user programs and data. The disc is a sealed, moving-head drive with a non-removable storage medium.

Features

- Winchester technology heads and medium with completely enclosed air flow, for low cost, high data density, and high reliability
- No preventative maintenance required
- Automatic self-test executed at power-on; also pushbutton invocable

Specifications

Capacity:

12.04 MBytes (12,042,240 bytes)

256 bytes/sector

32 sectors/track

735 tracks/surface

2 surfaces

Track-to-track seek time: 10 msec, maximum

Average seek time: 70 msec |

Average latency: 10 msec

Data transfer rate: 410 KBytes/sec, average

Flexible Disc Drive

The HP 300 uses flexible discs for offline user storage, software and data exchange, and disc backup. Flexible discs are read and written by an integrated Flexible Disc Drive in the HP 300 System Unit.

Features

- Double density, 2-sided HP flexible disc format for high storage capacity
- Format compatibility with other HP flexible disc systems (except HP 9885A)
- Direct access to data stored on flexible disc, without copying to online storage
- Automatic self-test executed at power-on; also pushbutton invocable

Specifications

Capacity:

1.03 MBytes (1,029,120 bytes)

256 bytes/sector

30 sectors/track

67 tracks/surface

2 surfaces

Medium: 2-sided, double density flexible disc (IBM #2736700 diskette)

Track-to-track seek time: 18 msec

Average seek time: 91 msec

Average latency: 83 msec

Data transfer rate: 100 KBytes/sec (burst)

Note: Only HP-certified flexible discs should be used.

Integrated Display System (IDS)

The IDS is an integrated CRT display screen and keyboard that forms the upper part of the HP 300 System Unit. It provides a highly intelligent, microprocessor-based front end for the HP 300, offering advanced display capabilities and facilitating user/system interaction. The IDS serves as a system console, a program development station, and an applications terminal.

Features

- **Softkeys.** Eight user-definable function keys can be dynamically labelled on the display screen for “natural” selection capability.
- **Windows.** The IDS screen can be partitioned into multiple display areas (windows), each independently and asynchronously controlled.
- **File Attachment.** Windows can serve as “windows into” certain types of disc files, for direct viewing of displayable data in the file (see illustration).
- **Scrolling.** Attached files can be moved vertically and horizontally past a window through keys on the IDS keyboard, to examine their entire contents.
- **On-screen editing.** The IDS editing keys are fully integrated with the system software; character and line editing can be done directly on the IDS screen image.
- **Keyboard.** A full-ASCII typewriter keyboard is separated from a numeric pad and five well organized control key groups for simplicity. (See photo).
- **ATTENTION facility.** An ATTENTION key interrupts IDS activity and returns IDS control to Amigo/300. Interrupted activity can be later resumed with no loss of data or status.
- **Display features.** The standard system features a full 128-character ASCII set and key-controlled display enhancements. Up to three optional character sets can be added for displaying line drawing, mathematical, international, or large characters.
- **Enhanced high-resolution display.** A 7 x 9 dot matrix character with half-dot shifting inside a 9 x 15 dot character cell improves clarity and allows accurate representation of descending and underlined characters.
- **Automatic self-test** executed at power-on; also pushbutton invocable.



Specifications

Display Screen

Dimensions: 13.7 x 26.4 cm (5.4 x 10.4 in.); 24 lines of 80 characters

Characters: 2.46 x 3.18 mm (.097 x .125 in.); 7 x 9 enhanced dot matrix with half dot shifting

Intensity control: Operator accessible

Standard character set: 128-character USASCII

Optional character sets:

Math characters

Line drawing set

Large characters

International characters

Display enhancements:

Half-bright

Blinking

Inverse video (black-on-white)

Underline

Key-controlled functions:

Display enhancements

Character set selection

Set/clear tab

Display of control functions

Screen hardcopy

Keyboard

(See IDS Keyboard figure)

Windowing

Concurrently active windows: 32 maximum

Borders: 1 arbitrary vertical border maximum;
Arbitrary horizontal borders

I/O: Input from one displayed window at a time; Output to any active window on an asynchronous basis

Format modes: Unformatted (window contents modifiable from keyboard); Implicitly Formatted (output protected from modification); Explicitly Formatted (input restricted to defined fields)

File Attachment/Scrolling/Editing

Files attachable: Keyed Sequential with DOUBLE keys, Direct

Maximum file length: Arbitrary

Maximum record length: 160 displayable characters (256 including control characters)

