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Errata

Title & Document Type:

Manual Part Number:

Revision Date:

HP References in this Manual

This manual may contain references to HP or Hewlett-Packard. Please note that Hewlett-Packard's former test and measurement, semiconductor products and chemical analysis businesses are now part of Agilent Technologies. We have made no changes to this manual copy. The HP XXXX referred to in this document is now the Agilent XXXX. For example, model number HP8648A is now model number Agilent 8648A.

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HP 3852A Data Acquisition/Control Unit

HP 44788A
HP-IB Controller Accessory

Configuration and Programming Manual



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Manual Part Number: 44788-90001
Microfiche Part Number: 44788-99001

Printed: February 1988 Edition 1
Printed in U.S.A. E0288

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Printing History

The Printing History shown below lists the printing dates of all Editions and Updates created for this manual. The Edition number changes as the manual undergoes subsequent revisions. Editions are numbered sequentially starting with Edition 1. Updates, which are issued between Editions, contain individual replacement pages which the customer uses to update the current Edition of the manual. Updates are numbered sequentially starting with Update 1. When a new Edition is created, all Updates associated with the previous Edition are merged into the manual. Each new Edition or Update also includes a revised copy of this printing history page.

Many product updates and revisions do not require manual changes and, conversely, manual corrections may be done without accompanying product changes. Therefore, do not expect a one-to-one correspondence between product updates and manual updates.

Edition 1 (Part Number 44788-90001) . . . . . FEBRUARY 1988

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SAFETY SUMMARY

The following general safety precautions must be observed during all phases of operation, service, and repair of this instrument. Failure to comply with these precautions or with specific warnings elsewhere in this manual violates safety standards of design, manufacture, and intended use of the instrument. Hewlett-Packard Company assumes no liability for the customer's failure to comply with these requirements.

GROUND THE INSTRUMENT

To minimize shock hazard, the instrument chassis and cabinet must be connected to an electrical ground.

DO NOT OPERATE IN AN EXPLOSIVE ATMOSPHERE

Do not operate the instrument in the presence of flammable gases or fumes. Operation of any electrical instrument in such an environment constitutes a definite safety hazard.

KEEP AWAY FROM LIVE CIRCUITS

Operating personnel must not remove instrument covers. Component replacement and internal adjustments must be made by qualified maintenance personnel. Under certain conditions, dangerous voltages may exist even with the instrument switched off. To avoid injuries, always disconnect input voltages and discharge circuits before touching them.

DO NOT SERVICE OR ADJUST ALONE

Do not attempt internal service or adjustment unless another person, capable of rendering first aid and resuscitation, is present.

DO NOT SUBSTITUTE PARTS OR MODIFY INSTRUMENT

Because of the danger of introducing additional hazards, do not install substitute parts or perform any unauthorized modification to the instrument. Return the instrument to a Hewlett-Packard Sales and Service Office for service and repair to ensure that safety features are maintained.

DO NOT OPERATE A DAMAGED INSTRUMENT

Whenever it is possible that the safety protection features built into this instrument have been impaired, either through physical damage, excessive moisture, or any other reason, REMOVE POWER and do not use the instrument until safe operation can be verified by service-trained personnel. If necessary, return the instrument to a Hewlett-Packard Sales and Service Office for service and repair to ensure that safety features are maintained.

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Operating and Safety Symbols

Symbols Used On Products And In Manuals

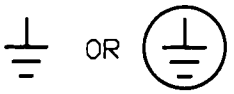
~ LINE — AC line voltage input receptacle.



Instruction manual symbol affixed to product. Warns and cautions the user to refer to respective instruction manual procedures to avoid personal injury or possible damage to the product.



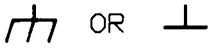
Indicates dangerous voltage – terminals connected to interior voltage exceeding 1000 volts.



Protective conductor terminal. Indicates the field wiring terminal that must be connected to earth ground before operating equipment – protects against electrical shock in case of fault.



Clean ground (low-noise). Indicates terminal that must be connected to earth ground before operating equipment – for single common connections and protection against electrical shock in case of fault.



Frame or chassis ground. Indicates equipment chassis ground terminal – normally connects to equipment frame and all metal parts.



Affixed to product containing static sensitive devices – use anti-static handling procedures to prevent electrostatic discharge damage to components.

NOTE

NOTE

Calls attention to a procedure, practice, or condition that requires special attention by the reader.

CAUTION

CAUTION

Calls attention to a procedure, practice, or condition that could possibly cause damage to equipment or permanent loss of data.

WARNING

WARNING

Calls attention to a procedure, practice, or condition that could possibly cause bodily injury or death.

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WARNING, CAUTION, and NOTE Symbols

Some labels on the HP 3852A, HP 3853A, and plug-in accessories include an international warning symbol (triangle with subscripted number) which refers the reader to the manuals for further information. This table shows the warning symbols used for the HP 3852A/3853A and plug-in accessories. Refer to the manual set for specific information on WARNINGS, CAUTIONS, or NOTES referenced with a warning symbol.

HP 3852A WARNING, CAUTION, and NOTE Symbols

Symbol	Meaning	Location
	Shock hazard originating outside the instrument (field wiring)	. Analog Extender Connector on Power Supply Modules . Terminal modules on plug-in accessories . Component module covers on plug-in accessories
	Treat all channels as "one circuit" for safety purposes.	. Inside terminal modules on plug-in accessories . Metal cover on component modules of plug-in accessories
	Maximum number of certain plug-in accessories to be installed into an HP 3852A or HP 3853A.	. HP 44701A, HP 44702A/B, HP 44727A/B/C plug-in accessories
	If High-Speed FET multiplexers are used with the HP 44702A/B, ribbon cable may be connected.	. HP 44711A, 44712A, 44713A (referenced on HP 44702A and HP 44702B)
	The instrument should not be operated at a line frequency of 440 Hz with a line voltage of 200 V or greater as the AC leakage current may exceed 3.5 mA.	. HP 3852A, HP 3853A Power Supply Modules

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Chapter 1
Introduction

Manual Contents

This manual contains the following:

- **Chapter 1 - Introduction** summarizes manual contents and gives a description of the HP 44788A HP-IB Controller accessory.
- **Chapter 2 - Installing the HP 44788A** gives you information needed to install the accessory for proper operation.
- **Chapter 3 - Using the HP 44788A** provides information on mass storage operations, available file types, and storing and retrieving data. Additional information is provided on interfacing the HP-IB Controller to disc drives, printers, and intrumentation with programming examples. A command summary of HP 44788A commands with a brief description and the syntax is given.

Accessory Description

The HP 44788A HP-IB Controller accessory for the HP 3852A provides CS/80 and SS/80 HP-IB disc drive control, printer control, and instrument control through a local device HP-IB port without the need for a separate system controller. For "local" HP-IB system control using only a disc drive (no computer in the system acting as controller) you can create a program with your system computer and store the program on a disc. This disc can be loaded into a disc drive connected only to the local HP-IB of the HP 3852A. Using the AUTOST IS command, the file name and msus (mass storage unit specifier) direct the HP 3852A to access the file containing the commands to be executed. Data throughput is increased by not having a host computer (the system controller) intervening with every input/output sequence. Figure 1-1 shows a typical "local" and "system" HP-IB system.

Local HP-IB and System Controller

You can address any device on the "local" HP-IB with a system controller connected to the "system" HP-IB. This is done by nesting a "local" output command within a "system" output command. Figure 1-2 shows a simplified system and typical nested command statement from system controller to "local" HP-IB device.

