

# Speech Synthesis Module

OWNER'S MANUAL

SERIES 80



CASH FLOW ANALYSIS

YEAR: 3 4 5

SHIPMENTS OF PROPERTY INCOME: TAXABLE INCOME

Total Gross	9600	16160	127776	140553.6
- Operating	2500	350	33275	36602.5
Net Operating				103951.1
- Interest				31865
- Depreciation				20000
Taxable Income				86.1

Net Operating Inc.	710		
- Prin.&Int. Pmt.	38		
Cash Flow Bef. Tax	7348		
- Income Tax	3692.2		
Cash Flow Aft. Tax	3478.8	29563.2	44464.66

INTERNAL RATE OF RETURN

Sale Proceeds After Tax:			
Discount Rate:			
Cash Flow Aft. Tax (Init. Invest. in Year 0)	-100000	25478.8	29563.2
Net Present Value	-77844.5	-55490.5	-330
IRR (Percent)	-74.5212	-31.41	

The vocabulary supplied with this product is copyrighted by Hewlett-Packard, 1982.



**HP 82967A  
Speech Synthesis  
Module  
Owner's Manual**

**Series 80**

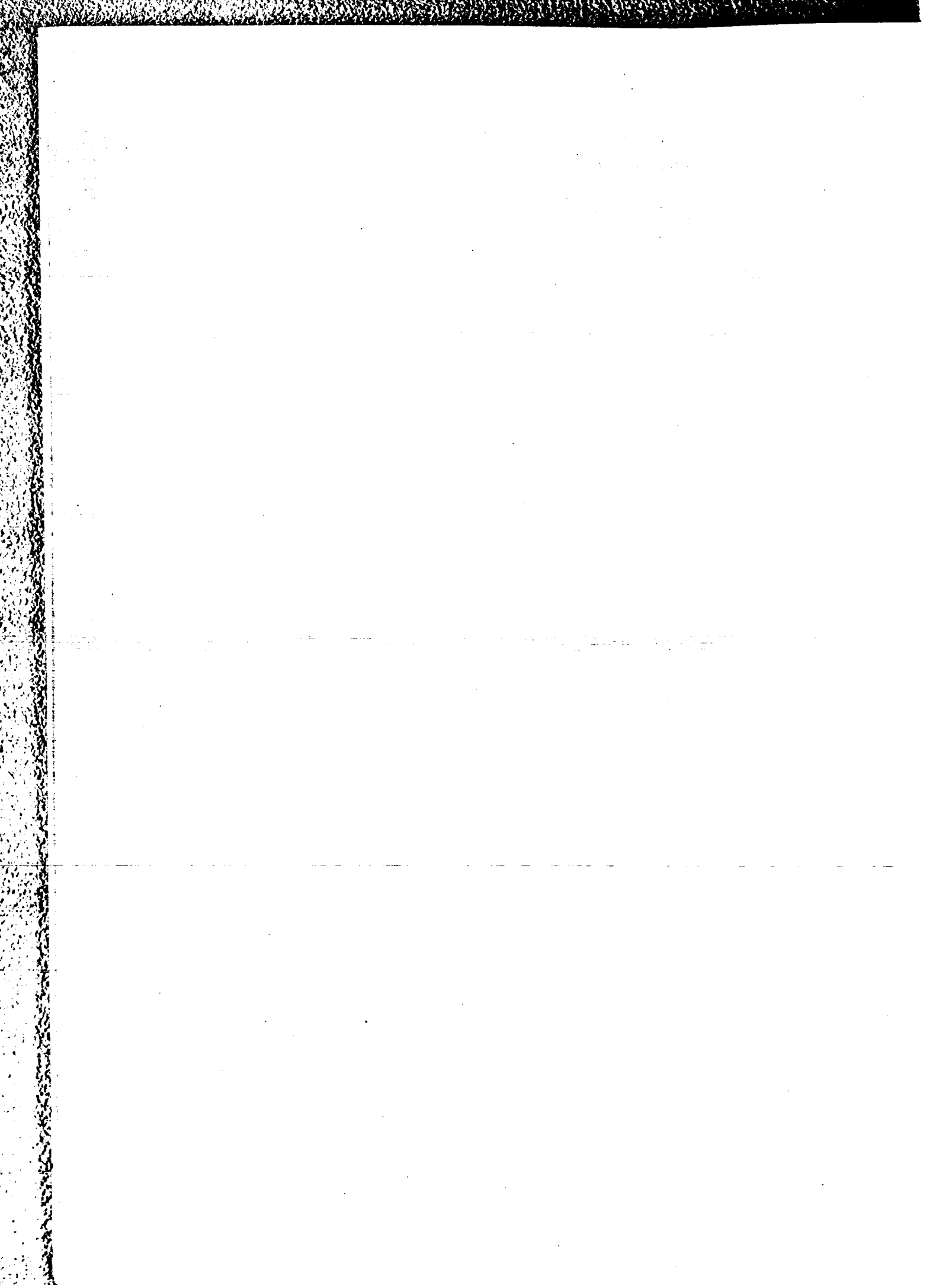
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82967-90004**

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## Introduction to Speech Synthesis

### Overview of Speech Synthesis

Digital speech synthesis is a relatively new outgrowth of today's semiconductor technology. Although tape recorders and other analog speech devices have been available for years, they are somewhat restricted in that they can replay only prerecorded speech. Tape recorders, in a strict sense, are not synthesizers, but sound reproduction systems.

A speech synthesizer creates an approximation of the human voice by processing a coded vocabulary of speech or vocal tract sounds. These sounds can be combined into words and phrases to generate original elements of speech. Speech synthesis has an advantage over prerecorded speech in that you can pick sounds and words at random and tie them together in any desired sequence.

The original source of synthetic speech is a human voice. A speaker pronounces sounds, words, or phrases into a microphone that is linked to an electronic sound coding system. Depending on the system, sound is converted into digital information through either *waveform coding* or *parametric coding* techniques. The digital code can then be used as vocabulary for a speech synthesis system, which converts the code into sounds we can hear. No coding scheme is perfect however and at least some qualities of speech are lost. The quality of the synthetic speech depends on the type and quantity of code used.

- *Waveform coding*: Words and phrases of speech are coded from direct sampling of the original speech sound wave in this technique. Characteristics of the sound wave are sampled at relatively high rates and converted into digital code. This type of coding is the most direct and results in the highest quality synthetic speech. However, high quality waveform coding requires a very high data sampling rate, and therefore a high storage requirement.
- *Parametric coding*: With this type of coding, the human voice is modeled through analysis. Rather than directly digitizing a word or phrase as in waveform coding, words and phrases of speech are analyzed according to a parametric model based on the human vocal tract. This technique requires less data than waveform coding, but at the expense of some quality.

As a communication tool, speech synthesis can be used in a variety of applications with computer systems. Anywhere speech communication is more convenient than printed or displayed output, synthetic speech offers a solution. For example, consider a situation where a person is operating a digital voltmeter on a printed circuit board. Rather than looking up from the board and possibly disturbing the leads of the voltmeter, the measured voltages could be output through speech. Other uses cover the range of the industrial, business, educational, and home environments.

### Series 80 Speech Synthesis

The HP 82967A Speech Synthesis Module is designed for all the Series 80 Personal Computers. It is the basis of a speech synthesis or generation system, and provides a means for Series 80 users to output speech by adding a minimal amount of equipment to their computer. The system uses a parametric coding

scheme known as LPC (linear predictive coding). This technique generates high quality speech at moderately low data transfer rates. It is exclusively a voice synthesis system and is not capable of performing voice recognition.

Features of the Series 80 speech system include:

- High quality speech output.
- A vocabulary of over 1500 words and sounds.
- A dictionary editing program for creating user speech files.
- Manual and programmable volume control.
- Both 1/4-inch and RCA phono jack output connectors.
- Hardware and speech file compatibility throughout Series 80 Personal Computers.

The Series 80 speech system includes both a plug-in module and software stored on a 5¼-inch and 3½-inch disc. The plug-in module contains the hardware necessary for outputting speech to a speaker or headphone set; both a standard ¼-inch and a RCA phono jack connector are provided on the module. An output speaker or headphones must be provided by the user; however, the speaker in the HP 82912A or HP 82913A Monitor can be used for speech synthesis with the HP-86.

The speech synthesis disc, supplied in two sizes, contains the software necessary to create and output speech with the module (the 3½ and 5¼-inch discs contains the same software). Three types of files are provided on the disc:

- BASIC program files named "EDIT85", "CH85", and "EDIT87": These programs provide the dictionary editing capability necessary for creating user speech files. Speech files are data files that contain the code for synthetic speech. "EDIT85" and "CH85" are used with the HP-83/85 and "EDIT87" is used with the HP-86/87.
- Binary program files named "SPKB85" and "SPKB87": These binaries enable your computer to access speech and vocabulary files and communicate with the speech module. "SPKB85" is used only with the HP-83/85, and is loaded automatically by "EDIT85". Likewise, "SPKB87" is used only with the HP-86/87, and is loaded automatically by "EDIT87".
- Vocabulary files named "A" through "Z" (26 files): The vocabulary data files stored on your disc are organized by letter categories. Each file contains the words available for speech synthesis that begin with the file name letter. In addition to a variety of commonly used English words, the vocabulary files contain the A-Z alphabet, number names sufficient for generating numbers up to 999,999,999, predefined pauses, prefixes, suffixes, and special sound effects. Vocabulary files are compatible with all of the Series 80 Personal Computer synthetic speech systems.

## Required Equipment

The following items are provided with the Series 80 Speech Synthesis System:

- HP 82967A Speech Synthesis Module.
- 5¼-inch and 3½-inch flexible discs (assigned the volume label "SPEECH").
- HP 82967A Speech Synthesis Module Owner's Manual (part number 82967-90004).

Synthesizing speech requires some equipment in addition to a Series 80 Personal Computer and the HP 82967A Speech Synthesis Module and disc. Listed below are descriptions and part numbers of the equipment required for each of the Series 80 Personal Computers. Although the HP 82967A Speech Module is compatible with each of the Series 80 computers, the speech software is not. Be sure that you use the correct software for your computer. Both the HP-83/85 software ("EDIT85", "CH85", and "SPKB85") and the HP-86/87 software ("EDIT87" and "SPKB87") are stored on the Speech Synthesis System Disc.

A minimum of one Series 80 disc drive is required for editing dictionaries with the "EDIT85" or "EDIT87" program; the internal tape drive of the HP-85 is not sufficient for this task. However, speech output files created with the disc-based "EDIT85" or "EDIT87" program can be stored on tape and accessed for speech output on the HP-85. When outputting files from tape, the HP-85 requires either a Mass Storage ROM (part number 00085-15001), Plotter/Printer ROM (part number 00085-15002), or I/O ROM (part number 00085-15003) to access the speech module.