Scrolling functions:

Scroll up/down

Scroll left/right

Display first/last page

Display previous/next page

Editing Functions:

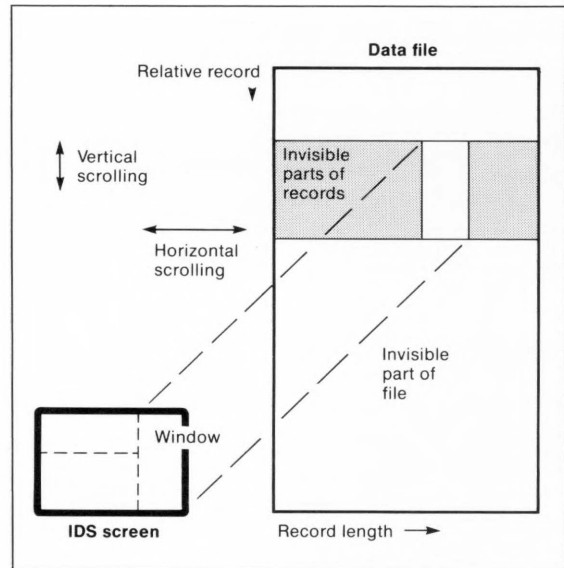
Scrolling

Cursor up/down/left/right

Character replace (type over)

Character insert/delete

Line insert/delete



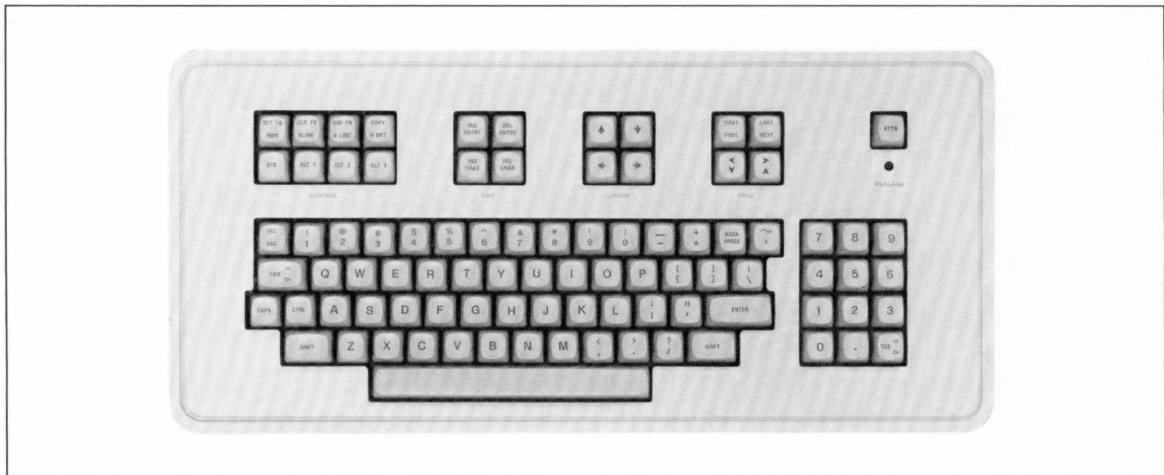
The IDS Window Concept

Softkeys

Number of softkeys: 8

Softkey labels: Dynamic labelling; 1 to 3 lines/label; 1 to 80 characters/label line

Softkey modes: Terminating (input terminates when key is struck); Non-terminating (input continues after key is struck).



IDS Keyboard

Amigo/300 Operating System

The Amigo/300 Operating System is a multi-programming, multitasking, virtual memory operating system with an extensive file management system and optional data base management. Control over HP 300 operation is provided through a highly interactive user interface to Amigo/300 at the IDS. In addition to accepting user commands, Amigo/300 provides runtime services that support program execution and creates the basic HP 300 execution environment.