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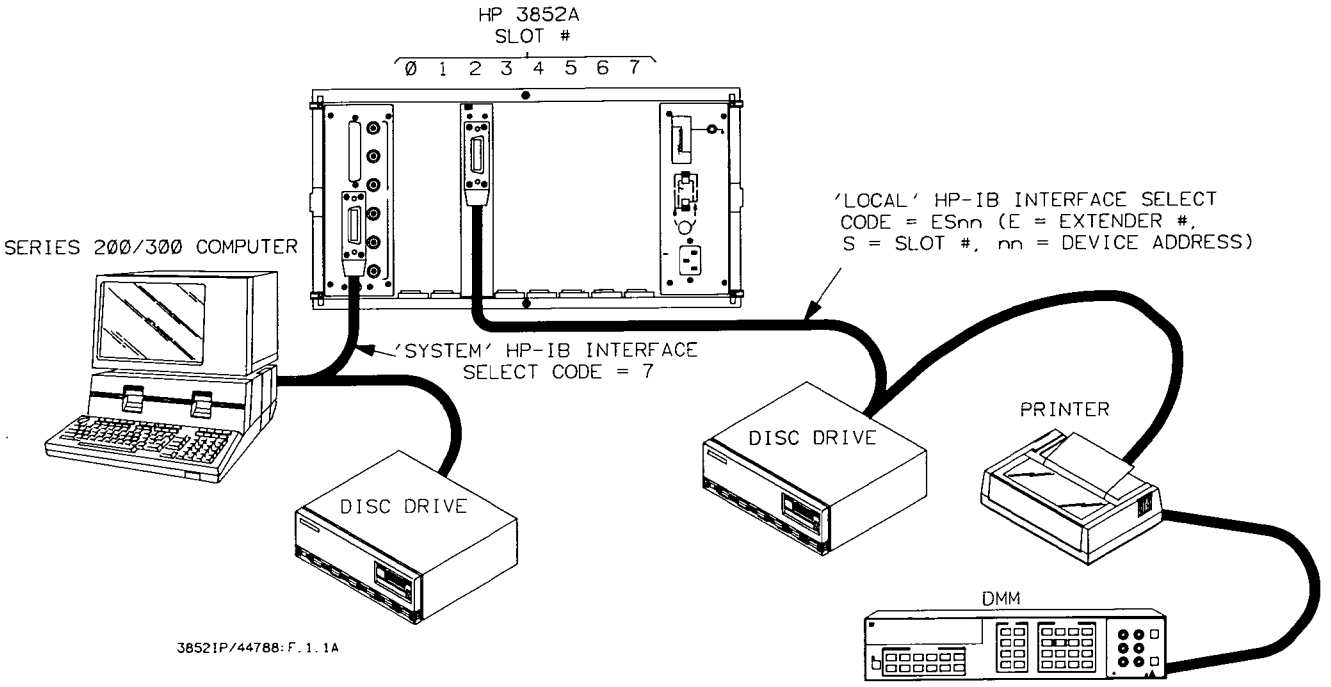


Figure 1-1. Typical "Local" and "System" HP-IB Systems.

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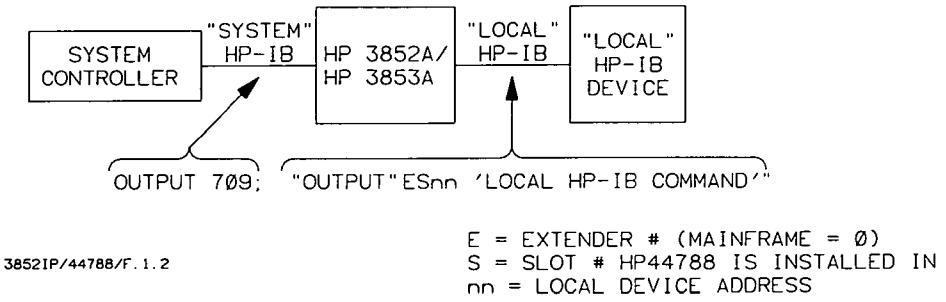


Figure 1-2. Typical "Nested" Command Statement.

When is it an advantage to use a system controller with an HP 3852A/HP 44788A and instruments on the "local" HP-IB? Accessories may not be available for your application but available external instruments can make the measurements. The system controller can download subroutines to the HP 3852A memory that when run, utilize an HP 44788A to control "local" devices. These subs control the "local" devices and store measurement data in memory without intervention by the system controller. The system controller can retrieve this data from the HP 3852A at a later time.

Disc Drive Compatibility

The HP 3852A will operate only with disc drives with the SS/80 or CS/80 command set. Table 1-1 lists some disc drives that use the SS/80 and CS/80 command set and some disc drives that use the AMIGO command set. Drives that use the AMIGO command set are not compatible with the HP 3852A. This list is not all inclusive of HP disc drives but does list disc drives available as of this printing. Executing CAT " " will cause error 113 (unsupported drive type) for a non-SS/80 or -CS/80 disc drive. If you have a disc drive not listed in Table 1-1 that does not respond and you do not know the type of command set it uses, you can contact your local HP Sales and Service office to determine its type of command set.

NOTE

Only disc drives with the SS/80 or CS/80 command set are compatible with the HP 44788A.

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Table 1-1. Disc Drive Command Sets/Model Nos.

COMMAND SETS SUPPORTED		COMMAND SET NOT SUPPORTED
SS/80	CS/80	AMIGO
9122D	7907	7905
9122S	7908	7906
	7911	7910
	7912	7920
	7914	7925
	7933	
9122D	7935	9121D
9122S	7936	9121S
	7937	
9125S		9133A
	7941	9133B
9133D	7942*	9133L
9133H	7945	9133V
	7946*	9133XV
9134D		
9134H	7953	9134A
	7957	9134B
9153A	7958	9134L
		9134XV
9154A		
		9135A
		9138A

* Disc only

Local System Interface Select Code

The two HP-IB ports ("local" HP-IB and "system" HP-IB) have different interface select codes. An HP-IB usually has an interface select code of 7 where a disc drive of address 00 has an HP-IB address of 700. You can have an interface select code other than 7. If you have more than one HP-IB, you may have another interface select code in addition to 7 i.e. 8. A disc drive with address 00 on this bus has an HP-IB address of 800. The "local" HP-IB interface select code for the HP 3852A is dependent on which slot the HP-IB Controller is installed in and has the form ESnn where E = extender # (mainframe = 0), S = slot #, and nn = the device address. If the HP-IB Controller is in slot 2 of the mainframe (E = 0), a disc drive of address 00 has a local HP-IB address of 200 (0200). Figure 1-1 illustrates the "local" and "system" HP-IB interface select codes.

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NOTE

The HP 44788A cannot be installed in slot 0 of the HP 3852A mainframe. Therefore, a local system interface select code where S = 0 is only valid for an extender frame where E is not 0 in the interface select code.

Mass Storage Unit Specifier

All mass storage operations require a properly initialized volume. See the section "Initializing a Disc" that follows. Some external disc drives that can be used with the HP-IB Controller have one volume per disc and others have multiple volumes on a disc. With the HP 3852A, volumes are specified by using a **mass storage unit specifier** (msus). This is a string expression which tells the HP 3852A where to look for the desired volume. The expression has the form ":,ESnn,u,v" where E specifies the frame number (mainframe = 0), S specifies the slot number that the HP 44788A is installed in, and nn is the disc drive address. u specifies the unit number and v specifies the volume number. All mass storage operations by the HP 3852A will use a default msus if you do not include one in your mass storage statement. The power-on msus is ":,ES00,0,0" where E is the frame number and S is the lowest number slot with an HP 44788A installed.

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Chapter 2
Installing the HP 44788A

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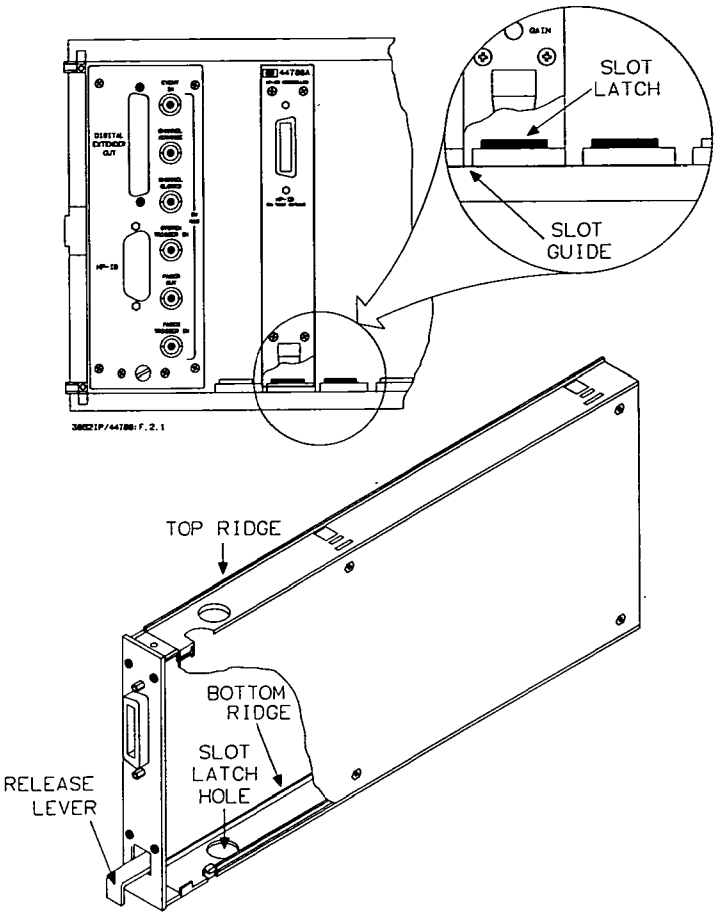
No Mainframe Slot 0 Installation