Any of the following Hewlett-Packard disc drives are compatible with Series 80 Personal Computers:

- HP 82901M and HP 82902M Flexible Disc Drives (5¼-inch flexible discs).
- HP 9121S and HP 9121D Flexible Disc Drives (3½-inch flexible discs).
- HP 9130A Flexible Disc Drive (5¼-inch flexible disc, HP-86 only).
- HP 9133A Winchester Disc (5¼-inch hard disc plus 3½-inch flexible disc).
- HP 9134A Winchester Disc (5¼-inch hard disc).
- HP 9135A Winchester Disc (5¼-inch hard disc plus 5¼-inch flexible disc).
- HP 9895A Flexible Disc Memory (8-inch flexible discs).

**HP-83/85 speech synthesis requires:**

- HP-83/85 Personal Computer.
- HP 82967A Speech Synthesis Module.
- Speech Synthesis System Disc. \*
- Series 80 disc drive. \*
- HP 82937A HP-IB Interface. \*
- HP 82936A ROM Drawer.
- Mass Storage ROM (part number 00085-15001). \*
- HP 82903A 16K Memory Module. †
- Output speaker or headphones (eight ohms) equipped with either a ¼-inch or RCA phono plug.

\* Not required for outputting existing speech files stored on tape with the HP-85. Plotter/Printer ROM or I/O ROM may be used in lieu of the Mass Storage ROM.

† Dictionary editing requires a minimum of 32K bytes RAM. However, the 16K memory module is not required for outputting existing speech files.

**HP-86 speech synthesis requires:**

- HP-86 Personal Computer.
  - HP-86 compatible display monitor (for example HP 82912A or HP 82913A Monitor) and video cable.
  - HP 82967A Speech Synthesis Module.
  - Speech Synthesis System Disc.
  - HP 9130A Flexible Disc Drive
- or
- Series 80 disc drive and HP 82937A HP-IB Interface.
- Audio connector with RCA phono plug on each end. We suggest the Hewlett-Packard audio cable (part number 8120-3760). The HP 82912A and HP 82913A monitors have a built-in eight ohm speaker with an RCA jack (marked IN/AUDIO); headphones or another type of eight ohm output speaker could also be used with the HP-86.

**HP-87 speech synthesis requires:**

- HP-87 Personal Computer.
- HP 82967A Speech Synthesis Module.
- Speech Synthesis System Disc.
- Series 80 disc drive and accessory cable (HP 10833A/B/C/D).
- Output speaker or headphones (eight ohms) equipped with either a ¼-inch or RCA phono plug.

## Optional Equipment

Although not required, the following Series 80 products can be used in conjunction with the HP 82967A Speech Synthesis Module as an enhancement.

- HP-83/85 I/O ROM (part number 00085-15003)
- or
- HP-86/87 I/O ROM (part number 00087-15003):

The I/O ROM can be used to access the speech module status/control registers and output speech through the OUTPUT statement. The I/O ROM is not required for outputting speech when the supplied binary program "SPKB85" or "SPKB87" is loaded into memory. If, however, some applications require that this binary not be used, the I/O ROM can be used to output speech to the module instead.

- HP 82907A, HP 82908A, HP 82909A memory modules (32K, 64K, and 128K) for the HP-86/87 only:

As it is shipped from the factory, the "EDIT87" dictionary editing program is dimensioned for a 32K byte system. If additional memory is available, the dictionary editing program variables can be redimensioned to access it (refer to page 20). More memory enables you to construct longer phrases and speech files.

## Using the Manual

You may think of the speech synthesis system as a speech "processor," analogous to the word processing systems used in creating written reports and other printed output. Just as a word processor is used to create, store, and print text, the speech synthesis system is used to create, store, and output speech.

The organization of this manual reflects the way in which the HP 82967A Speech Synthesis Module is used. The system is designed to perform two basic tasks:

- Creating and editing speech files.
- Generating speech output from within a BASIC program.

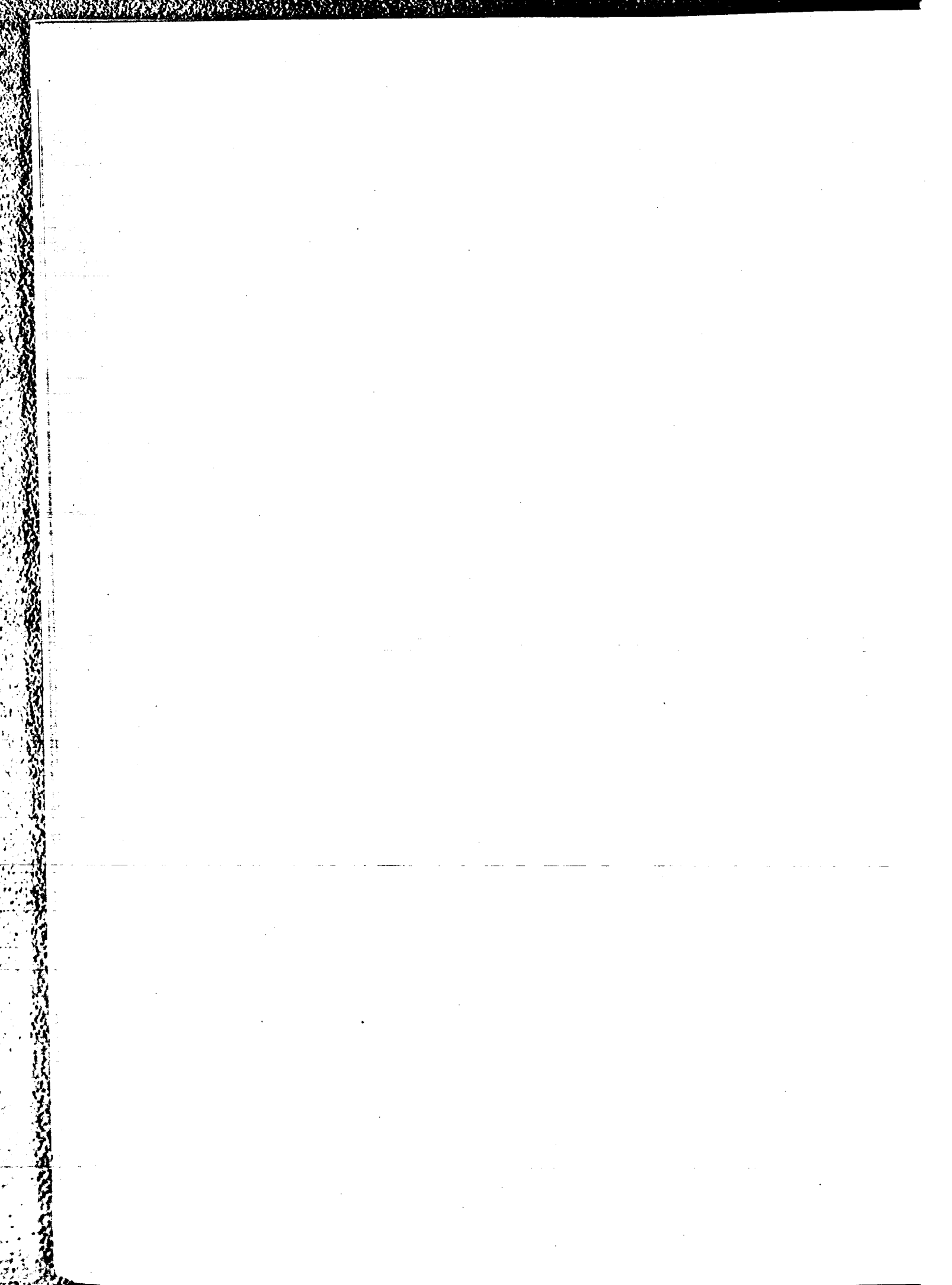
Initial setup and installation procedures are discussed in section 2: Getting Started. The task of creating and editing speech files is discussed in section 3: The Dictionary Editing Program. The procedure for outputting existing speech files from within a BASIC program is discussed in section 4: Using Synthetic Speech With BASIC. Some examples of speech applications in BASIC programs are presented in section 5.

A complete list of the approximately 1500 words and sounds of available vocabulary is presented in appendix A. You'll also find a tear-out card at the back of the manual containing a quick reference list of the vocabulary.

## Syntax Guidelines

The syntax for speech statements and functions is presented in the same manner as syntax for BASIC statements and commands. The following conventions apply:

- |                      |   |
|----------------------|---|
| <b>DOT MATRIX</b>    | Items in DOT MATRIX are keywords that must be entered exactly as shown, except that lowercase letters may be substituted for uppercase letters.     |
| <b>[ ]</b>           | Brackets are used to enclose optional items.  |
| <i>italics</i>       | Items in italics are numeric and string expressions that must be included in the statement (unless enclosed by brackets).                           |
| <i>stacked items</i> | When items are placed one above the other, one and only one must be chosen.   |
| ...                  | An ellipsis placed after an item or a series of items enclosed by brackets indicates that the item or the contents of the brackets may be repeated. |



## Getting Started

### Installation Procedures

#### Speech Module Installation

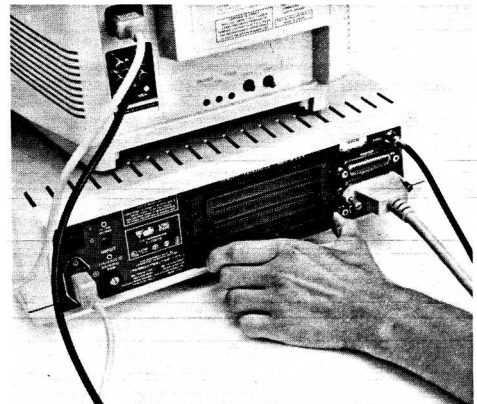
Before you can generate synthetic speech, the HP 82967A Speech Module must be installed in one of the four module ports on the rear of the computer. The computer is shipped from the factory with removable protective covers on each of the ports. It is recommended that ports not in use be kept covered.

#### WARNING

Do not place fingers, tools, or other foreign objects into the module ports. Such actions may result in minor electrical shock hazard and interference with pacemaker devices worn by some persons. Damage to module port contacts and the computer's internal circuitry may also result.

The procedure for installing plug-in modules is as follows:

1. Turn off the computer and any connected peripheral devices. However, make sure the computer is plugged into a grounded (three-wire) ac outlet.
2. Remove the protective cover from any one of the unused ports, keeping the remaining unused ports covered. It may be necessary to reconfigure previously installed modules prior to installing the speech module.

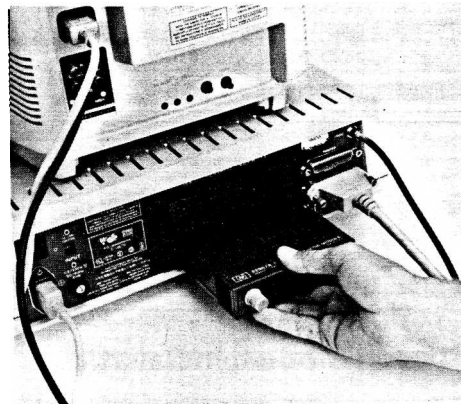


#### CAUTION

To ensure proper computer operation and to prevent damage to equipment:

- Always switch off the computer and all peripherals before inserting or removing modules. Use only plug-in modules designed by Hewlett-Packard for your computer.
- Do not force a module into a port. The port tracks are keyed to prevent the module from being inserted upside down. Forcing an upside down module into a port could result in damage to the module or to the computer.