Features

- **Multiprogramming.** Amigo/300 supports concurrent execution of many independent programs, along with program development or system utility operation. Programs are fully protected from interference with one another.
- **Multitasking.** Multiple tasks, each functioning as an independent “virtual processor” can execute in parallel within a single HP 300 program, sharing code and global storage for efficient memory utilization.
- **Virtual Memory.** A demand segmentation technique using variable-length code and data segments allows efficient sharing of main memory among many programs and permits execution of very large programs in small memory configurations.
- **Large addressing space.** A potential virtual addressing space of over 2 million bytes for code storage and 268 million bytes for data storage is available to each program.
- **Priority scheduling.** Processor and memory resources are scheduled for rapid servicing of input/output requests on a task-by-task priority basis.
- **Multiterminal application support.** Amigo/300 provides a wide range of programming structures and techniques for implementation of online multi-terminal applications.
- **Callable system services.** Applications can programmatically access the facilities of Amigo/300 through callable system services for program management, task management, file management, data base management, synchronization, resource management, and other functions.
- **Single step startup.** Amigo/300 automatically begins operation when HP 300 power is switched on, without further user action.
- **Interactive operating environment.** Amigo/300 uses the advanced capabilities of the IDS to create a powerful, easy-to-use environment for system control.
- **Easy-to-use command facility.** Amigo/300 commands feature familiar sentence structure, permissive use of synonyms, automatic spelling correcting, abbreviation, and highly descriptive error messages.
- **HELP facility.** A built-in reference manual provides online information about system operation in response to user questions.
- **Interactive system configuration.** Hardware and software configuration changes are made incrementally through an online System Build utility.
- **Error logging.** Abnormal I/O conditions, temperature excesses, system shutdown, and other events are logged for troubleshooting and preventative maintenance.

Amigo/300 File System

The Amigo/300 Operating System includes a comprehensive file system that provides uniform, high-level access and control for all HP 300 files and devices. The file system offers a rich variety of data storage and access facilities, for high flexibility in matching application requirements.

Features

- File and device independence. A common set of commands and system services provides uniform, high-level access to all types of files and devices.
- Dynamic file allocation. File space is dynamically allocated and reclaimed by the file system as the file grows and is processed.
- Seven data file organizations for flexibility in data storage.
- Serial and keyed file access.
- Private file domains with password protection.
- Private volumes for removable online disc storage.
- Variable length records.
- File equation. Files can be specified with logical names within HP 300 programs, and associated with actual files through "file equations" stored with the program or entered as system commands.
- File sharing among multiple tasks or programs.
- Programmatic access to file system capabilities through callable system services for file creation, purging, modification and access.
- Wait and No-wait I/O. Applications programs can either wait for I/O completion before proceeding (normal mode) or proceed with other processing before synchronizing with I/O completion (No-wait I/O).

- Variety of key types for keyed file access.
- Unique or duplicate key operation.
- Partial and approximate key retrieval.
- User hashing support for direct files.
- User file labels for applications use.

Specifications

File structures

Sequential
Relative
Keyed Sequential
Direct (Hashed)
Library
Primitive
Memory
Null

Access methods:

Serial (forward/backward)
Keyed

Key types supported:

Integer (2- and 4-byte)
Real (4- and 8-byte)
Character string (to 255 bytes)

Keyed retrieval modes:

Exact key match
Next key < search key
Next key > search key
Next key <= search key
Next key >= search key

File Sharing modes:

Exclusive access
Read-only sharing
Update sharing with file locking/unlocking

Maximum record length: 2028 to 2036 bytes, including keys, depending on file structure.

Image/300 Data Base Management System

Image/300 is the HP 300 version of HP's Image Data Base Management System, which is also available on the HP 3000, HP 1000, and HP 250 systems. Image/300 allows logically related data to be structured into an integrated data base that expresses the structural relationships among data items. The data can then be accessed according to the defined structure, without being encumbered by its physical organization.

Image/300 consists of four distinct components:

- A **schema processor utility (DBSCHEMA)** is used to enter, edit, and compile data base schemas at the IDS. Schemas are written using the Image data base definition language, to define the structure and capacity of a data base.
- **Data base access procedures** are system services called by application programs to access and maintain data bases.
- **Data base utility commands** are part of the Amigo/300 command set, entered through the IDS to create, erase, purge, store and restore data bases.
- A **Data Base Inquiry facility (DBI)** is used to interactively retrieve and update data base contents. It can be used for data base debugging, and also provides an ad hoc query facility to answer simple inquiries without writing a program.

Features

- Integrated structure. Logically-related files can be handled as a single entity (a data base).
- Network structuring. Master/detail data sets allow for complex relationships among data.
- Interactive schema definition and editing on the Integrated Display System.
- Data security through read and write access levels at the data set and data item level.
- Flexible data access from Business Basic/300 programs through four different access methods.