The HP 44788A occupies one slot and can be installed in any slot except slot 0 of the HP 3852A mainframe. However, it can be installed in any of the 10 slots (0-9) in the HP 3853A extender. When in slot 0 of the mainframe, the controller will not be able to distinguish between a device on the local HP-IB with device selector of 01 and the HP 3852A display whose select code is 1. Additionally, other addressing conflicts cause improper operation of the accessory when in slot 0. Figure 2-1 shows the installation procedure for the HP 44788A.

WARNING

Installation of the HP 44788A should be performed with the mainframe and extender turned off and all field wiring power disconnected.

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Installing the HP 44788A HP-IB Controller

1. Line up the ridges on the top and bottom rails of the accessory with the slot guides to the left of the slot number on the mainframe.

2. Slide the accessory into the slot and press firmly to lock the accessory in the slot. You'll hear a click when the accessory locks.

Removing the HP 44788A HP-IB Controller

To remove the accessory, lift the release lever FIRST. Then, firmly pull the accessory from the slot. If you try to pull the accessory from the slot before you lift the release lever, you may jam the mechanism.

Figure 2-1. Installing the HP 44788A.

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Chapter 3
Using the HP 44788A

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Chapter 3
Using the HP 44788A

Introduction

Chapter 3 gives you information on the use of mass storage devices with the HP 44788A, the types of files that are supported, disc and file structure, accessing files, and storing and retrieving data. The chapter begins with a summary of commands used by the HP 44788A. Following this, it provides information on disc drive compatibility, the local HP-IB system interface select code, and the mass storage unit specifier (msus). Additionally, programming, disc, and file information is presented. The last sections provide some simple examples of data storage and retrieval, instrument control, and printing by use of auto-started programs from an auto start file.

Command Summary

The following is an alphabetical summary of commands used by the HP 44788A HP-IB Controller. Refer to the HP 3852A Command Reference Manual for a complete description of these commands.

ASSIGN

Used to perform one of the following actions: assign an I/O path name and attributes to a device or a mass storage file or to close an I/O path.

Syntax: ASSIGN *@I/O path name* **TO** *device selector* or *"file specifier"* or * **[,FORMAT ON** or **OFF] [,EOL OFF]**

AUTOST IS

This statement sets up the path to a disc drive and file name for auto start.

Syntax: AUTOST IS "[*file_name***[:***msus***]]"**

CAT

This statement lists all or specified portions of the contents of a mass storage directory on the mainframe display or controller display.

Syntax: CAT "[*:msus***]"**

CLEAR

Allows the mainframe to put selected HP-IB devices into a defined, device-dependant state.

Syntax: CLEAR *@I/O path name* or *device selector*

CREATE ASCII

Creates an ASCII file on the mass storage media.

Syntax: CREATE ASCII *"file specifier", number of records*

CREATE BDAT

Creates a BDAT (binary untyped data file) on the mass storage media.

Syntax: CREATE BDAT *"file specifier", number of records* **[,***record size***]**

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ENTER

Used to input data from a device, file, string, or buffer and assign the values entered to variables.

Syntax: ENTER *@I/O path name* or *device selector, enter_items*

INITIAL

This statement initializes a disc in the mass storage media.

Syntax: INITIAL *":msus"*[*,interleave factor* [*,format option*]]

MSI

This statement specifies the system mass storage device.

Syntax: MSI "[*:msus*]"

OUTPUT

This statement outputs items to the specified destination.

Syntax: OUTPUT *destination* [*output_items* [**,NOEOL**]]

PRINT

This statement sends items to the PRINTER IS device. When the output list is a quoted literal, a maximum of 27 characters (including spaces) are allowed within the quotes.

Syntax: PRINT [*output_list* [**,NOEOL**]]

PRINTER IS

Specifies the system printing device.

Syntax: PRINTER IS *device selector*

PURGE

This statement deletes a file entry from the directory of the mass storage media.

Syntax: PURGE "*file specifier*"

SPOLL

This function returns an integer containing the serial poll response from the addressed device.

Syntax: SPOLL (*@I/O path name* or *device selector*)

TRIGGER

This statement sends a trigger message to a selected device addressed to listen, on the HP-IB controlled by the mainframe.

Syntax: TRIGGER *@I/O path name* or *device select*

NOTE

Semicolons are an invalid character on the local HP-IB system. Use a comma where a semicolon would normally be used on a Series 200/300. For example, to send the HOME command H4 to a Multimeter of device address 23, the system HP-IB statement would be OUTPUT 723;"H4". The local HP-IB statement would be OUTPUT S23,"H4" where S is the slot the HP 44788A is installed.

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Mass Storage Operations

This section provides a brief tutorial of mass storage, the structure of ASCII and BDAT files and when to use which, how to initialize a disc, and how to store and retrieve data from a file. For detailed information on mass storage operations, refer to your Series 200/300 BASIC Programming Techniques Manual and BASIC Interfacing Techniques Manual.

Mass Storage

As the adjective "mass" suggests, mass storage devices are data-storage devices which are generally capable of storing "large" amounts of data. Just how much data constitutes a large amount depends on the device itself. Most mass storage devices are capable of storing on the order of hundreds of thousands to several million items.

Besides having the ability to store data, mass storage devices are capable of providing means for keeping data organized so that logical groups may be accessed systematically and efficiently. Data items are organized into logical groups of data known a *files*; a file is merely a collection of data items. Mass storage *volumes* are composed of one or more files. On most HP mass storage devices, a volume consists of all files on the device's mass storage *media*; mass storage media are the actual physical means by which data are stored i.e., magnetic particles on a plastic disc which can be magnetized to store data. Most HP mass storage devices use magnetic discs as their storage media. Any disc drive that has the SS/80 or CS/80 command set is compatible with the HP 3852A (some are listed in Table 1-1).

Available File Types

With the HP 3852A/HP 44788A HP-IB Controller, there are two different types of files in which you can store and retrieve data (ASCII and BDAT files). Understanding the characteristics of each file type will help you choose the one best suited for your specific application. This section summarizes the advantages and disadvantages of ASCII and BDAT files.

ASCII Files

ASCII files are used for general text and numeric data storage.

Advantages:

- There is less chance of reading the contents into the wrong data type (which is possible with BDAT files). Thus, ASCII files are the easiest to read when you don't know how it is written.
- The file format provides fairly compact storage for string data.
- ASCII files are compatible with other HP computers that support this file type. The full name of ASCII files is "LIF ASCII". LIF stands for Logical Interchange Format, an HP standard directory and data storage format.

Disadvantages:

- ASCII files can only be accessed serially.
- They can only be written in default ASCII format (no formatting is possible and the data cannot be stored in internal representation).

ASCII files can be used to store programs or data. In an ASCII file, every data item, whether string or numeric, is represented by ASCII characters; one byte represents one ASCII character. Each data item is preceded by a two-byte length header which indicates how many ASCII characters are in the item. However, there is no "type" field for each item; data items contain no indication (in the file) as to whether the item was stored as string or numeric data.

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There is a large amount of overhead for storing numeric data items in an ASCII file. Similarily, reading numeric data from an ASCII file can be a complex and relatively slow operation. The numeric characters in an item must be entered and evaluated individually by the system's "number builder" routine, which derives the number's internal representation. Because of this complex process, ASCII files are not the preferred file type although they are interchangeable with many other HP products.