3. Line up the module with the port opening and gently slide the module into the port. When you feel a small amount of resistance, firmly press the module into the port until the module grips meet the side of the port. A slight side-to-side motion may be necessary to seat the module in the port.



The speech synthesis module is now installed. If you ever wish to remove the module, follow these instructions:

1. Turn off the computer and any connected peripherals.
2. Firmly grasp the module and pull it from the port. Side-to-side motion may be necessary to dislodge the module. When not in use, modules should be stored in their original container or in a box where they are protected from damage.
3. Replace the port cover.



The speech synthesis module is preset to select code 10 at the factory. Instructions for changing the select code are provided in appendix D. Be sure that no two plug-in modules share the same select code.

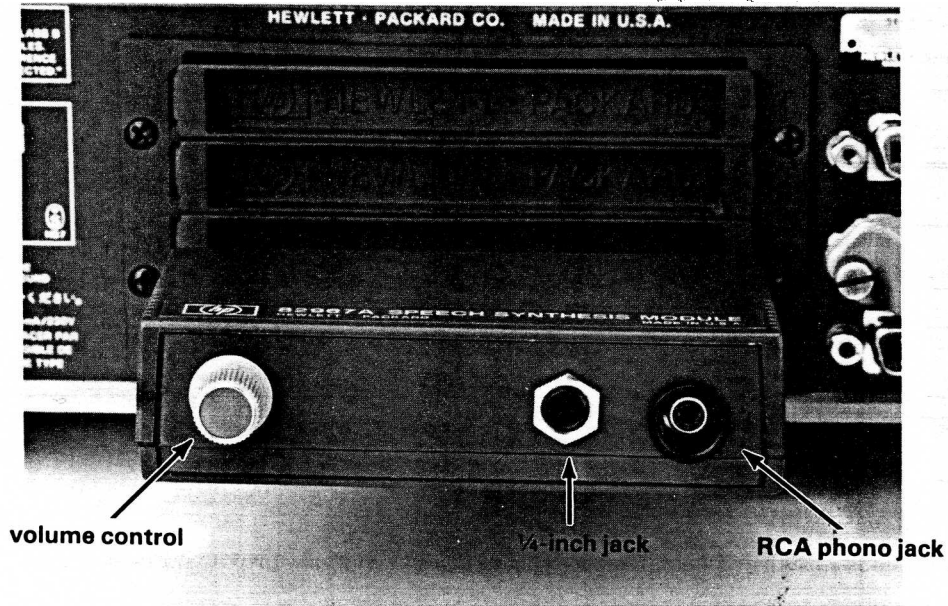
When not generating speech, the module may be left in place; it will not interfere with the general operation of the your computer.

## ROM Installation

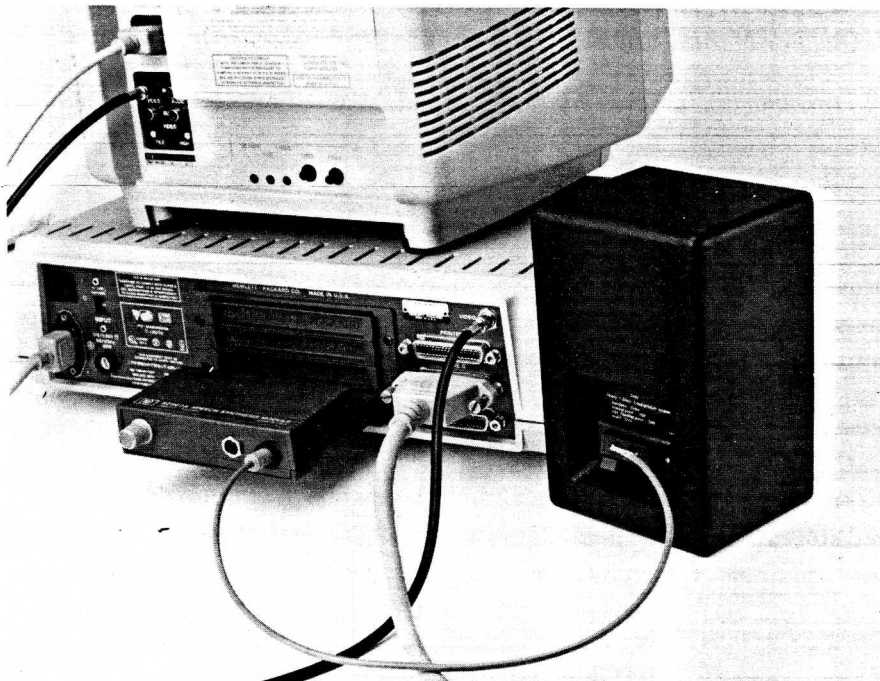
If you are using an HP-83/85 Personal Computer for dictionary editing, you will need to add a Mass Storage ROM (part number 00085-15001) to your computer. In addition to the ROM, you will require an HP 82936A ROM Drawer (up to six ROMs are housed in a single plug-in ROM drawer). The procedure for installing ROMs into the ROM drawer is explained in the *HP 82936A ROM Drawer Instruction Sheet* (supplied with the ROM drawer). The ROM drawer is installed into your computer using the same procedure as the speech module.

## Connecting the Speaker

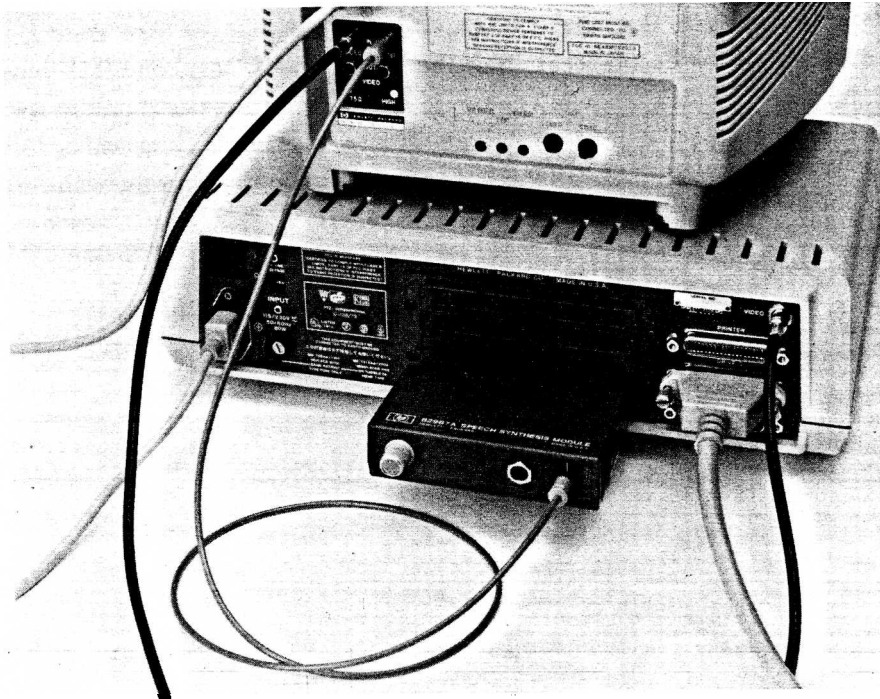
The following photograph shows the location of the ¼-inch and RCA phono jack connectors and the volume control knob on the speech module. The two jacks should not be used simultaneously, nor should multiple speakers be connected to either jack. The audio output volume is increased by turning the control knob clockwise. Turn the volume control all the way to the left for minimum volume.



To connect your speaker or headphone, insert the ¼-inch or RCA speaker plug into the corresponding jack on the speech module. If you are using the HP-86 monitor for speech output, you will need a speaker cable with RCA phono plugs on both ends. Insert one plug into the speech module and the other plug into the input audio jack on the back of the monitor.



**External Speaker Connection**



HP-86 Monitor Connection

### Connecting the Disc Drive

If your disc drive is not already connected, refer to the instructions provided in the appropriate manuals listed below.

**HP-83/85:** Refer to the *Series 80 HP-IB Interface Owner's Manual* for interface installation procedures, and to the documentation accompanying your disc drive for information about connecting it.

**HP-86:** Refer to *Introduction to the HP-86* for information about connecting the HP 9130A Flexible Disc Drive. If you are using an HP 82937A HP-IB Interface and another type of disc drive, refer to the *Series 80 HP-IB Interface Owner's Manual* and the documentation provided with the disc drive.

**HP-87:** Refer to *Introduction to the HP-87* for information about connecting the built-in HP-IB interface to your disc drive.

## Speech Software

The software provided with the HP 82967A Speech Synthesis Module is your primary tool for creating speech files. The vocabulary files "A" through "Z" provide the raw materials for speech, the BASIC "EDIT85" and "EDIT87" programs are your dictionary editing tools for assembling speech files, and the binary programs "SPKB85" and "SPKB87" enable you to output speech to the module.

The "SPKB85" and "SPKB87" binaries are loaded automatically by "EDIT85" and "EDIT87" to enable you to output words and phrases while assembling a speech file. Once a speech file is created and stored on disc, the dictionary editing program is not required to output the file; only the binary program is required.\* Through the statements provided by the speech binaries, synthetic speech can be incorporated into user-written programs in a fashion similar to printed output. This process is discussed in section 4.

\* It is also possible to output speech without the speech binary using the I/O ROM. Refer to appendix E for details.

**Note:** The "EDIT85" program loads the "SPKB85" binary and chains to a program named "CH85" that contains the dictionary editing routines. The binary must be loaded prior to loading "CH85" due to the manner in which memory is allocated by the HP-83/85. This chaining procedure is not necessary with the HP-86/87.