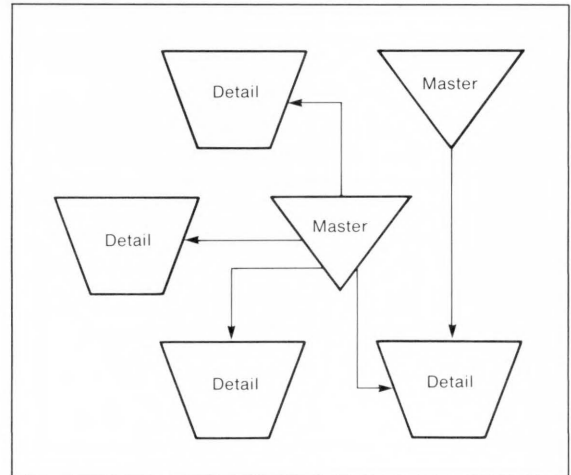


Image Network Structure

- Simultaneous access to multiple data bases.
- Concurrent access to a single data base from multiple tasks and programs.
- Locking at the data base or data set lock group level.
- Distribution of data sets from a single data base across multiple disc volumes.
- Data base backup on flexible discs or via volume backup.
- Ad hoc data base access and update through the Data Base Inquiry utility.
- Full compatibility of data base access procedures with Image/3000.

Specifications

Terminology:

Data item: Smallest accessible unit of data.

Data entry: Group of data items forming a record.

Data set: Collection of like data entries.

Schema: Definition of relationships between data items, data entries, and data sets that comprise a data base.

Data base: Collection of related data sets described by a schema.

Data set structure: Networked, with master and detail data sets (see illustration).

Data set access methods:

Serial

Direct

Calculated (Master set)

Chained (Detail set)

Data item names per data base: 255 maximum

Data items per data entry: 127 maximum

Data sets per data base: 50 maximum

Detail data sets per master data set: 8 maximum

Search items (keys) per detail set: 8 maximum

Data entry size: 2034 bytes (Master), 2020 bytes (Detail) maximum

Data entries per data set: 65,535 maximum

Data entries per chain: 65,535 maximum

Business Basic/300

Business Basic/300 is an augmented implementation of the ANSI X3.60 Standard for Minimum Basic. It is an extended and enhanced Basic language, with advanced features that are especially designed for online commercial data processing applications. Program development in Business Basic/300 takes place at the Integrated Display System, in a special programming environment that combines simplicity of operation with access to powerful programming tools. Business Basic/300 is a fully compiled language.

Features

- Interactive program development environment, using the IDS windowing and softkey capabilities.
- On-screen editing of source program text through the IDS editing keys.
- Online syntax checking as each statement is entered.
- Source program module structure, permitting independent compilation of subprograms.
- Symbolic debug and trace facility for interactive program debugging using source language variable names and statement labels.
- Fully compiled code for run-time execution efficiency.
- Six data types, including 2-byte Integer, 4-byte Integer, 4-byte Real (6-digit accuracy), 8-byte Real (16-digit accuracy), Decimal (1 to 14 bytes; up to 27-digit accuracy) and String (1 to 255 bytes).
- Long alphanumeric variable names (up to 31 characters, unique to the first 15).
- Alphanumeric statement labels.
- Formatted Output (PRINT USING statement), with fixed or run-time format specification.
- File support for sequential, direct and indexed access within the language syntax.
- Program-independent file or device allocation.
- Arrays of up to 32 dimensions for integers, real numbers, and character strings.
- Powerful string handling facilities, including concatenation, string searching, substring extraction and substring replacement.
- Very large program and data areas through code and data segmentation and virtual memory.
- Parameterized subprograms, with dynamically allocated local storage.
- Common (global) data storage for data sharing among subprograms and the main program.
- Multi-line user definable functions.
- Access to callable system services through the ICALL statement.
- Full matrix package.
- Over 30 built-in numeric and string functions.
- Mixed mode arithmetic with automatic data type conversion.

RPG II/300

RPG II/300 is an implementation of the popular Report Program Generator II (RPG II) language. Its highly formatted source specifications allow a programmer to specify many important printing, data collection and file maintenance operations with a minimum of effort. RPG II/300 programs can also access one or more HP 300 terminals for data entry through a multiterminal data entry extension to the language. Program development in RPG II takes place at the Integrated Display System, in a highly interactive programming environment that features RPG II screen templates for simplified program entry and editing.