In general, ASCII files are most useful when you want to transport data between this system and certain other HP machine(s). There may be other instances where you will want to use ASCII files, but you should be aware that they cause a noticeable performance degradation compared to BDAT files.

BDAT Files

BDAT files provide the most compact and flexible data storage mechanism.

Advantages:

- BDAT files can be randomly or serially accessed but the HP 3852A allows serial access only.
- More flexible in data formats and access methods.
- Faster transfer rates.
- Generally more space-efficient than ASCII files (except for string data items).
- They allow data to be stored in ASCII format or internal format.
- They are compatible with Series 200/300 BASIC systems.

Disadvantages:

- You must know how the data items were written (as INTEGERs, REALs, strings, etc.) in order to correctly read the data back.
- These data files cannot be interchanged with as many other systems as can ASCII files (for example, the Series 200/300 Pascal Workstation system cannot read BDAT files).

BDAT files allow you to store and retrieve data using internal or ASCII format. With internal format, items are represented with the same format the system uses to store data in internal mainframe memory. With ASCII format, items are represented by ASCII characters.

In most applications, you will use internal format for BDAT files. Unless we specify otherwise, you can assume that when we talk about retrieving and storing data in BDAT files, we are also talking about internal format. This format is synonymous with the FORMAT OFF attribute of the ASSIGN command.

Because BDAT files use almost the same format as internal memory, very little interpretation is needed to transfer data from the mainframe to a BDAT file, or vise versa. BDAT files, therefore, not only save space, but also time.

Data stored in internal format (FORMAT OFF) in BDAT files require the following number of bytes per item:

```
INTEGER     2 bytes

REAL        8 bytes

String      1 byte per character (plus 1 pad byte if the string length is an
            odd number), plus a 4-byte length header
```


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Mass Storage Unit Specifier

Before you begin using the HP 44788A commands, you need to understand the mass storage unit specifier (*msus*). *msus* is what the HP 3852A uses to identify your disc drive. For example, the msus of an HP 9133H when the HP 44788A is in slot 3 appears as follows:

```
":HP9133,300,1"
```

Note that the msus is composed of three parts, separated by commas:

1) A device type	:HP9133	
2) A device selector	300	(3 is the slot number)
3) A unit number	1	

The device type is simply the name of the disc drive you are using, such as the HP 9133. The device type is optional (and ignored by the HP 3852A) on the HP 44788A system. For example, you can type your msus as ":,300,1", leaving out the HP 9133 device type.

The device selector refers to the address of your disc drive. The first number (3) is the slot the HP 44788A is installed in. The last two numbers may vary depending on what address the device is set for (see the following section "HP-IB Device Selectors").

The unit number refers to the drive you wish to access. In this example, the unit number of 1 means that you wish the HP 44788A to access the flexible disc drive of the HP 9133H. If you wish the HP 44788A to access the fixed drive of the HP 9133H, the unit number is 0.

HP-IB Device Selectors

Each device on the HP-IB interface has a primary address by which it is uniquely identified; each address must be unique so that only one device is accessed when one address is specified. Devices include external printers, disc drives, instruments, and all other physical entities that can be connected to the HP-IB through the interface. Each device is accessed through the interface it is connected to.

Each interface has a unique number by which it is identified, this is the interface select code. The built-in HP-IB of the mainframe has an interface select code of 7. The local HP-IB of the HP 44788A has an interface select code of which is the slot number of the slot the HP 44788A is installed in. The device selector is a combination of the interface select code and device's primary address. To access a device on an HP 44788A in:

mainframe slot 6 (HP 44788A in slot 6) at primary address 01, use device selector 601

extender 1, slot 3 (HP 44788A in slot 3) at primary address 14, use device selector 1314.

MSI Command

The mass storage is (MSI) command is used to direct all your disc drive commands to your most frequently used disc. If you use the MSI command, you do not have to specify an *msus* with every disc drive command with the exception of the INITIAL command. For the HP 9133H example in the previous section, the MSI command specifies the msus with the following statement:

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```
MSI ":,300,1"
```

Subsequent disc drive commands will be directed automatically to the flexible drive of the HP 9133H.

Intializing a Disc

Before a disc is used for the first time, it must be initialized. If the disc has already been initialized on a LIF-compatible device, it can be used with the HP 44788A without initializing again. However, if a previously initialized disc does not have any data on it (or you don't need the data on it), it may be advantageous to re-initialize it with the HP 44788A to get maximum performance. The disc drive, when initializing a disc, sets an interleave factor optimized for use with itself. Experimentation may be required for maximum performance in a given application. A disc must be properly initialized before the HP 44788A can use it, but initializing a disc destroys all the data previously stored on the disc.

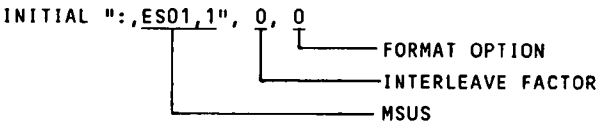
The following steps show a typical initialization process using drive number 1 of a disc drive with address 01 connected to the HP 44788A.

1. Make sure that the disc does not contain any important data or programs. When a disc is initialized, all the data on the disc is destroyed.

2. Ensure that the disc is not "write protected". Trying to initialize a write-protected disc results in an error.

3. Be sure the disc is properly inserted in the proper drive.

4. Execute INITIAL":*msus*" [*interleave factor*] [,*format*]



The complete msus (:,ES01,1) must be specified in the INITIAL command. Trying to use the default msus, by not specifying one, will result in an error.

The interleave factor establishes the distance in physical records between consecutively numbered records. If you do not specify an interleave factor or specify 0, the default interleave factor for the mass storage device is used. The format option, if not specified or specified as 0, results in the default format option of the mass storage device. See the following two sections for information on the disc interleave and format option.

After initialization has completed successfully, the disc is ready for storing programs and data.

Disc Interleave

The INITIAL command allows you to specify an interleave factor as an optional parameter. Interleaving a disc causes the sectors on each track to be numbered according to a specified interval. An interleave factor of 1 causes sectors to be numbered consecutively. A factor of 2, on the other hand, tells the system to skip every other sector. If you specify 0 or do not specify a factor, the mass storage device default is used. Refer to your mass storage device operating

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manual for detailed information. The purpose of disc interleave is to increase data-transfer rates. If you need maximum transfer rates, experiment to determine the optimal interleave for your particular application.

Format Option

The format option of the INITIAL command selects the sector/volume size with which the disc is initialized. The default size is dependent on the mass storage device you use. Refer to your mass storage device operating manual for more information about the format option. Some mass storage devices do not have format options. **The HP 3852A only supports a sector size of 256 bytes.**

Creating a File

The CREATE ASCII and CREATE BDAT commands are used to create files on the mass storage media that the HP 3852A can use. ASCII and BDAT files are the only file types that the HP 3852A can communicate with. This section provides information on each command including the parameters of each command.

CREATE ASCII Command

The CREATE ASCII command creates a new ASCII file and directory entry on the mass storage media. The command does not open the file. A file specifier and the number of records must be specified in the command. The file specifier consists of the file name you choose and optionally, the msus. If the msus is not included, the default msus or the msus specified by the MSI command will be used. The physical records of an ASCII file have a fixed length of 256 bytes. In the event of an error, no directory entry is made and the file is not created. An ASCII file named "MYFILE" of 50 records is created by the command

CREATE ASCII *"file specifier", number of records*

```
CREATE ASCII "MYFILE:,100,1",50      (S = slot # = 1)
```

This is equivalent to

```
MSI ":,100,1"
CREATE ASCII "MYFILE",50
```

CREATE BDAT Command

The CREATE BDAT command creates a new BDAT file and directory entry on the mass storage media. The command does not open the file. The file specifier specifies the file name you choose and optionally, the msus. If msus is not specified, the default msus or the msus specified by the MSI command is used. You must declare the number of records and optionally, you can declare the record size. The default record size is 256 bytes per record. Creating a BDAT file named "EXAMPLE" with 7 records of record size 128 bytes is accomplished by

CREATE BDAT *"file specifier", number of records [,record size]*