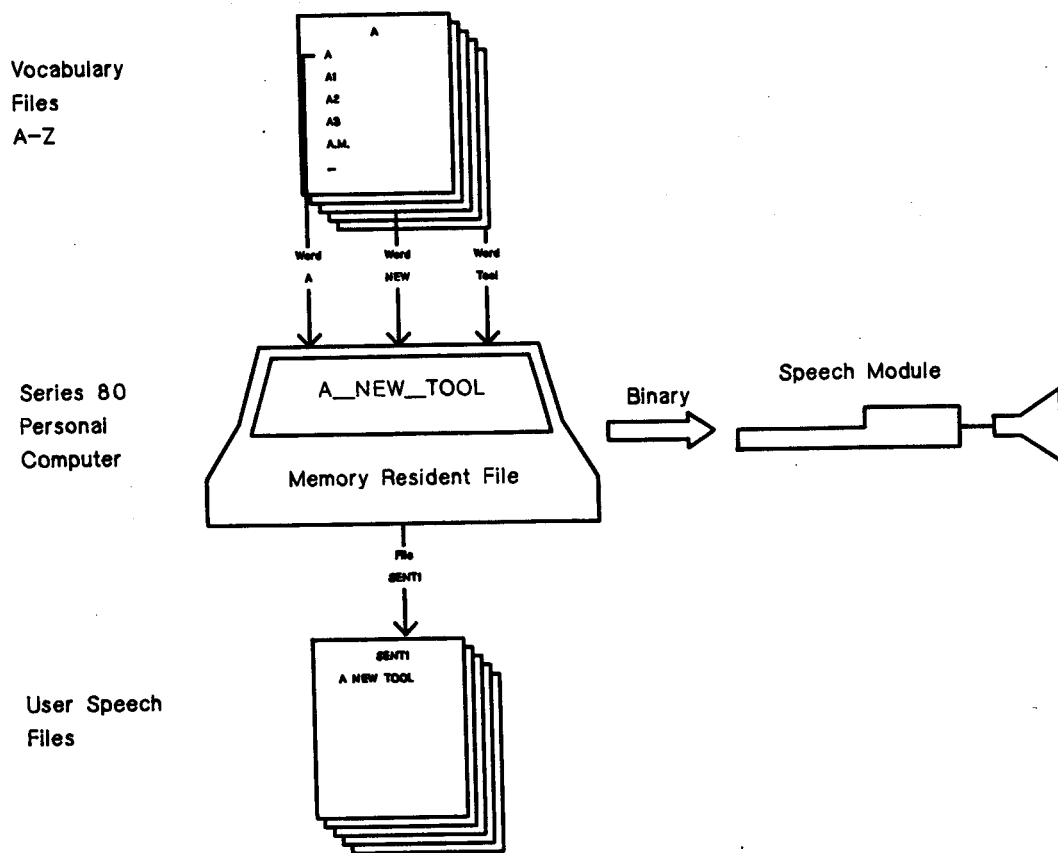
The following is a summary of the two major speech synthesis tasks and the software used to perform them.

**Speech Software Summary**

Task	Software Required		
	Name	Type	Function
Creating speech files (section 3).	"EDIT85" and "CH85" or "EDIT87"	BASIC program(s)	Dictionary editor.
	"A"."Z"	Vocabulary data files	Vocabulary source.
	"SPKB85" or "SPKB87"	Binary program	Enables speech output.
Outputting speech files from BASIC application programs (section 4).	user file	BASIC program	User-written speech output program.
	user file	Speech data file	User speech file, created from vocabulary.
	"SPKB85" or "SPKB87"	Binary program	Enables speech output.

The following diagram shows how the dictionary editing program is used in creating a speech file containing the phrase "a new tool."

1. The individual words A, NEW, and TOOL are loaded into computer memory from the A, N, and T vocabulary files (top of the diagram). The words are concatenated with underlines ( ) to form the phrase.
2. Once loaded, the phrase is sent to the speech module and pronounced by means of the speech binary.
3. The phrase is added to the resident dictionary file.
4. The resident file is given the name SENT1 and stored on disc or tape as a speech file. This speech file can be recalled either from the dictionary editing program or by another BASIC application program.



### Loading the Software

1. Turn on your disc drive (not required for HP 9130A Disc Drive).
2. Turn your computer off, then on.
3. Insert the Speech Synthesis Disc into the drive marked **DRIVE 0**. If you are using more than one drive 0 device, use the drive with the lowest interface select code and device address. This drive is the default mass storage location for your system.
4. Type in
 

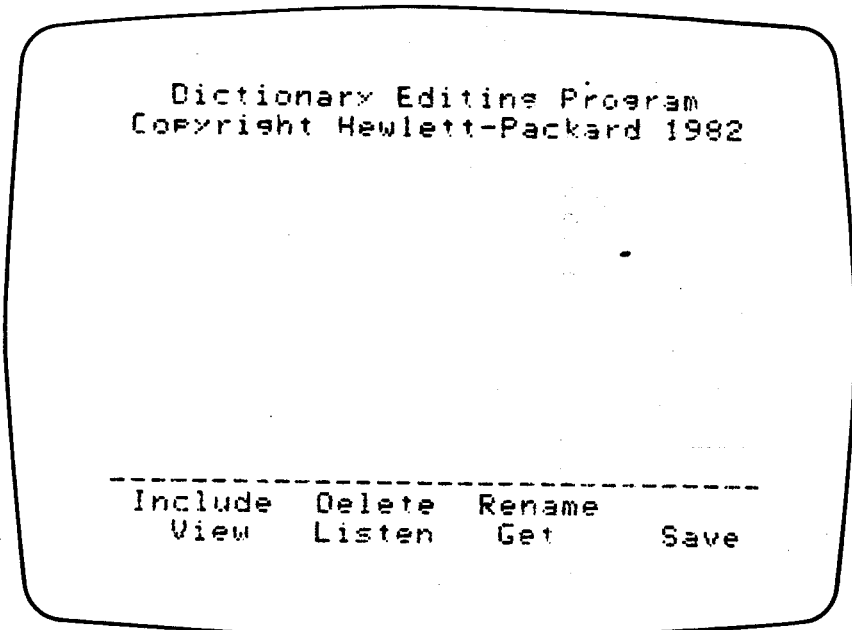
```
LOAD "EDIT85" (for the HP-83/85)
```

 or
 

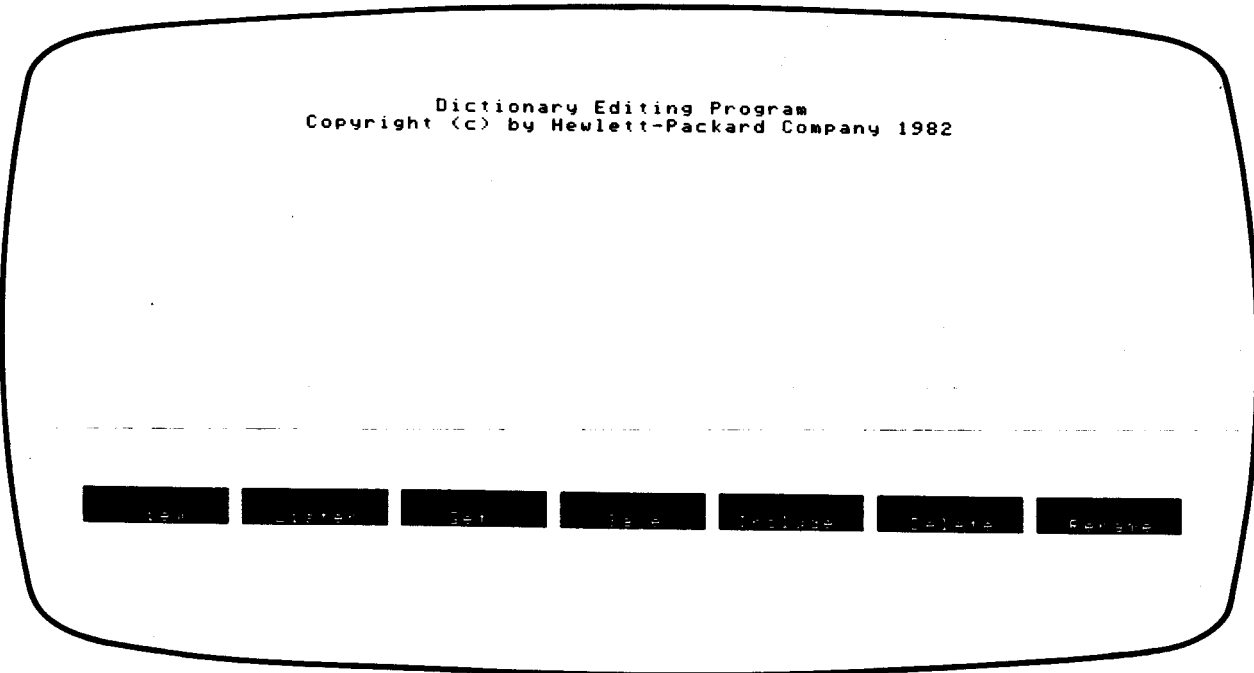
```
LOAD "EDIT87" (for the HP-86/87)
```

 and press the **END LINE** key. Wait until the red disc access light goes off, indicating that the dictionary editing program is loaded.
5. Press the **RUN** key. The disc access light will go on, indicating that the speech binary is being loaded. On the HP-83/85, "EDIT85" chains to "CH85".

After a few seconds, the following prompt and special function keys should appear on the CRT.



HP-83/85



HP-86/87

If your computer responds with Error 19 on line 90 : MEM OVF, there is insufficient memory to run the dictionary editing program. To correct, check the following:

1. For an HP-83/85, be sure the HP 82903A 16K Memory Module is installed. The dictionary editing program requires at least 32K bytes of system RAM.

2. If the line 90 DIM statement has been altered to access memory over 32K bytes on an HP-86/87, the additional memory must be in place (by installing the correct combination of HP 82907A, HP 82908A, and HP 82909A memory modules). This situation could not occur unless the "EDIT87" program was previously loaded and redimensioned. Refer to page 21 for the correct variable dimensions for your system memory configuration. Since memory on the HP-83/85 is limited to 32K bytes maximum, the line 90 COM statement in "CH85" should not be altered.
3. Series 80 enhancement ROMs use varying amounts of system RAM for overhead; this ROM overhead could cause memory overflow if several ROMs are installed in the computer. To correct memory overflow caused by ROM overhead, turn off your computer and remove any unneeded ROMs.

If your computer does not display this prompt, try the procedure again. Be sure that:

- The speech module is installed.
- The disc drive is properly connected.
- You are using the disc drive with the lowest interface select code and device address (for multiple disc drives).
- The speech disc is inserted in drive 0 with the label up and towards the front.
- The drive latch is closed.
- No other peripherals share the same select code and address.

If you are still unsuccessful, refer to section 6 for instructions.

Check that your system is functional by pressing the key marked Listen. The prompt `Word/phrase to speak?` should appear. Type in `CONGRATULATIONS` **(ENDLINE)**. If your module and speaker are properly connected, the word "congratulations" will be output through the module. Remember that the output volume can be adjusted from the control knob located on the module. Repeat the speech output by pressing the Again key, and then press the Continue key to return to the main key set.

As an alternative to loading the speech software from the default drive, you may wish to access the speech synthesis disc through a volume label. The speech disc is assigned the volume label "SPEECH" at the factory. To load the dictionary editing program, place the speech disc in any one of the connected drives and type in

`LOAD "EDIT85.SPEECH" (for the HP-83/85)`

or

`LOAD "EDIT87.SPEECH" (for the HP-86/87)`

and press **(ENDLINE)**. Wait until the red disc access light goes off and press **(RUN)**.

Refer to the mass storage discussion in your computer manual for more information about loading program files.