Features

- Industry-standard RPG II language.
- High compatibility with HP 3000, IBM S/34 and S/32 RPG for minimum conversion effort.
- Interactive source program entry and editing, using RPG II screen templates.
- Online syntax checking as each RPG II program line is entered.
- Automatic EBCDIC/ASCII file translation and alternate collating sequence.
- Access to keyed files (including record deletion).
- Multiterminal data entry capability. An extension to the RPG language provides automatic terminal handling, screen formatting and record grouping for data entry from one or more terminals into a single RPG program.

Sort/Merge

Sort/Merge is a utility for sorting and merging HP 300 data files.

Features

- Interactive operation from the IDS as a utility program.
- Callable from application programs through system services.
- Sorting/merging of data files of any length (limited only by available mass storage).
- Full performance statistics generated for each sort or merge.

Specifications

Input files: 16 maximum

Input file organizations:

Sequential

Relative

Keyed Sequential

Direct

Sort/merge keys: 16 maximum

Sort/merge key types:

ASCII string (to 255 bytes)

Logical (2 bytes)

Integer (2 or 4 bytes)

Real (4 or 8 bytes)

Packed Decimal (to 27 digits)

Zoned Decimal (to 27 digits)

Key positions: arbitrary

Sorted/merged output options:

Complete records

Sorted/merged keys only

Record addresses (tag sort)—Sort only

Typist

Typist is the HP 300 text and document editor. It provides the same type of editing capabilities for general text that the HP 300 Language Subsystems provide for program text. Text formatting and output control capabilities specialized to text editing are also provided. Typist is used from the IDS.

Features

- On-screen editing of text through the IDS editing keys.
- Powerful editing commands for bulk text manipulation.
- Text formatting commands for control of page numbering, margins, titles, etc., on printed output.
- Named text modules for saving blocks of text that are repetitively used.

HELP Facility

HELP is an online reference manual that presents information about major system commands and operational procedures at the IDS.

Features

- Natural language inquiry. HELP answers questions posed in natural syntax (e.g., “How do I create a file?”), through a key-word-in-context matching algorithm.
- Softkey invocation. A HELP softkey is available at most times during system operation.
- Scrollable index. HELP’s complete index can be searched with the IDS scrolling capability to locate information of interest.
- Self-teaching. HELP includes an entry that explains “How to use HELP”.
- Environment preservation. HELP saves the environment from which it is entered, and restores it upon exit, without loss of data.

System Build

System Build is an online system configuration utility. It is used to add or delete hardware or software on an HP 300 system, and for software updating. System Build is used from the IDS.

Features

- Utility mode operation. System Build executes as a utility program executing under Amigo/300. Replacement of the executing system with a newly-defined configuration takes place at the next power-on.
- Incremental operation. System Build incrementally adds and deletes features from a starting configuration, eliminating the need to respecify the entire system for small changes.
- Interactive operation. Major System Build functions are softkey selectable, and the IDS is used to clearly display and request configuration information in easy-to-understand terms.
- Inactive configurations. Configurations can be defined and saved for later use.

Diagnostic and Utility System

The Diagnostic and Utility System (DUS) is a stand-alone, memory based system for performing hardware diagnosis and stand-alone utility functions. The system is easily loaded from a flexible disc, and is designed for operation by a non-technical user.

Features

- Pre-programmed, easy to use diagnostic programs for isolating system failures.
- Diagnostic language for creating and executing ad hoc diagnostics.
- Volume formatting for flexible discs, disc cartridges and disc packs.
- Volume analysis for detecting and configuring around defective tracks.
- Volume restoration from backup media for the system volume.
- Enabling of the backup system for the next system startup.

2631A Serial Printer

The 2631A is a microprocessor-controlled, 180 character per second serial printer that serves as a low-to-medium speed printer for the HP 300 system. It can be used either as a desktop printer, or with an optional pedestal, as illustrated here.

Features

- 180 cps bidirectional printing with high-speed skipping over consecutive blanks.
- Full 128-character USASCII character set with underlining and display functions.
- Optional additional character set for multi-lingual printing.
- Horizontal print expansion and compression.
- Multipart forms handling to 6 copies.
- 8-channel fixed Vertical Forms Control.
- Horizontal tabs.
- Long-life print head.
- Easily replaceable cartridge ribbon and print head.
- Pushbutton invoked self-test.