```
CREATE BDAT "EXAMPLE:,100,1",7,128
```

The following two sections give you information specifying the number of records and record size.

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Number of Records

Both the length of the file (number of records) and the length of the defined records (record size) are specified when you create a BDAT file. This section shows you how to specify the length of a BDAT file.

For example, the following statement would create a file called EXAMPLE with 7 defined records, each record being 128 bytes long on the default msus (because no msus is specified in the command):

```
CREATE BDAT "EXAMPLE",7,128
```

If you don't specify a record length in the CREATE BDAT statement, the system will set each record to the default length of 256 bytes.

Both the record length and number of records are rounded to the nearest integer with the record length, if odd, rounded up to the nearest even integer. Once a file is created, you cannot change its length, or the length of its records. You must therefore calculate the record size and file size required before you create a file.

Record Size

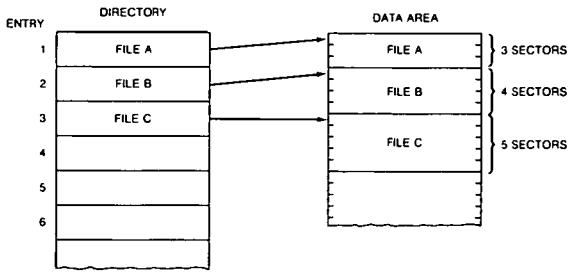
Since the HP 3852A only supports serial access, record size is not an important consideration when creating a BDAT file. Record size does affect the file size (# records x record size = file size).

Purging Files

You can purge a file from the directory by using the PURGE statement. Purging a file deletes the directory entry for the file and releases the reserved space in the data area. Purging a file, therefore, creates two "gaps" on the disc: one in the data area and one in the directory. When you create a file, the system looks at all the gaps in the data area to see if the newly created file will fit in any of them.

Directory entries must be in the same order as the files in the data area. The fourth directory entry, for example, must correspond to the fourth file in the data area. Consequently, if you PURGE a file, and then create a smaller file, you may lose disc space. The following examples illustrate this principle.

Suppose that you have three consecutive files on a disc with the following names and sizes.

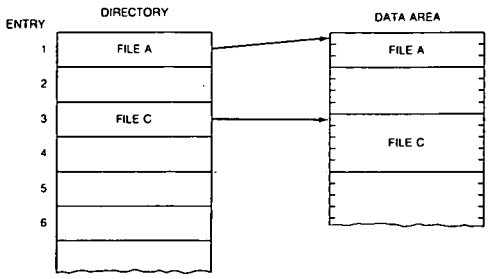


Executing the following statement:

```
PURGE "FILEB"
```


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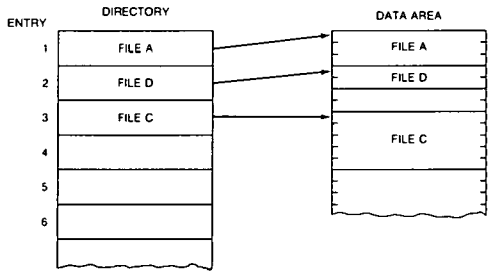
creates a 1-entry gap in the directory and a 4-sector gap in the data area.



Now, suppose you create a 2-sector file:

```
CREATE ASCII "FILED",2
```

The HP 3852A will place this file in the data-area gap and place the directory entry in the directory gap.



You now have a 2-sector gap in the data area but no gaps in the directory. If you create another file, the system will fill entry 4 in the directory and will reserve space in the data area past FILEC. The two unused sectors will not be reclaimed unless you PURGE one of the adjacent files, FILED or FILEC.

Accessing Directories

A directory is an index to the files on a mass storage media. You use the CAT":msus" command to get a catalog listing of a directory. You must specify CAT":msus" to get the disc catalog versus simply using CAT which returns a catalog list of all mainframe variables, arrays, and subroutines. Executing CAT" " (with no media specifier) directs the system to get a catalog of the current system mass storage directory which is either the default msus or the msus specified by an MSI command.

Including a media specifier directs the system to get a catalog of the specified mass storage. For example, the following statement returns a catalog of the directory of drive number 1, disc drive address 00 when the HP 44788A is in slot 3. This catalog is sent to the mainframe display and must be single-stepped to see each line.

```
CAT ":,300,1"
```

The following returns the same catalog:

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```
MSI ":,300,1"
CAT" "
```

To use a system controller and catalog the mass storage device, use the following program. This program returns the directory entries to the controller CRT.

```
10 DIM A$[50]
20 OUTPUT 709;"CAT ':,300,1'"
30 REPEAT
40   IF BIT(SPOLL(709),0) THEN
50     ENTER 709;A$
60     PRINT A$
70   END IF
80 UNTIL BINAND(SPOLL(709),17)=16
90 END
```

The following printout is a typical catalog resulting from the above program.

```
"::,              300,      1,     0       "
"VOLUME LABEL: HP-LID                       "
"FILE NAME   TYPE   REC/FILE BYTE/REC   ADDR"
"MYFILE      ASCII       100      256     23"
"DATA1       BDAT         10      128    124"
"STORAGE     BDAT         10      256    130"
```

Accessing Files

Before you can access a data file, you must assign an I/O path name to the file. Assigning an I/O path name to the file sets up a table in the mainframe memory that contains various information describing the file, such as its type, which mass storage device it is stored on, and its location on the media. The I/O path name is then used in I/O statements (OUTPUT and ENTER) which move the data to and from the file. I/O path names are also used to transfer data to and from devices.

Every I/O path to a file maintains the following information:

Validity Flag - Tells whether the path is currently opened (assigned) or closed (not assigned).

Type of Resource - Holds the file type (ASCII or BDAT).

Device Selector - Stores the device selector of the drive. (I/O paths can be associated with devices also).

Attributes - Such as FORMAT OFF/ON and EOL OFF.

File Pointer - There is a file pointer that points to the place in the file where the next data item will be read or written. The file pointer is updated whenever the file is accessed.

End-Of-File Pointer - An I/O path has an EOF pointer that points to the byte that follows the last byte of the file.

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Opening an I/O Path

I/O path names are similar to other variable names, except that I/O path names are preceded by the "@" character (this character is a special character obtained with the "E" key scroll). When an I/O path name is used in a statement, thesystem looks up the contents of the I/O path name and uses them as required by the situation.

To open an I/O path to a file (to set the validity flag to Open), assign the I/O path name to a file specifier by using an ASSIGN statement. For example, executing the following statement

```
ASSIGN @PATH1 TO "EXAMPLE"
```

assigns an I/O path name called @PATH1 to the file "EXAMPLE". The file that you open must already exist and must be a data file. If the file does not satisfy one of these requirements, the HP 3852A will return an error. If you do not use an msus in the file specifier, the HP 3852A will look for the file on the current MSI (mass storage is) device. If you want to access a different device, use the msus syntax described earlier.

ASSIGNing an I/O path name to a file has the following effect on the I/O path table:

- If the I/O path is currently open, the system *closes* the I/O path and then *reopens* it. If the I/O path is not currently open, it is opened. In both cases, the system sets the validity flag to Open.
- The file type (ASCII or BDAT) and its msus are recorded.
- The specified attributes are assigned to the I/O path name. If an attribute is not specified, the appropriate default attribute is assigned.
- The file pointer is positioned to the beginning of the file.
- If the path name is associated with a BDAT file, the EOF pointer from the system sector is copied to the I/O path table.

Once an I/O path has been opened to a file, you always use the path name to access the file.

Assigning Attributes

When you open an I/O path to a BDAT file, certain attributes are assigned to it which define the way data is to be read and written. There are two attributes which control how data items are represented: FORMAT ON and FORMAT OFF. With FORMAT ON, ASCII data representations are used; with FORMAT OFF, the system's internal data representation are used. An additional attribute is available (EOL OFF) which is used to eliminate the CR/LF end-of-line sequence.

As mentioned in the section "BDAT Files", BDAT files can use either data representation; however, ASCII files only permit ASCII-file format. Therefore, if you specify FORMAT OFF for an I/O path to an ASCII file, the system ignores it. The following two examples of ASSIGN statements specify a FORMAT attribute.

```
ASSIGN @PATH1 TO "FILE1",FORMAT OFF
```

If "FILE1" is a BDAT file, the FORMAT OFF attribute specifies that the internal data formats are to be used when sending and receiving data through the I/O path. If the file is of type ASCII, the attribute will be ignored. *Note that*

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FORMAT OFF is the default FORMAT attribute for BDAT files.