**Note:** To pause the "EDIT85" or "EDIT87" program, press any key except **(RESET)**. Continue the program by pressing **(CONT)**. The **(CONT)** key will restart the program without affecting the contents of the resident dictionary. While the program is paused, do not press **(RUN)**, **(RESET)**, or **(INIT)**. These keys will erase the contents of the resident dictionary.

## Backing Up the Disc

### CAUTION

Failure to back up the speech disc could make your speech synthesis system inoperative in the event that the disc is damaged or accidentally erased. Routine use will also wear out a disc. We recommend that before using the software, a backup copy be made and that the original be used only for making copies. The disc is write-protected at the factory; do not attempt to store any files on the original disc.

To back up the speech disc you will need two disc drives:

1. Press any key to pause the dictionary editing program.
2. Determine the mass storage unit specifier (*msus*) for the source drive (drive 0) and the destination drive (drive 1). The *msus* character string uniquely identifies each mass storage location connected to your system. The *msus* has the form:

*msus* = : device type [interface select code device address drive number]

For example, if your drive 0 source disc is connected via select code 7 and device address 0, the source *msus* is :D700. The destination *msus* for the drive 1 with the same select code and address is :D701.

3. Remove all discs from all disc drives. Insert a new disc, for the speech disc copy, into the destination drive (drive 1). Initialize the new disc using the following form of the INITIALIZE command:

```
INITIALIZE "SPEECH", "destination msus", 4
```

SPEECH is the new disc volume label; the number 4 refers to the directory size of the disc. For example, if the new disc has an *msus* equal to :D701, execute:

```
INITIALIZE "SPEECH", ":D701", 4
```

4. Insert the original factory speech disc into the source drive (drive 0). Execute the following COPY statement using the *source* and *destination msus* for your system.

```
COPY "source msus" TO "destination msus"
```

In this form, COPY duplicates all files from the source disc to the destination disc. The file names are preserved during the copy operation.

#### Example:

*source* and *destination* select code = 7  
*source* and *destination* device address = 0  
*source* drive number = 0  
*destination* drive number = 1

```
COPY ":D700" TO ":D701"    Copies all files from source ":D700" to destination
                             ":D701".
```

Both the drive 0 and drive 1 disc access lights should blink on and off, indicating that the copy operation is active.

5. When disc activity has ceased, remove the original factory speech disc from drive 0 and store it in a protected place. Use this original only for making copies.
6. Place your new speech disc in drive 0 and load the BASIC dictionary editing program as described in steps 1 through 4 on page 16.

### Speech Disc Volume Label

The default mass storage location for the "EDIT85" and "EDIT87" programs is assigned in line 121 of the program:

```
121 CLEAR @ A$=".SPEECH" @ ON ERROR GOTO 127 @ MASS STORAGE
IS A$
```

Both programs access the volume .SPEECH for words and dictionaries unless another volume label or msus is included in the input as part of the dictionary name. If you wish to change the default mass storage location to another volume label or msus, enter the desired label or msus in line 121 before running the program.

### Memory Requirements

As it is shipped from the factory, the dictionary editing program is dimensioned for a 32K byte system. If your system has more than 32K bytes, you may alter the program's dimension statement to take advantage of the additional memory. More memory allows you to construct longer phrases and work with a larger resident file. The storage requirements for different words vary considerably depending on the complexity of the code. A long, complicated sound such as BUGLE CALL requires a great deal of memory (1469 bytes). Less complicated words, such as PRACTICE require less storage (71 bytes). Storage requirements for each word are listed with the vocabulary files in appendix A.

If you are using an HP-83/85 or an HP-87 32K byte system, do not alter the program variable dimensions, since they were originally designed for this amount of memory. Skip this material and begin reading in section 3.

If it is running, pause the "EDIT87" program by pressing any key. Press the **LIST** key to obtain a listing of the first page of program lines (the alpha display is set to a page size of 24 lines by the program).

Note the DIM statement in line 90:

```
90 DIM A#[1710], B#[2300], C#[160], D#[17], R#[1710], W#[159],
W1#[159], P#[6000]
```

The character strings in line 90 are used for internal storage of data during dictionary access and speech output. Briefly, the strings contain the information listed below. For a more complete discussion of name strings and parameter strings, refer to section 4.

- A\$: Dictionary name string; contains the name string for dictionaries not yet included in the resident file, but brought into memory for viewing or listening.
- B\$: Parameter string for a word or phrase not yet included in the resident file, but brought into memory by the listen function.
- C\$: Contains concatenated word names (without underlines) for phrases in the resident dictionary.
- D\$: Main use is for temporary storage of dictionary names.

R#: Resident dictionary name string.

W#, W1#: Temporary word name storage.

P#: Parameter string for resident dictionary.

To alter this statement according to your system's available memory, move the cursor up to line 90 and enter the values from the following table. Press **(END LINE)** when you are finished. The table lists only a few of the possible memory combinations with your computer and one or more of the HP 82907A, HP 82908A, and HP 82909A Memory Modules. Interpolate the maximum string dimensions for other memory configurations using the values in the table as a guide.

HP-86/87 Dictionary Editing  
String Dimensions

System Memory (computer plus memory modules)	Maximum String Dimension							
	A#	B#	C#	D#	R#	W#	W1#	P#
32K bytes	1710	2300	160	17	1710	159	159	6000
64K bytes	2000	7300	160	17	2000	159	159	25000
96K bytes	2300	12300	160	17	2300	159	159	45000
128K bytes	2600	17300	160	17	2600	159	159	65000
For each additional 32K byte increment add *	1000	14000	0	0	1000	0	0	0

**Example:**

For a computer system with 128K bytes, the DIM statement should be altered to:

```
90 DIM A#[2600], B#[17300], C#[160], D#[17], R#[2600], W#[159],
W1#[159], P#[65000]
```

The program message String overflow on line number indicates that the line 90 dimensions have been exceeded for a string. This usually happens while attempting to load a large dictionary or a long, code-intensive phrase. Note which string is too short by listing the line number given in the string overflow message. It may be possible to adjust the dimensions to suit your needs by changing the length of A#, B#, R#, and P#. However, before altering the line 90 DIM statement, store

\* Maximum string dimension allowed by the HP-86/87 is 65530.

the contents of the resident file using the save function. When a program dimension is altered, memory is re-initialized. Here are some guidelines for adjusting dictionary editing string dimensions:

- For longer phrases (more concatenations) increase the length of B#.
- For larger dictionaries (more entries) increase A# and R# jointly to accommodate more names.
- For words and phrases that require a great deal of code (sound effects and long phrases, in particular) increase the length of P#.

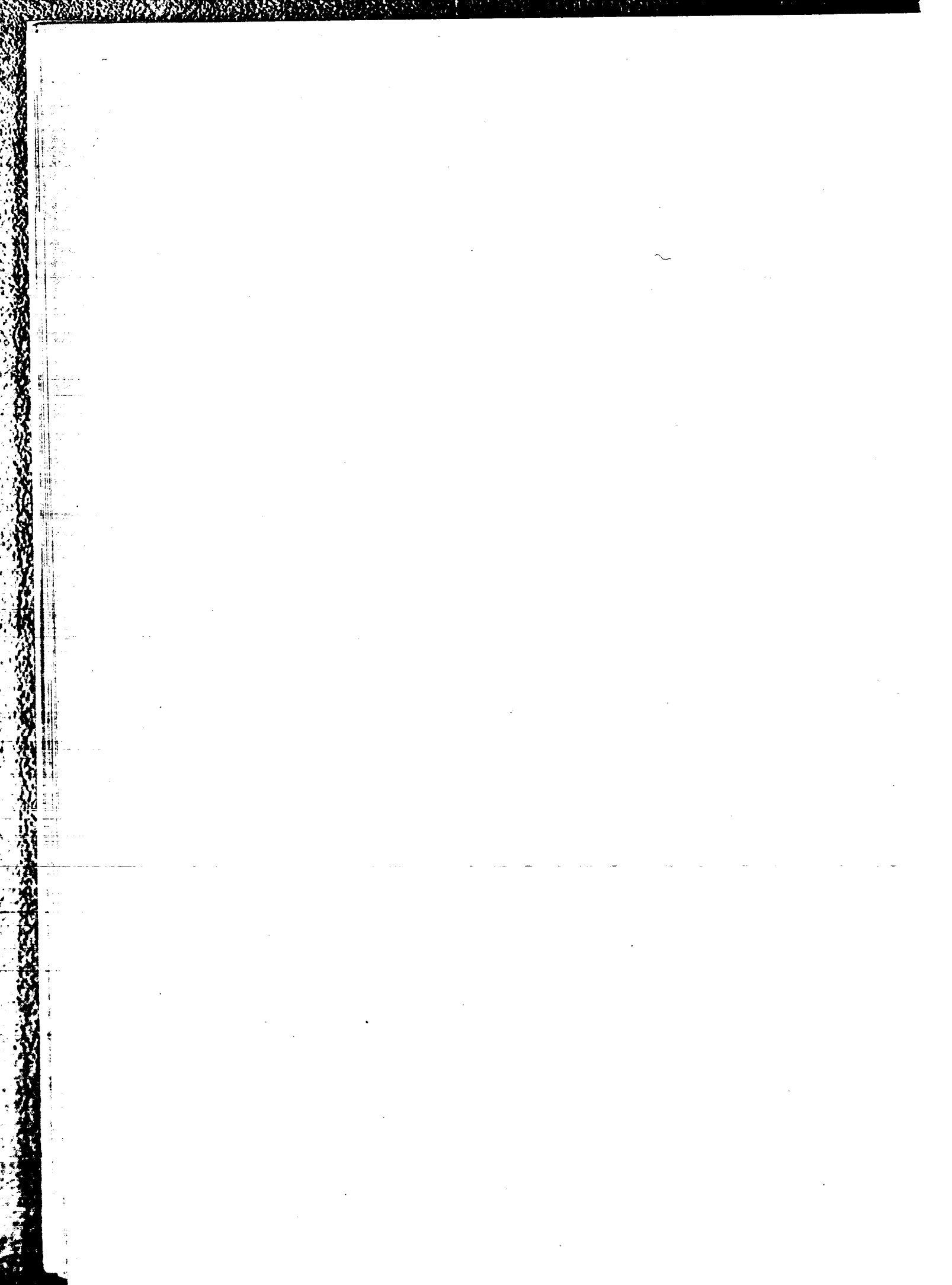
The dimensions of A#, B#, R#, and P# must be balanced within the confines of the available system memory. The length of C#, D#, W#, and W1# should not be altered.

If the parameters in line 90 exceed the available system memory, the computer displays:

```
Error 19 on line 90 : MEM OVF
```

**Note:** Once you've altered the dictionary editing program according to the available memory, you can store the program by executing a STORE command. Remember that whenever your new version of "EDIT87" is used, the additional memory must be in place.

**Notes**



# The Dictionary Editing Program

If you followed the instructions in section 2, you should be ready to begin speech synthesis with your Series 80 Personal Computer. The speech module should be installed and connected to an output speaker, and your disc drive should be connected to your computer before proceeding any further. The material in this section will explain how to:

- Access the supplied vocabulary files.
- Create and edit your own speech files.
- Listen to speech files.
- Store and recall speech files.