Specifications

Printing technique: 7 x 9 dot matrix, impact; cartridge ribbon

Speed: 180 char/sec, bidirectional; high-speed slew over multiple consecutive blanks

Horizontal pitch:

10 char/in., 136 char/line—normal

5 char/in., 68 char/line—expanded

16.7 char/in., 227 char/line—compressed

Vertical pitch:

6, 8 lines/inch, switch selectable

1,2,3,4,6,8,12 lines/inch, software selectable

Character sets: 128 character USASCII standard; optional European subset characters set

Forms handling:

8-channel Vertical Forms Control

6 part forms handling

Forms tractors

Paper out detection



Unsupported Features

The following 2631A features are not supported, or only partially supported, by the HP 300 system:

- Interfaces other than the HP 300 HP-IB interface (option 330) are not supported.
- Carriage control characters for common use on I/O devices are defined by the Amigo/300 file system. These are not compatible with the 2631 Vertical Forms Control codes.
- Programmatic control over print compression/expansion, auto-underline, horizontal tabulation, variable vertical pitch and vertical forms control is via escape sequences unique to the 2631A. Support and/or compatibility of these sequences with other devices is not guaranteed.

2640 Series CRT Terminals

The 2640 series is a family of compatible interactive display terminals that serve as application terminals for the HP 300 system. All members of the 2640 series share a common set of keyboard, display, and operational features. In addition, each model offers its own unique capabilities, as described below.

Features

The 2640B offers features that are common to all 2640 series terminals, including:

- Enhanced high-resolution display. A large screen and enhanced character generation offer excellent readability
- Plug-in character sets, including optional full upper/lower case, line drawing, mathematical, and large characters
- Inverse video for highlighting; and optional blinking, underline, and half-bright display enhancements
- Programmable protected fields for constructing screen display forms
- Dynamically-allocated memory and off-screen storage with local scrolling capability
- Character or block mode operation
- Full editing capability for locally-stored data
- Optional hard copy interface
- Detached keyboard
- Pushbutton-invoked self test

The 2645A Display Station includes all the features of the 2640B, and also provides:

- Optional minicartridges for local mass storage
- User-defined soft keys
- Data communications speeds up to 9600 baud
- Alphabetic/numeric field checking

The 2648A Graphics terminal adds local graphics capability to the feature of the 2645A, including:

- Automatic plotting of tabular data into X-Y charts
- Hardware pan and zoom
- Rubber band line
- Rectangular area shading
- Graphics text



The 2647A Intelligent Graphics Terminal includes all the features of the 2648A, plus:

- User programmability in Basic
- High-level graphics commands
- Automatic plotting of pie charts, bar charts and logarithmic X-Y charts

Specifications

Screen: 12.7 x 25.4 cm (5 x 10 in.); 24 lines x 80 columns

Characters: 2.46 x 3.18 mm (.097 x .025 in.); 7 x 9 enhanced dot matrix with half dot shifting

Standard character set: 64-character USASCII (2640B); 128-character USASCII (2645A, 2647A, 2648A)

Display enhancements:

Inverse video (standard)

Blinking (optional)

Half-bright (optional)

Underline (optional)

Keyboard: Detachable; main typewriter group, control and editing keys, cursor pad, numeric pad (2640B, 2645A) or graphics pad (2647A, 2648A).

Data Communications Interface: RS-232C, asynchronous, half or full duplex

Data rates: External switch selectable; 110, 150, 300, 1200, 2400, baud (all terminals); 4800, 9600 baud (except 2640B)

Optional Mini-cartridge tape:

2 mechanisms

10 ips read/write speed

800 bpi recording density

110 KByte maximum capacity per cartridge

Optional hardcopy interface: RS-232C or HP parallel interface.**Graphics display:** Independent graphics memory; 720 dots x 3670 rows (2647A, 2648A only)**Interactive Display Terminals at a Glance**

	2640B	2645A	2647A	2648A
Maximum Baud Rate	2400	9600	9600	9600
Maximum Memory	8 KB	12 KB		8 KB
Lowercase Characters	Optional	Std	Std	Std
Inverse Video	Standard			
User-Defined Softkeys	—	8 Std	9 Std	9 Std
2 Tape Cartridge Drives	—	Optional	Std	Optional
Underline, Blink, Half-Bright	Optional			
Math Character Set	Optional			
Line Drawing Set	Optional			
Large Character Set	Optional			
Raster Scan Graphics	—	—	Std	Std

Unsupported Features

The following 2640 series features are not supported, or only partially supported, by the HP 300 system:

- Interfaces other than standard RS-232C asynchronous communications (i.e., current loop, asynchronous and synchronous multipoint) are not supported.
- Connection to the HP 300 system via modems is not supported.
- Minicartridge tapes, local hardcopy devices, and video monitors are local capabilities of the terminal only. They are not supported as HP 300 I/O devices.
- Graphics capability in the 2647A and 2648A is a local capability of the terminal only. The HP 300 supports these terminals as a 2645A.