Executing the following statement directs the system to use the ASCII data representation (if possible) when sending and receiving data through the I/O path.

```
ASSIGN @PATH2 TO "FILE2",FORMAT ON
```

If "FILE2" is a BDAT file, data will be written using ASCII format, and data read from it will be interpreted as being in ASCII format. For an ASCII-file, ASCII format is the only data representation allowed.

It is important to note that in general, *data should always be read in the same manner as it was written.* For instance, data written to a BDAT file with FORMAT OFF should also be read with FORMAT OFF and vice versa. In addition, the same data types should be used to write the file as to read the file. For instance, if data items were written as INTEGERs, they should also be read as INTEGERs.

In theory, there is no limit to the number of I/O paths you can ASSIGN to the same file. Each I/O path, however, has its own file pointer and EOF pointer, so that it can become exceedingly difficult to keep track of where you are in a file if you use more than one I/O path. *It is recommended that you use only one I/O path for each file.*

Closing I/O Paths

I/O path names can be closed two ways by the HP 3852A. When you re-ASSIGN an I/O path name, the previous association of the path name is cancelled.

You can explicitly close an I/O path by ASSIGNing the path name to an * (asterisk). For example, the statement:

```
ASSIGN @PATH2 TO *
```

closes @PATH2 (sets the validity flag to Closed). @PATH2 cannot be used again until it is re-ASSIGNed. You can re-ASSIGN a path name to the same file or to a different file. Re-ASSIGNing the same path has the effect of closing and re-opening the path.

Writing Data

Data is always written to a file with an OUTPUT statement via an I/O path. You can OUTPUT numeric and string variables, numeric and string expressions, and arrays. When you OUTPUT data with the FORMAT OFF, data items are written to the file in internal format (described earlier).

The number of data items you can write in a single OUTPUT statement is limited by code buffer size and depends on the type of items output (about 30 simple variables, 37 integer values, 13 real values, or 11 arrays). If you try to OUTPUT more data than the file can hold, the HP 3852A will return an End-Of-File error. If an End-Of-File condition occurs, the file retains any data output ahead of the end condition.

There is also no restriction on mixing different types of data in a single OUTPUT statement. The system decides which data type each item is before it writes the item to the disc. Any item enclosed in quotes is a string. Numeric

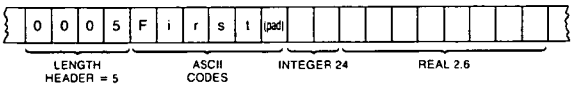
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variables and expressions are OUTPUT according to their type (8 bytes for REALs and 2 bytes for INTEGERs). Arrays are written to the file starting at element 0.

OUTPUT The HP 3852A outputs data serially. Each data item is stored immediately after the previous item without any type of separator. Sector and record boundaries are ignored. Data items are written to the file one by one, starting at the current position of the file pointer. As each item is written, the file pointer is moved to the next byte. After all of the data items have been output, the file pointer points to the first byte following the last byte just written. The examples that follow illustrate how data is stored serially in a BDAT file with FORMAT OFF. The statement:

```
OUTPUT @PATH1, "FIRST",24,2.6
```

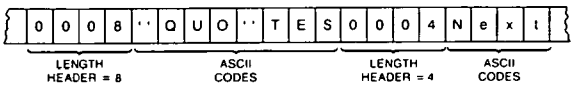
would result in the following storage format:



Note that quotation marks around a string are not written to the file. To write quote marks to a file, enter two quote marks for every one you want to OUTPUT. Note also that separators are not written to the file. To write a comma or semi-colon to a file, you must enclose it in quotes. For example, the statement:

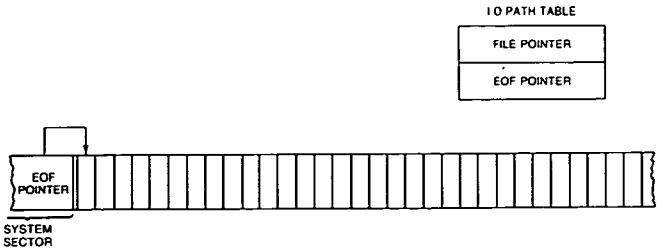
```
OUTPUT @PATH1, """QUO""TES","NEXT"
```

would be stored:



The following sequence of serial OUTPUT statements show how data is written to a BDAT file and how the file pointer and EOF pointers are updated.

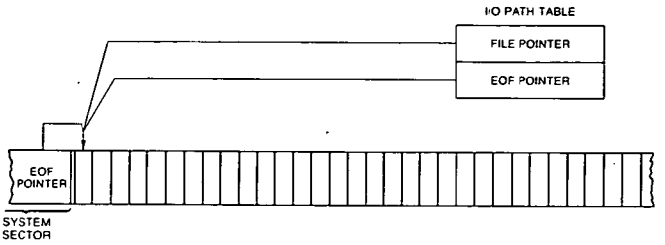
```
CREATE BDAT "EXAMPLE",4,128
```



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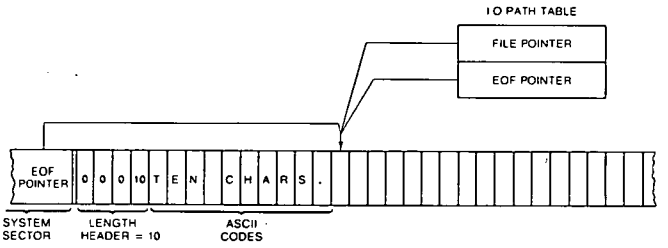
Creates a BDAT file with four 128-byte records. The EOF pointer in the system sector points to the first byte in the file.

```
ASSIGN @PATH1 TO "EXAMPLE"
```



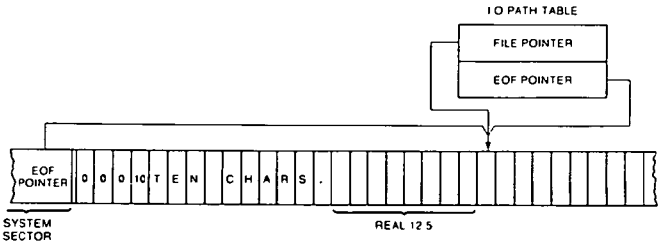
Opens an I/O path to "EXAMPLE". The EOF marker in the system sector is copied to the I/O path table. The file pointer is positioned to the beginning of the file.

```
OUTPUT @PATH1,"TEN CHARS."
```



Fourteen bytes are written to the file. The EOF pointers are moved to the 15th byte. The file pointer also points to the 15th byte.

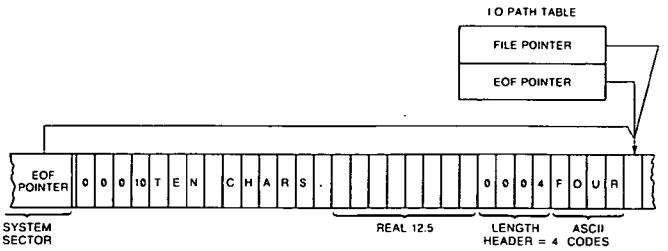
```
OUTPUT @PATH1,12.5
```



Eight more bytes are written to the file. The file pointer now points to the 23rd byte. Both the EOF in the I/O path table and EOF in the system sector are updated to 23.

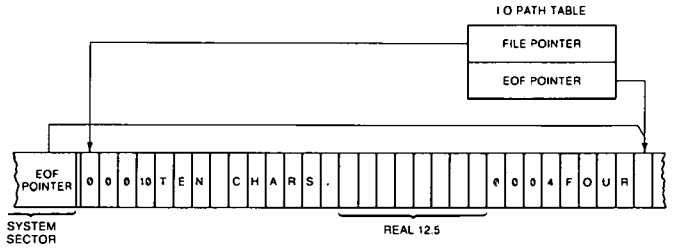
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```
OUTPUT @PATH1,"FOUR"
```



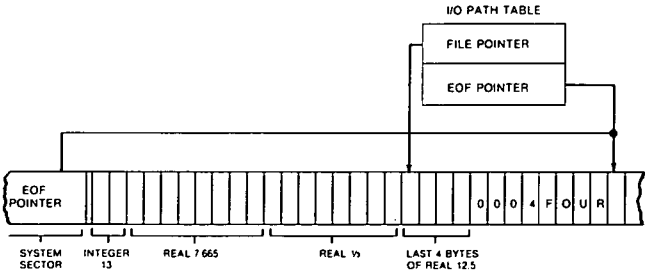
Eight more bytes are written to the file. The file pointer now points to the 31st byte. The EOF markers are updated to 31 because 31 is greater than 23, the current EOF value.