## Definitions

Here is a list of some commonly used terms in this manual:

*word* A single element of speech from the vocabulary files supplied with the software. All synthetic speech is formed from word elements. There are a variety of word types supplied with your system including words from the English language, the alphabet, names of numbers, pauses, sound effects, and some prefixes and suffixes. Although some words from the speech vocabulary consist of two English words or a group of sounds, each element from the A-Z vocabulary files is considered a single word.

*word name* Character string used to identify one word. The default word names supplied with the vocabulary files are listed in appendix A. As an identification aid, the sound effect names end with a right parentheses `)` and prefixes and suffixes end with an apostrophe `'`. It is possible to rename words through the dictionary editing rename function. When referencing a word, all punctuation, embedded spaces, and upper or lowercase letters must be entered exactly as shown in the word name. The maximum number of characters in a word name is limited to 95 on the HP-83/85 and 159 on the HP-86/87. The `<`, `_`, `*`, `,`, and `CHR$(255)` characters are not allowed in word names.

### Examples:

```
AIR BRAKES
HUNDRED
CHIME1)
SSS'
```

*phrase* Two or more words (up to 254 maximum) linked together by the user. Phrases can be constructed from words and previously constructed phrases. Words are concatenated by the underline character (`_`); extra underlines generate additional pauses between words/phrases. The maximum number of words allowed in one phrase is 254; however, this upper limit can only be achieved by successive constructions and renaming due to the string input limitation of 95 characters on the HP-83/85 and 159 characters on the HP-86/87.

**Examples:**

```
IT RAIN SSS' IN FEBRUARY
TONE2) YOUR_ AMERICAN EXPRESS_ ACCOUNT_ IS_ OVER_ THE3
LIMIT
HELLO_ ACE_ _ACE_ _WHERE_ IS_ THE2_ PARTY1
```

*phrase name*

Character string used to identify a phrase. Phrases are named, by default, as the word concatenation with spaces instead of underlines (extra pause underlines are removed).

**Examples:**

```
IT RAIN SSS' IN FEBRUARY
TONE2) YOUR AMERICAN EXPRESS ACCOUNT IS OVER
THE3 LIMIT
HELLO ACE WHERE IS THE2 PARTY1
```

The dictionary editing rename function can be used to rename phrases.

**Examples:**

```
Line number 1
MESSAGE HELLO
WEATHER REPORT CLOUDY
```

The maximum number of characters in a phrase name is limited to 95 on the HP-83/85 and 159 on the HP-86/87. As with word names, the following characters are not allowed: <, \_, \*, ,, and CHR\$(255).

*dictionary file*

File containing words or phrases and their names. There are three types of dictionary files: *vocabulary files*, *speech files*, and the *resident file*. Vocabulary and speech files are stored on either tape (HP-85 only) or disc, and can be transported between Series 80 computers.

*vocabulary file*

One of the 26 data files ("A" through "Z") supplied with the speech software. Each file contains words that begin with the file name letter.

*speech file*

A mass storage file created by the user containing words and phrases of synthetic speech. Speech files are created from words selected from the 26 vocabulary files, or from other speech files.

*resident file*

A file in memory created by the "EDIT85" or "EDIT87" dictionary editing program. The resident file is the memory workspace where speech files are created from vocabulary files. Since the resident file occupies memory in RAM, it is erased whenever the **INIT**, **RESET**, or **RUN** key is pressed, or the computer is turned off.

## Vocabulary Files

The vocabulary files are listed in appendix A, and on the tear-out card at the end of the manual. Note that in addition to many words from the English language, there are some additional types of possible speech output:

- Complete alphabet, A through Z.
- Sound Effects (denoted by words ending in a right parenthesis), for example BAT HITTING BALL), BUGLE CALL), RISING WHISTLE), and TONE).
- Numbers 1 through 999,999,999. Numbers are generated from concatenations of words, for example TWO\_THOUSAND\_FOUR\_HUNDRED\_SIXTY\_TWO.

- Pauses. There are three pauses available in the vocabulary, identified by the words PAUSE1 (.1 second pause), PAUSE2 (.2 second pause), and PAUSE10 (1 second pause). Extra underlines between concatenations also generate pauses, .2 seconds for each underline.
- Prefixes/suffixes (denoted by words ending in an apostrophe '), for example REE', TH', ED', and SSS'. Prefixes and suffixes can be concatenated with other words to obtain plurals (BUSINESS\_SSS'), and other word forms not available directly.

Many words end in a number; these represent different pronunciations of the same word. For example IS, IS1, IS2, and IS3 represent four pronunciations of the word "is." These word variations are provided to enable more "natural" sounding speech output, where different usage requires different pronunciations.

## Special Function Keys

"EDIT85" and "EDIT87" provide speech editing capability through the special function keys. There are 14 of these keys on the HP-86/87 (marked k1 through k14) and eight on the HP-83/85 (marked k1 through k8). The upper row of keys are accessed by pressing **SHIFT** and the special function key.

Both programs use seven special function keys (k1 through k7). The main set of keys appears when the program is first run. A secondary set of keys is used when the listen function is selected. When a main key is selected, the program prompts you for input, in the form of words, phrases, file names, or other special types of inputs. The secondary listen keys perform the selected operation directly, and do not require any input. A brief description of the main and listen keys is presented in the following tables.

**Main Keys**

Name	Key	Function
View	k1	View dictionary (vocabulary, resident, or speech) files.
Listen	k2	Listen to words, phrases, or dictionary files.
Get	k3	Load dictionary into resident file (current resident file is erased).
Save	k4	Save resident dictionary (create speech file on disc or HP-85 tape).
Include	k5	Include word, phrase, or dictionary in resident file.
Delete	k6	Delete selected words/phrases or entire contents from resident file.
Rename	k7	Rename word/phrase from resident file.

**Listen Keys**

Name	83/85 Key	86/87 Key	Function
Again	k2	k5	Listen to selected word, phrase, or dictionary file again.
Include	k3	k6	Include selected word, phrase, or dictionary in resident file.
Continue	k4	k7	Return to main keys.

As an example, to create and store a speech file you might use the following sequence of special function keys.

Key	Input
View	Input vocabulary file name. This allows you to view the available words in a vocabulary file. Repeat with other vocabulary files.
Listen	Input phrase (words concatenated with "_"). The phrase is brought into memory and pronounced.
Again	No input. Used to repeat pronunciation.
Include	No input. The phrase is included in the resident dictionary. Repeat the above procedure to build the contents of your speech file.
Save	Input file name and optional mass storage unit specifier or volume label. Creates a user speech file on the specified or default mass storage device.

## Input Types

When a main key is selected, the "EDIT85" or "EDIT87" program responds with a request for input. Depending on the main key selected, the required input could be a word or phrase, a dictionary file specifier, or another special type of input. All inputs are typed in from the keyboard and entered by pressing **END LINE**.

Most dictionary editing inputs reference information stored on disc or tape (HP-85 only): words, phrases, vocabulary files, or speech files. Mass storage files are referenced through a file specifier of the form:

*file specifier* = *file name* [ *msus* , *volume label* ]

The *file name* is a character string containing from 1 to 10 characters (1 to 6 for the HP-85 tape drive). All upper and lowercase characters and symbols may be used except the period (.), colon (:), quotes ("), less than sign (<), underline (\_), multiplication sign (\*), comma (,), and CHR#(255).

When referencing a mass storage location other than the volume .SPEECH, you must include either a *volume label* (up to six characters) or *msus* (mass storage unit specifier) in the *file specifier*. The dictionary editing program looks for the .SPEECH disc when accessing all files, unless another *volume label* or *msus* is specified. The *msus* : T references the HP-85 internal tape drive.

Listed below are the general types of input recognized by the program. Several of these items may appear within one input, depending on the selected function.

Upper and lowercase letters as well as embedded spaces are significant; note that the <, #, and \_ characters have special meaning. Input length is restricted to 95 characters on the HP-83/85 and 159 characters on the HP-86/87.

**END LINE** Returns to main keys with no further action. Used to abort the current operation.

**word name**  
**phrase name** References a word or phrase; limited to a maximum of 95 characters on the HP-83/85 and 159 characters on the HP-86/87. All upper and lowercase characters are allowed except: <, \_, \*, ., and CHR\$(255). All *word/phrase* name inputs can be tagged with a *dictionary file specifier* to indicate the location of the word/phrase. The *dictionary file specifier* follows the *word/phrase name*, separated by the < character. When a dictionary file is not specified, the word/phrase is searched for in the vocabulary file corresponding to the first letter of the *word/phrase name*, on the volume .SPEECH.

**dictionary file** Refers to one of the following types of dictionary files:

**specifier**  
**vocabulary file specifier** A through Z; must include mass storage unit specifier or volume label if file is not on volume .SPEECH (for example B:D701).

**speech file specifier** Assigned by user; must include msus or volume label if not on volume .SPEECH.

\* The resident file in memory.

Dictionary file specifiers are limited to a maximum of 17 characters: 10 characters for the *file name* and 7 characters for the *msus* or *volume label*.

**phrase** Concatenated group of words or phrases. Word names and existing phrase names are joined together with underlines ( \_ ) to form the new phrase. An optional *dictionary file specifier* may be tagged on the end of the *word/phrase name* (using < ) before the underline character.

\*ALL Refers to all words or vocabulary files (A-Z).

\*CAT Special input for view function. Generates a catalogue listing of all files on the volume .SPEECH.

< Used to indicate that the characters which follow refer to a *dictionary file specifier*. The dictionary could be either a vocabulary, resident, or speech file.