Disc Drives

The 7906, 7920, and 7925 form a family of disc drives that can be added to an HP 300 system for increased mass storage capacity. The 7906 has approximately 20 MBytes of storage capacity using a removable/fixed cartridge disc; the 7920 and 7925 both use removable disc packs with 50 and 120 MByte capacities, respectively. Each disc comes in two models. The Master Drives (7906M, 7920M, 7925M) include a controller that supports additional Add-on Drives (7906S, 7920S, 7925S), subject to HP 300 configuration limits.

Every HP 300 system includes either a fixed disc (within the System Unit) or a 7906M disc that serves as a system disc. Up to 2 additional disc drives can be added, both of which must be the same type.

Features

- Microprocessor-based disc controller (in Master Drives) that supports multiple discs of the same type
- Fast data access
- Removable cartridge/fixed disc configuration (7906M/S) for disc-to-disc backup
- Removable disc packs (7920M/S, 7925M/S) for disc-to-disc backup and private volume capability
- Constant spindle speed, independent of line frequency
- Exceptional reliability over a wide range of environmental conditions
- Hardware error correction
- Self-contained fault indicators for rapid, accurate servicing

Specifications

Capacity:

7906M/S: 20 MBytes (19,660,800 bytes)

7920M/S: 50 MBytes (50,073,600 bytes)

7925M/S: 120 MBytes (120,176,640 bytes).

	7906M/S	7920M/S	7925M/S
Bytes/sector	256	256	256
Sectors/track	48	48	64
Tracks/surface	400 ⁶	815	815
Surfaces	3 ⁶	5	9



HP 7906, HP 7920/7925

Track-to-track seek time: 5 msec

Average seek time: 25 msec

Average latency: 8.3 msec (7906/7920); 11.1 msec (7925)

Burst data transfer rate: 937.5 KBytes/sec

Unsupported Features

The following 7906/20/25 features are not supported, or only partially supported, by the HP 300 system:

- 7906 cartridge removability is supported for stand-alone disc-to-disc backup operations only. For online use, the 7906 operates as a 20 MByte fixed disc.
- Rack-mounted versions of the 7906 are not supported.
- Interfaces other than the HP-IB interface (option 100) are not supported.
- Different types of discs cannot be connected to a single disc controller.
- The capacity of the disc controller is limited to fewer than 8 drives by HP 300 configuration guidelines, as given above.

⁶ 2 surfaces @ 400 tracks/surface on cartridge; single surface of 800 tracks on fixed disc.

Physical and Environmental Data

The HP 300 system is designed to operate in a normal office environment, and makes minimal demands on physical facilities.

Features

- Small floor space. A basic system occupies less than 1 square meter (10 square feet), including the printer.
- Low operating noise. System noise is comparable to that of office machines and copiers.
- Easy installation and relocation. A set of rear wheels on the System Unit facilitates system movement.
- Single-phase commercial power. The system plugs into standard wall outlets. (In some cases, power line noise considerations will require use of a dedicated circuit).
- No air conditioning requirements. The system is comfortable in the normal office temperature range, and automatically shuts down if safe temperatures are exceeded.
- Safe operation by non-technical personnel. The system is designed to meet worldwide safety regulations for Data Processing Equipment and Office Machines.

Specifications

The following specifications apply to the HP 300 System Unit and all peripheral devices described in this manual:

Temperature

Operating: 10° to 40° C (50° to 104° F)⁷

Non-operating: -40° to 65° C (-40° to 149° F)

Maximum rate of change: 10° C/hour (linear)

Humidity

Operating: 20% to 80% RH (maximum wet bulb temperature 26° C, no condensation)

Non-operating: 8% to 80% RH (maximum wet bulb temperature 30° C, no condensation)

Altitude

Operating: To 4600m (15,000 ft)

Non-operating: To 15,200m (50,000 ft)

⁷ Optimum interchange and data transfer require that the 7920 disc drive be operated within ± 15° C (± 27° F), and the 7925 disc within ± 10° C (± 18° F), of the temperature at which the heads were aligned.