```
ASSIGN @PATH1 TO "EXAMPLE"
```



Re-ASSIGNs the I/O path name. The file pointer is positioned back to the beginning of the file. The system sector EOF value is copied to the I/O path table.

```
OUTPUT @PATH1,3,7.665,1/3
```



18 bytes (one INTEGER and two REALs) are OUTPUT, starting at the beginning of the file. The original data, therefore, is overwritten. The file pointer points to the 19th byte.

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Reading Data

Data is read from files with the ENTER statement. As with OUTPUT, data is passed along an I/O path. You can use the same I/O path you used to output data or you can use a different I/O path.

You can have several variables in a single ENTER statement. It is extremely important to make sure that your variable types agree with the data type in the file. If you wrote a REAL number to a file, you should ENTER it into a REAL variable; INTEGERs should be entered into INTEGER variables; and strings into string variables. The rule to remember is:

Read it the way you wrote it.

That is the *only* technique that is always guaranteed to work.

ENTER

When you read data, the system enters data into variables starting at the current position of the file pointer and proceeds, byte by byte, until all of the variables in the ENTER statement have been filled. If there is not enough data in the file to fill all of the variables, the HP 3852A returns an End-Of-File error. All variables that have already taken values before the end-of-file is detected retain their values.

The following statements create a BDAT file, assigns an I/O path name to the file (with default FORMAT OFF attribute), writes five data items, and then retrieves the data items.

```
MSI ":,300,1"
CREATE BDAT "STORAGE",1
ASSIGN @PATH TO "STORAGE"
INTEGER FRRST,THIRD          (NOTE: FIRST is a reserved keyword)
REAL SECOND
FRRST = 999
SECOND = 1.414
THIRD = 200
OUTPUT @PATH,FRRST,SECOND,THIRD
ASSIGN @PATH TO "STORAGE"
INTEGER A,C
REAL B
ENTER @PATH,A,B,C
PRINTER IS 301
PRINT A,B,C

999  1.414000E+00  200
```

Note that we re-ASSIGNed the I/O path in the statement preceeding ENTER. This was done to re-position the file pointer to the beginning of the file. If we had omitted this statement, the ENTER would have produced an End-Of-File error.

Using an Auto Start File

An auto start file containing the command strings to be executed needs to be created if you operate without a system controller. The AUTOST IS command is used to access this file from a disc drive connected to the HP 44788A. This section shows how a simple program is stored in an auto start file and accessed by the AUTOST IS command for booting commands from the file.

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NOTE

AUTOST IS " " *is used to cancel the auto-start feature.*

Generating an Auto Start File

A simple example (mainframe beeps 4 times) is used to show how the program is stored in an auto start file and how the AUTOST IS command is used to access the file. Figure 3-2 shows the system set-up, including a system controller, used for this example.

The program is stored in the file as strings using the following program. You must initialize your disc and create the file "AUTO_ST" prior to running this program. This example assumes the HP 44788A is installed in slot 3 of the mainframe and that the primary address of the disc drive is 00 with the disc in drive 1.

```
 10  OUTPUT 709;"ASSIGN @PATH TO "AUTO_ST:,300,1"
 20  OUTPUT 709;"OUTPUT @PATH 'SUB BEEPER'"
 30  OUTPUT 709;"OUTPUT @PATH 'INTEGER I'"
 40  OUTPUT 709;"OUTPUT @PATH 'FOR I=1 TO 4'"
 50  OUTPUT 709;"OUTPUT @PATH 'BEEP'"
 60  OUTPUT 709;"OUTPUT @PATH 'NEXT I'"
 70  OUTPUT 709;"OUTPUT @PATH 'SUBEND'"
 80  OUTPUT 709;"OUTPUT @PATH 'CALL BEEPER'"
 90  OUTPUT 709;"ASSIGN @PATH TO *"
100  END
```

The file "AUTO_ST" is now present on the disc containing the strings which when entered by the AUTOST IS command, are executable commands.

AUTOST IS Command

After you have created an auto start file and stored your program, you must execute the AUTOST IS command:

```
OUTPUT 709;"AUTOST IS 'AUTO_ST:,300,1'"
```

You can cycle power on the HP 3852A or execute RESET HARD for the HP 3852A to access the auto start file. The HP 3852A, through the HP 44788A, will access the file "AUTO_ST", read in each string and execute the command.

NOTE

*If the HP 3852A and disc drive are powered-on at the same time, the disc drive will not be ready when the HP 3852A auto start command is executed. The HP 3852A will display "WAITING FOR DISK" for up to five minutes before error 115 (*DRIVE NOT FOUND OR BAD ADDRESS*) occurs. Use the front panel CLEAR or the HP-IB CLEAR to regain control of the HP 3852A during this five minute period.*

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Printer and Instrument Control Commands

The following two sections provide information on the use of external printers and instruments with the HP 44788A. The commands discussed are:

Printer Commands	Instrument Control Commands
PRINTER IS	CLEAR
PRINT	SPOLL
	TRIGGER
	OUTPUT
	ENTER

Using a Printer

The HP 44788A will work with printers supported by Series 200/300 BASIC. The PRINT statement normally directs text to the mainframe display unless re-directed to an external printer by using the PRINTER IS statement.

```
PRINT "HELLO"
PRINT 417,"STRING",X
```

This is equivalent to the following statements:

```
PRINTER IS 1      (redundant since display is the default)
PRINT "HELLO"
PRINT 417,"STRING",X
```

Changing the printing device to an external printer is done with the PRINTER IS statement.

```
PRINTER IS 301
PRINT "HELLO"
```

This statement directs text from the PRINT command to a printer with primary address 01 connected to an HP 44788A installed in slot 3 of the mainframe.

Instrument Control

The HP 3852A provides five commands for instrument control. These commands are CLEAR, SPOLL, TRIGGER, OUTPUT, and ENTER. The examples shown in this section assume a device primary address of 05 and the HP 44788A installed in slot 3 of the mainframe.

- CLEAR allows the mainframe to put a selected HP-IB device into a defined, device-dependent state. A selected device clear is sent to the device specified in the command. A typical statement is:

```
CLEAR 305
```

- SPOLL returns an integer containing the serial poll response from the addressed device. A typical statement is:

```
VREAD SPOLL (305)
```

- TRIGGER sends a group execute trigger to the specified device. A typical statement is:

```
TRIGGER 305
```


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- OUTPUT is used to send program code (i.e. FUNCTION, RANGE, etc.) to an instrument. A typical statement is:

```
OUTPUT 305,"F1RAT1Z1"
```

- ENTER retrieves data from an instrument. A typical statement is:

```
ENTER 305,A,B,C
```

Programming Examples

This section gives two programming examples. The first is an example of creating an auto start file for a system made up of a disc drive, a printer, and a DVM. The example illustrates instrument control, use of a printer, and mass storage operations. The system configuration shown in Figure 1-1 is used for these examples. The second example illustrates how a system controller, connected to the "system" HP-IB can be used to retrieve data stored in a file from a disc drive connected to the "local" HP-IB. Data stored from example 1 is retrieved by the system controller in example 2.

Program Example 1

This example creates an auto start file by storing command strings in the file for use by the AUTOST IS command.

NOTE

The HP 3852A allows a maximum length of 27 characters (including spaces) for strings within quotes. To save length, this example uses the MSI command to specify a msus which all subsequent commands use without having to specify it. In all strings, you should verify that the length does not exceed 27 characters when developing your program.

---

1. Create an ASCII file large enough to hold the program for local operation by executing:

```
OUTPUT 709;"CREATE ASCII 'MYFILE:,300,1',10"
```

Also create a data file named "DATA1" for this example by executing:

```
OUTPUT 709;"CREATE BDAT 'DATA1:,300,1',5,128"
```

2. Assign an I/O path name to the file called "file_name" in the first line of your program.