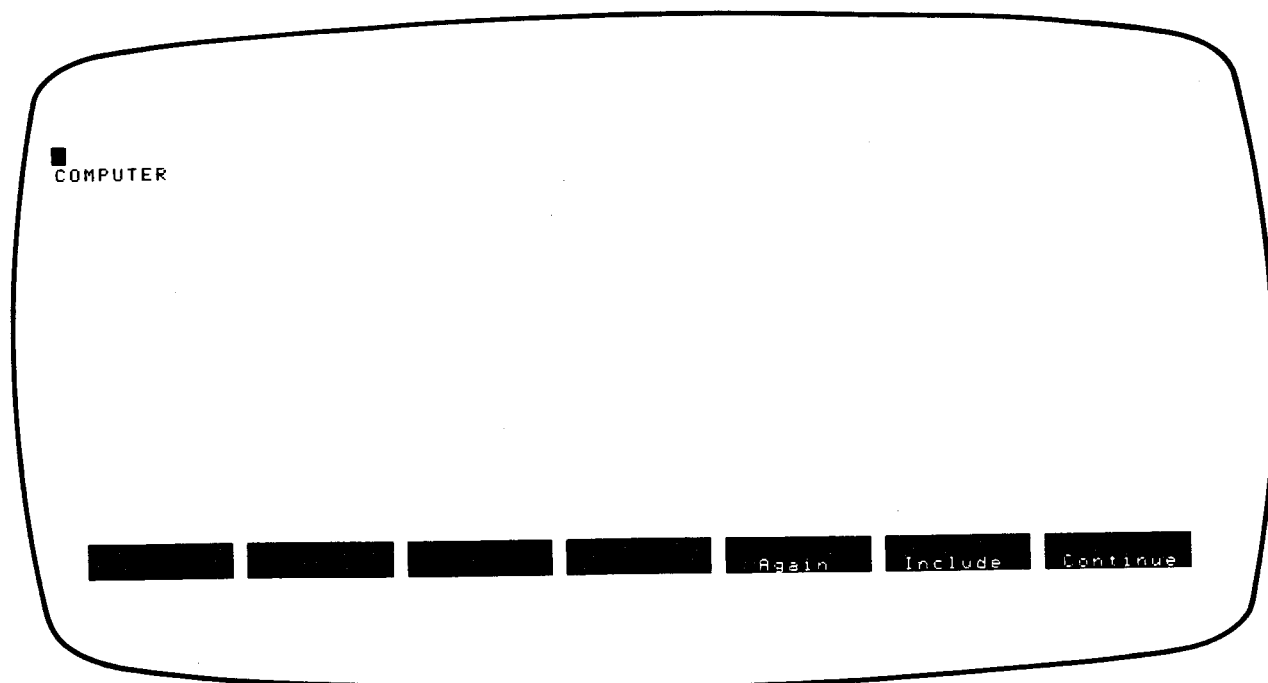
\_ Underline character. Used for concatenating words/phrases into new phrases. Can also be used repeatedly to insert one or more .2 second pauses between words. The maximum number of words that can be concatenated is 254.

^ Used to separate first and last *word/phrase names* of a block. Used in delete, listen, and include functions.

**Example:** Load and run the "EDIT85" (HP-83/85) or "EDIT87" (HP-86/87) program. When the main key set appears, press the Listen key (**k2**); the computer responds with:

Word/phrase to speak?

Type in the word COMPUTER and press **ENDLINE**. The program looks for the word COMPUTER in the C vocabulary disc file. The speech code for the word is loaded into memory and output through the speech module. Then the Listen keys appear; press Continue (**k7**) on the HP-86/87, (**k4**) on the HP-83/85) to return to the main keys. Remember, you can adjust the volume of the output by turning the knob on the back of the speech module; turn the knob clockwise to increase the volume.



Each of the dictionary editing program special function keys are discussed in the remainder of this section. For each key, the prompt, the possible types of input, and the resulting response are listed. Other pertinent information and an example are also included under each key discussion. A summary of the dictionary editing inputs is presented in appendix B.

## View Key

**Function:** The View key enables you to view the contents of a dictionary file.

**Prompt:** Dictionary name?

Input	Response
<b>END LINE</b>	When pressed without any other input, <b>END LINE</b> returns control to the main keys (aborts key function). It is also pressed following other inputs to enter the information.
*CAT	Lists the file directory of the volume .SPEECH.
<i>vocabulary file specifier</i>	Lists the contents of the vocabulary file.
<i>speech file specifier</i>	Lists the contents of the speech file.
*ALL	Lists all the letter name vocabulary files, A through Z starting with A, located on the volume .SPEECH.
*	Lists the contents of the resident file.

### Error Messages:

Message	Condition
Dictionary <i>file specifier</i> not found	Vocabulary or speech file cannot be found. Be sure that you are accessing the correct mass storage.
No RESIDENT entries	Resident file is empty.
Dictionary name size exceeded	Dictionary file name limit is 17 characters (includes <i>msus</i> or <i>.volume label</i> ).

**Application Notes:**

- The View key causes the computer to scroll continuously through the file(s). If you wish to halt the scrolling process and examine the display, press the **(PAUSE)** key to halt the viewing operation. Press **(CONT)** to resume viewing the file.
- To get a printed copy of a dictionary file:
  1. Pause the "EDIT85" or "EDIT87" program by pressing any key except **(RESET)**.
  2. Select the printer by executing the CRT IS statement (for example, CRT IS 701). CRT IS 2 selects the internal printer of the HP-85.
  3. Press **(CONT)** to continue the dictionary editing program.
  4. Press View and input the dictionary file to be printed. The view output will be routed to the selected printer.
  5. When the file has completed printing, pause the program and execute CRT IS 1 to return display output to the CRT.
  6. Press **(CONT)** to continue the dictionary editing program.

**View Examples:**

Dictionary name?

A **(END LINE)**

Lists the A vocabulary file located on the default .SPEECH disc.

Dictionary name?

SPFILE#2:D701 **(END LINE)**

Lists the speech file named SPFILE#2 located on the disc with msus :D701.

Dictionary name?

\* **(END LINE)**

Lists the resident dictionary.

## Listen Key

**Function:** The Listen key enables you to listen to individual words, words concatenated into phrases, or an entire dictionary file. Listen provides its own set of secondary keys:

**Again key:** Repeats pronunciation of the selected word(s) or phrase(s).

**Include key:** Includes selected word(s) or phrase(s) in the resident dictionary.

**Continue key:** Returns to the main key set with no further action.

**Prompt:** Word/phrase to speak?

**Input****Response****(END LINE)**

When pressed without any other input, **(END LINE)** returns control to the main keys (aborts key function). It is also pressed following other inputs to enter the information.

Input	Response
<i>phrase name</i> <i>word name</i>	<i>phrase name</i> [ <i>&lt;dictionary file specifier&gt;</i> ... ] <i>word name</i> [ <i>&lt;dictionary file specifier&gt;</i> ... ]

Looks for each word/phrase in the specified or default (first letter) dictionary. When all the words/phrases have been found, the entire new phrase is pronounced. Underlines ( \_ ) are used to concatenate the words/phrases; extra underlines cause extra delay (.2 seconds) between words. A maximum of 254 words can be concatenated in a single phrase (through successive concatenations of phrases). Possible *dictionary file specifiers* include *vocabulary file specifiers*, *speech file specifiers*, and \* (resident file).

\*ALL<*dictionary file specifier*

Looks for the specified dictionary, displays and pronounces each word or phrase.

<*dictionary file specifier*

When a *dictionary file specifier* alone is input, the dictionary entries are displayed on the screen along with the message Name above to speak?. There are three options at this point:

**END LINE** Returns control to the main keys with no further action.

*word name1*      *word name2*  
*phrase name1* [ , *phrase name2* ]

Pronounces block of words/phrases beginning with word/phrase1 and ending with word/phrase2. If word/phrase2 is omitted, the single word/phrase1 is pronounced.

The third option is to move the cursor up to one of the words or phrases and press **END LINE**. The single word/phrase is pronounced.

#### Error Messages:

Message	Condition
Dictionary <i>file specifier</i> not found	Vocabulary or speech file cannot be found. Be sure you are accessing the correct disc.
Word <i>name</i> not found	Selected word/phrase cannot be found. Be sure that the word is spelled correctly and that the correct dictionary and disc are being accessed. In the case of phrase generation, move the cursor up to the phrase, edit it, and press <b>END LINE</b> to try again, or press <b>END LINE</b> on a clear line to abort the function.
No RESIDENT entries	Resident file is empty.
Size limits exceeded	Number of words concatenated exceeds 254.
String overflow on line number	Insufficient memory to load selected phrase. You may wish to break the phrase into a group of short phrases (entered separately), or reconstruct the phrase using fewer and less complicated words.
Dictionary name size exceeded	Dictionary file name limit is 17 characters (includes <i>msus</i> or <i>. volume label</i> ).
Illegal use of < or _	Underline may not precede or follow <.

**Application Notes:**

- Many words in the vocabulary files have more than one pronunciation. For example, THE has seven possible pronunciations, identified by the word names THE, THE1, THE2, THE3, THE4, THEE, and THEE1. Experiment with the different pronunciations to see which is best for the particular phrase. An example of poor pronunciation might be:

THEE\_TIME\_IS1\_FOUR\_A.M.1

A better pronunciation of the same phrase can be obtained from:

THE2\_TIME1\_IS2\_FOUR4\_A.M.

- Be sure to enter words or phrases exactly as viewed in the dictionary file, including any punctuation or spaces. Refer to appendix A or the tear-out vocabulary card for word spellings.
- Long phrases often cause the B\$ parameter string to overflow. When sampling words and especially sound effects, keep the phrases short.

**Listen Examples:**

Word/phrase to speak?

FAHRENHEIT (END LINE)

Looks in the F dictionary file for the word FAHRENHEIT, and pronounces it.

Word/phrase to speak?

BAT HITTING BALL)\_A1\_HOME\_RUN (END LINE)

Looks in the B dictionary for the word BAT HITTING BALL), the A dictionary for A1, the H dictionary for HOME, and the R dictionary for RUN. Pronounces the phrase when located. Note the use of the extra \_ to insert a .2 second pause.

Word/phrase to speak?

\*ALL<PARA1:T (END LINE)

Pronounces the entire speech file PARA1, located on tape (HP-85 only).

Word/phrase to speak?

<\*(END LINE)

Allows individual or block pronunciation of the resident file entries.

## Include Key

**Function:** The Include key enables you to add words, phrases, or dictionaries to the resident file.

**Prompt:** Word/phrase to include?

**Input**

**Response**

(END LINE)

When pressed without any other input, (END LINE) returns control to the main keys (aborts key function). It is also pressed following other inputs to enter the information.

Input	Response
<i>phrase name</i> <i>word name</i>	[ <i>&lt; dictionary file specifier &gt;</i> ][ <i> phrase name</i> <i> word name</i> [ <i>&lt; dictionary file specifier &gt;</i> ... ]

Looks for each word/phrase in the specified or default (first letter) dictionary. When all the words/phrases have been found, the entire new phrase is included in the resident dictionary. Underlines ( \_ ) are used to concatenate the words/phrases; extra underlines cause extra delay (.2 seconds) between words. A maximum of 254 words can be concatenated in a single phrase (through successive concatenations of phrases). Possible *dictionary file specifiers* include *vocabulary file specifiers*, *speech file specifiers*, and \* (resident file).

\*ALL<*dictionary file specifier*

Looks for the specified dictionary, displays and includes each word or phrase; returns to main keys after including as many entries as available memory permits.

<*dictionary file specifier*

When a *dictionary file specifier* alone is input, the dictionary entries are displayed on the screen along with the message Name above to include?. There are three options at this point:

**END LINE** Returns control to the main keys with no further action.

*word name1 word name2*  
*phrase name1 [ , phrase name2 ]*

Includes block of words/phrases beginning with word/phrase1 and ending with word/phrase2. If word/phrase2 is omitted, the single word/phrase1 is included in the resident dictionary.

The third option is to move the cursor up to one of the words or phrases and press **END LINE**. The single word/phrase is included in the resident dictionary.