HP 300 System and Peripherals—Physical Characteristics

	Height cm/in.	Width cm/in.	Depth cm/in.	Net Wt. kg/lb	Heat Dissip. Watts
31032A System Unit	110.5/43.5	122.0/48.0	85.1/33.5	118/260	800
31381A Work Surface	71.4/28.1	61.0/24.0	109.2/43.0	18.1/40	0
7906 Disc	71.8/28.3	55.3/21.8	79.1/31.1	154/340	720 ⁹
7920/7925 Disc	82.5/32.5	50.0/19.7	81.3/32.5	158.7/350	720 ⁹
2631 Printer	92.8/36.5 ⁸	64.0/25.2	47.0/18.5	23.5/51	265
2640 Series Terminal	34.2/13.5	44.4/17.5	64.8/25.5	228/50	150

⁸ Including pedestal.

⁹ 720 watts—7906M/7920M/7925M; 550 watts—7806S/7920S/7925S

The following specifications apply to the HP 300 System Unit only:

Power requirements

Voltage: 100, 120, 220, or 240V; $\pm 5\%$, -10%

Frequency: 50 or 60 Hz; $+2$ Hz, -2 Hz

Power disturbances (system withstands):

Short-term undervoltage: $< 85\%$ of nominal for 11 ms duration, measured from peak of the AC waveform

Short-term overvoltage: 150V for 30 sec duration (110, 120V); 300V for 30 sec duration (220, 240V)

Line interference pulses: 1000V for 50 μ sec (line-to-neutral or neutral-to-ground)

Fast pulse disturbances: 1500V for 30 nsec (line and neutral to ground)

Shock (non-operating): 30g

Flexible disc storage Temperature: 5° to 50° C (41° F to 122° F)

Max. rate of temperature change: 20° C/hr (36° F/hr)

Humidity: 8% to 80% RH

Safety/RFI Certification

USA: UL 478, 114

Canada: C22.2 #154

Appendix

A

The documentation for the HP 300 Computer System is organized into two logically distinct groups: “manuals” and “application guides”. The manuals provide the formal documentation of the system and its subsystems, consisting primarily of all the common user information needed to use the system at the “language level.” The guides provide advanced application information for taking full advantage of the system-level functions that are not normally available within the languages. The guides thus provide “how-to” information for the systems programmer, rather than product documentation—which is the function of the standard manuals.

The manuals and guides that are available as of the current printing date of this manual are listed below. For more recent publications, consult your local HP sales representative.

HP 300 Owner's Manual. Describes site selection, installation, preventive maintenance, and all System Manager functions: software installation, system configuration and modification, troubleshooting, and diagnostics.

HP 300 Console Operations Manual. Gives general information on the console display, keyboard, windows, softkeys, and flexible disc; the operating system and the use of files, domains, volumes, jobs, and workspaces; the Help facility; operating instructions for accessory equipment; system and file backup; and simplified definitions for the HP 300 command set.

HP 300 Error Messages Manual. Lists all error messages and recovery procedures.

HP 300 Operating System Reference Manual. Provides formal syntax and complete definitions for the HP 300 command set; also complete documentation for HP 300 files, as accessed through Business Basic/300 or RPG II/300 languages.

Business Basic/300 Reference Manual. Defines the Business Basic/300 language and describes the program development process for Basic.

RPG II/300 Reference Manual. Defines the RPG II/300 language, and describes the program development process for RPG.

HP 300 Typist Reference Manual. Describes the text editing subsystem of the HP 300; how to enter, edit, and print reports and letters.

Image/300 Reference Manual. Gives procedures for data base design, definition, installation, and loading; also use and maintenance of existing Image/300 data bases.

HP Sort/Merge Reference Manual. Describes use of the Sort/Merge Utility; either stand-alone or from a Business Basic/300 program.

HP 300 Multiterminal Applications Guide. Gives detailed instructions on writing and installing dedicated multiterminal applications in the Business Basic/300 language. Intended for the systems programmer.

HP 300 System Services Guide. Defines the callable system services.

HP 300 Program and Library Operations Guide. Describes the components of a program workspace and segment libraries, and how these elements can be manipulated for best efficiency in various applications.

HP 300 Architecture Guide. Provides a tutorial description of the HP 300 system architecture; intended for the systems programmer to gain an understanding of the HP 300 internal design.

HP 300 Display System Guide. Describes the operation of the HP 300 Integrated Display System, and how Business Basic/300 programs can access its features through callable system services.

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Part No. 31000-90002

5953-3704

Printed in USA September 1978

HEWLETT  PACKARD