```
10  OUTPUT 709;"ASSIGN @DEMO TO 'MYFILE:,300,1'"
```

3. Write the remaining program lines to store the program commands in the file "MYFILE".

```
20 OUTPUT 709;"OUTPUT @DEMO, 'REAL A,B'"
30 !
```


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```
 40 !**********************SET PRINTER DEVICE************************
 50 OUTPUT 709;"OUTPUT @DEMO, 'PRINTER IS 301'"
 60 !****************************************************************
 70 !
 80 !************************SPECIFY MSI*****************************
 90 !Quoted strings sent through the mainframe have a length
100 !limit.  Commands must be no more than 27 characters long.
110 !Specifying msus shortens some later commands.
120 OUTPUT 709;"OUTPUT @DEMO, 'MSI '':,300,1'''"
130 !****************************************************************
140 !
150 !****************THE FOLLOWING PRINTS A HEADING*****************
160 OUTPUT 709;"OUTPUT @DEMO,'PRINT ''NO COMPUTER USED'''"
170 OUTPUT 709;"OUTPUT @DEMO,'PRINT ''================'''"
180 OUTPUT 709;"OUTPUT @DEMO,'PRINT'"
190 !****************************************************************
200 !
210 !*********ASSIGN A PATH TO THE DVM OF ADDRESS 23*****************
220 OUTPUT 709;"OUTPUT @DEMO,'ASSIGN @DVM TO 323'"
230 !****************************************************************
240 !
250 !**********************DVM SET-UP********************************
260 OUTPUT 709;"OUTPUT @DEMO,'OUTPUT @DVM ''F1RAN5T1Z1'''"
270 !****************************************************************
280 !
290 !**************ASSIGN I/O PATH TO THE DATA FILE*****************
300 OUTPUT 709;"OUTPUT @DEMO,'ASSIGN @DISC TO ''DATA1'''"
310 !****************************************************************
320 !
330 !********SUB TO ENTER, PRINT, AND STORE MEASUREMENTS************
340 OUTPUT 709;"OUTPUT @DEMO, 'SUB MDATA'"
350 OUTPUT 709;"OUTPUT @DEMO, 'ENTER @DVM,A'"
360 OUTPUT 709;"OUTPUT @DEMO, 'PRINT ''MEASUREMENT ='',A'"
370 OUTPUT 709;"OUTPUT @DEMO, 'OUTPUT @DISC, A'"
380 OUTPUT 709;"OUTPUT @DEMO, 'SUBEND'"
390 !****************************************************************
400 !
410 !******SUB TO ENTER MEASUREMENTS FROM DISC AND PRINT************
420 OUTPUT 709;"OUTPUT @DEMO, 'SUB FMDISC'"
430 OUTPUT 709;"OUTPUT @DEMO, 'PRINT ''READ FROM DISC'''"
440 OUTPUT 709;"OUTPUT @DEMO, 'ENTER @DISC, B'"
450 OUTPUT 709;"OUTPUT @DEMO, 'PRINT ''READ FROM DISC: '',B'"
460 OUTPUT 709;"OUTPUT @DEMO, 'SUBEND'"
470 !****************************************************************
480 !
490 !*******RESET FILE POINTER AND CALL SUB MDATA*******************
500 OUTPUT 709;"OUTPUT @DEMO,'ASSIGN @DISC TO ''DATA1'''"
510 OUTPUT 709;"OUTPUT @DEMO,'CALL MDATA 10'"
520 !****************************************************************
530 !
540 !*******RESET FILE POINTER AND CALL SUB FMDISC******************
550 OUTPUT 709;"OUTPUT @DEMO,'ASSIGN @DISC TO ''DATA1'''"
560 OUTPUT 709;"OUTPUT @DEMO,'CALL FMDISC 10'"
570 !****************************************************************
```


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```
580 !
590 OUTPUT 709;"OUTPUT @DEMO,'DISP ''FINISHED'''"
600 OUTPUT 709;"ASSIGN @DEMO TO *"
610 END
```

Program Example 2

This example illustrates how a system controller, connected to the "system" HP-IB, can be used to retrieve data stored in a file from a disc drive connected to the "local" HP-IB. This example retrieves the ten readings stored in example 1 from the file "DATA1". Unlike example 1, this example does not output commands to a file for later use by the "local" HP-IB system. This program is executed immediately.

```
 10  OUTPUT 709;"DIM T(9)
 20  OUTPUT 709;"REAL T(9)"
 30  OUTPUT 709;"INTEGER I"
 40  OUTPUT 709;"PRINTER IS 301"
 50  OUTPUT 709;"MSI ':,300,1'"
 60  !
 70  OUTPUT 709;"SUB TRANSFER"
 80  OUTPUT 709;"ASSIGN @DISC TO 'DATA1'"
 90  OUTPUT 709;"FOR I = 0 TO 9"
100  OUTPUT 709;"ENTER @DISC, T(I)"
110  OUTPUT 709;"PRINT T(I)"
120  OUTPUT 709;"NEXT I"
130  OUTPUT 709;"VREAD T"
140  OUTPUT 709;"SUB END"
150  !
160  OUTPUT 709;"CALL TRANSFER"
170  !
180  REAL Readings (0:9)
190  DIM Readings (0:9)
200  ENTER 709; Readings(*)
210  PRINT USING "K,/";Readings(*)
220  !
230  END
```

Error Message Summary

A summary of error messages that are generated by the HP 3852A is provided in this section. The error number and a description of each message is given.

ERROR CODE	ERROR MESSAGE	DESCRIPTION
109	PATH NAME NOT EXPECTED	Attempting to use a path name where not allowed.
110	IMPROPER FILE NAME	File names are limited to 10 characters. Foreign characters are allowed, but punctuation is not.
111	IMPROPER DEVICE TYPE	The msus has the correct general form, but the characters used for a

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		device are not recognized.
112	IMPROPER MSUS	The characters used for a msus do not form a valid specifier.
113	UNSUPPORTED DRIVE TYPE	Drive does not use the CS/80 or SS/80 command set.
114	UNSUPPORTED SECTOR SIZE	Sector size too large. Must be 256 bytes/record. Sectors larger are not supported.
115	DRIVE NOT FOUND OR BAD ADDRESS	The msus contains an improper device selector, or no external disc is connected.
116	INVALID UNIT NUMBER	The msus contains a unit number that does not exist on the specified device.
117	INVALID MASS STORAGE PARAMETER	A mass storage statement contains a parameter that is out of range, such as a negative record number or an out of range number of records.
118	MEDIA CHANGED OR NOT IN DRIVE	Either there is no disc in the drive or the drive door was opened while a file was assigned.
119	MEDIA IS WRITE PROTECTED	Attempting to write to a write-protected disc.
120	DIRECTORY FULL	Although there may be room on the media for the file, there is no room in the directory for another file name.
121	NO ROOM ON DISK	There is not enough contiguous free space for the specified file size. The disc is full.
122	FILE NOT FOUND	The specified file name does not exist in the directory. Check the contents of the disc with the CAT" " command.
123	DUPLICATE FILE NAME	The specified file name already exists in directory. It is illegal to have two files with the same name on one volume.
124	IMPROPER FILE TYPE	Many mass storage operations are limited to certain file types.
125	PATH NAME NOT ASSIGNED	Must assign path name before its use.

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126	FILE OPEN	The specified file is assigned an I/O path name which has not been closed.
127	END OF FILE FOUND	No data left when reading a file, or no space left when writing a file.
128	INITIALIZATION FAILED	Too many bad tracks found. The disc is defective, damaged, or dirty.
129	MASS STORAGE SYSTEM ERROR	Usually a problem with the hardware or the media.
130	BAD SELECT CODE	No HP-IB card in slot, slot is bad, or select code is >30.
131	I/O OPERATION NOT ALLOWED	Attempting to use a CLEAR, TRIGGER, or SPOLL command with a path assigned to a file.
132	MEDIA NOT INITIALIZED	Media must be initialized before use.

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