#### Error Messages:

Condition	Message
Dictionary <i>file specifier</i> not found	Vocabulary or speech file cannot be found. Be sure you are accessing the correct disc.
Word <i>name</i> not found	Selected word/phrase cannot be found. Be sure that the word is spelled correctly and that the correct dictionary and disc are being accessed. In the case of phrase generation, move the cursor up to the phrase, edit it, and press <b>END LINE</b> to try again, or press <b>END LINE</b> on a clear line to abort the function.
No RESIDENT entries	Resident file is empty.
Size limits exceeded	Number of words concatenated exceeds 254.
String overflow on line number	Insufficient memory to load selected phrase or dictionary. You may wish to break the phrase into a group of short phrases (entered separately), or reconstruct the phrase using fewer and less complicated words.

Dictionary name size exceeded

Dictionary file name limit is 17 characters (includes msus or . volume label).

Illegal use of < or \_

Underline may not precede or follow <.

### Application Notes:

- Be sure to enter words or phrases exactly as viewed in the dictionary file, including any punctuation or spaces.
- Duplicate *word/phrase names* in the resident dictionary could cause some ambiguity. These can be caused by including the same word/phrase more than once, or by renaming words/phrases to names of existing entries. When referencing an entry that has a duplicate name elsewhere in the dictionary, the first appearance of the word/phrase is the one referenced. The other occurrences cannot be referenced individually, but may be accessed through a block operation. It is best to avoid duplicate names; use the rename function, when necessary, to remove duplicate names from a dictionary file.
- When a word/phrase is included in the resident dictionary, it is placed at the bottom of the list of resident entries; the order of words/phrases matches the order in which they were included.
- Once a phrase is included in the resident dictionary, the underlines are replaced by spaces to form the phrase name. Extra underlines (for pauses) and file specifiers are removed entirely. For example, the phrase SOUND2) \_\_ THUNDERSTORMS\_TONIGHT\_AND\_TOMORROW is listed and referenced in the resident dictionary under the phrase name SOUND2) THUNDERSTORMS TONIGHT AND TOMORROW.

### Include Examples:

Word/phrase to include?

YOU\_HAVE1\_SEVENTEEN\_DOLLARS\_LEFT1\_IN\_YOUR1\_ACCOUNT **END LINE**

Enters the phrase into the resident dictionary.

Word/phrase to include?

\*ALL<Z **END LINE**

Enters all entries from the Z vocabulary file into the resident dictionary.

Word/phrase to include?

<MESSAGE#1.USER **END LINE**

Allows individual or blocks of words/phrases to be entered from the speech file MESSAGE#1 located on the volume .USER into the resident dictionary.

## Delete Key

**Function:** The Delete key enables you to delete words or phrases from the resident dictionary. Words/phrases to be deleted can be selected individually or in blocks.

**Prompt:** Name above to delete?

**Input**

**Response**

**END LINE**

When pressed without any other input, **END LINE** returns control to the main keys (aborts key function). It is also pressed following other inputs to enter the information.

\*ALL

Deletes all words/phrases from the resident dictionary.

**Input**

*word name1*    *word name2*  
*phrase name1* [ , *phrase name2* ]

**Response**

Deletes the block of words/phrases beginning with *word/phrase1* and ending with *word/phrase2*. If *word/phrase2* is omitted, the single *word/phrase1* is deleted.

Another option is to move the cursor up to one of the words or phrases and press **END LINE**. The single *word/phrase* is deleted.

**Error Messages:**

Message	Condition
No RESIDENT entries	Resident file is empty.
Word <i>name</i> not found	Selected <i>word/phrase</i> cannot be found. Check that the <i>word/phrase name</i> is spelled correctly.
No deletions. <i>name</i> appears more than once.	Delete function has been cancelled because there is more than one occurrence of the <i>word/phrase name</i> to be deleted. Use the rename function to rename duplicate entries.

**Application Notes:**

- With the exception of the \*ALL input, deleting entries from the resident dictionary does not, by itself, create room for additional words or phrases. The delete function only removes the name from the list of resident dictionary entries, the actual speech code remains in memory. If the resident dictionary becomes full, and you wish to "pack" the dictionary by erasing the speech code from previously deleted entries, use the save and get functions: save the file (refer to page 38) then get it (refer to page 39). The save/get functions automatically pack the code while transferring speech files to and from mass storage.
- The delete function is ignored if a designated word/phrase name occurs in duplicate. This is a precaution against deleting the wrong entry. Use the rename function to rename duplicate entries before attempting to delete one.

**Delete Example:**

```

Dictionary *
CAN YOU FOXTROT
HANG UP THE PHONE
HEADING THIS WAY
YOU ALL READY HAD LUNCH
YOU HAVE MAIL
Name above to delete
?
CAN YOU FOXTROT,HEADING THIS WAY END LINE

```

Deletes the first three phrases from the resident dictionary.

## Rename Key

**Function:** The Rename key enables you to rename words or phrases contained in the resident dictionary.

**Prompt:** Name above to rename?

Input	Response
<b>END LINE</b>	When pressed without any other input, <b>END LINE</b> returns control to the main keys (aborts key function). It is also pressed following other inputs to enter the information.
<i>word name</i> <i>phrase name</i>	Selects a word or phrase from the resident dictionary to be renamed. The prompt <i>New name?</i> is displayed; type in the new name and press <b>END LINE</b> . Control is returned to the main keys. The renamed word/phrase maintains its original position in the resident dictionary.

The third option is to move the cursor up to one of the words or phrases and press **END LINE**; the single word/phrase is selected for renaming. The prompt *New name?* is displayed; enter the new name and press **END LINE**. Control is returned to the main keys.

### Error Messages:

Message	Condition
No RESIDENT entries	Resident file is empty.
Word <i>name</i> not found	Selected word/phrase cannot be found. Check that the <i>word/phrase name</i> is spelled correctly.

### Application Notes:

- Rename is useful for shortening the notation of a long phrase. For example, you may want to rename a long phrase to an easily referenced name like `LINE1`.
- When renaming words/phrases, be conscious of the other names in the resident dictionary. It is possible, but not desirable, to rename words/ phrases to names already contained in the resident dictionary. This situation can cause some ambiguity. For example, all references of a duplicate name are directed to the first occurrence of that name. It is best not to create duplicate names in a dictionary file.

There are two restrictions for renaming words/phrases:

- The *word/phrase name* cannot exceed 95 characters on the HP-83/85 and 159 characters on the HP-86/87.
- The *word/phrase name* cannot contain any of the following characters: `<, _, *, ,, CHR$(255)`.

### Rename Example:

```

Dictionary *
THE3 BALANCE IN YOUR AMERICAN EXPRESS ACCOUNT IS
DOLLARS
CENTS1
Name above to rename
?
```

Move the cursor up to the first phrase and press **END LINE**.

New name?

AMEXBAL **END LINE**

Renames the selected phrase to AMEXBAL.

The resident dictionary now contains the following entries:

Dictionary \*

AMEXBAL  
DOLLARS  
CENTS1

## Save Key

**Function:** The Save key enables you to store the contents of the resident dictionary as a speech file.

**Prompt:** Save RESIDENT dictionary under what name?

Input	Response
<b>END LINE</b>	When pressed without any other input, <b>END LINE</b> returns control to the main keys (aborts key function). It is also pressed following other inputs to enter the information.
<i>speech file specifier</i>	Stores the resident file on disc or tape (HP-85 only). The <i>file specifier</i> consists of a <i>file name</i> and optional <i>msus</i> or <i>. volume label</i> .

### Error Messages:

Message	Condition
That file exists. Okay to purge it (Y/N)?	Attempt to save a file under an existing file name. If you wish to use the name, enter Y or N; all other entries return the Save key input prompt.
Insufficient mass storage	There is insufficient space on the disc or tape to store the resident file. Either pack the disc, purge unwanted files, or use another disc/tape with more space and repeat the save operation.
Dictionary name size exceeded	Dictionary file name limit is 17 characters (includes <i>msus</i> or <i>. volume label</i> ).

### Application Notes:

- The original speech disc is write-protected at the factory. It is not possible to save speech files on this disc. Your copy of the speech disc may not be write-protected, but due to length of the vocabulary files there is not much available space on the disc. Initialize another disc, with a different volume label, and use it for speech file storage.
- The speech file specifier cannot exceed 17 characters: 10 for the file name and 7 for the *. volume label* or *msus*. All upper and lowercase characters may be used except the period (.), colon (:), quotes ("), underline (\_), less than sign (<), multiplication sign (\*), comma (,), and CHR\$(255).

**Save Examples:**

Save RESIDENT dictionary under what name?

STORY:T **END LINE**

Stores the resident dictionary under the name STORY on the HP-85 internal tape drive (HP-85 only).

Save RESIDENT dictionary under what name?

Account#1 **END LINE**

Stores the resident dictionary under the name Account#1 on the default volume .SPEECH.

Save RESIDENT dictionary under what name?

78636.USER **END LINE**

Stores the resident dictionary under the name 78636 on the volume .USER.

## Get Key

**Function:** The Get key enables you to load a speech or vocabulary file into the resident dictionary. When a new file is loaded using the get function, the current resident entries are erased.

**Prompt:** Dictionary to get?

### Input

### Response

**END LINE**

When pressed without any other input, **END LINE** returns control to the main keys (aborts key function). It is also pressed following other inputs to enter the information.

*vocabulary file specifier* [ , S]

Loads the contents of the selected vocabulary file into the resident dictionary (as memory permits) and lists the contents. If the available memory is not sufficient to load the entire file, a subset is loaded, beginning with the first word and continuing until memory is full. The optional sort parameter S causes an alphabetical sorting of the file as it is loaded.

*speech file specifier* [ , S]

Loads the contents of the selected speech file into the resident dictionary (as memory permits) and lists the contents. The optional sort parameter S causes an alphabetical sorting of the file as it is loaded.

### Error Messages:

#### Message

#### Condition

Dictionary file  
specifier not found

Vocabulary or speech file cannot be found. Be sure you are accessing the correct disc.

String overflow on line  
number

Insufficient memory to load selected file. Memory must be added to your computer (HP-86/87 only) and the program variables must be redimensioned (refer to page 20) to load the entire file.

Dictionary name size  
exceeded

Dictionary file name limit is 17 characters (includes *msus* or *. volume label*).

**Application Notes:**

Any time a file is loaded using the get function, the current resident dictionary is erased. If you wish to add a group of files to the resident dictionary and not erase the contents, use the include function and input \*ALL<dictionary file specifier for each file.

**Get Examples:**

Dictionary to get?

USERFL1.AP,S (END LINE)

Loads file USERFL1 from the volume .AP into the resident dictionary, sorting it alphabetically, and lists the contents.

Dictionary to get?

Z (END LINE)

Loads file Z from the default volume .SPEECH into the resident dictionary and lists the contents.

## Example Session

The following example uses all of the dictionary editing keys described in this section. The purpose of the example is to create a speech file containing the words/phrases necessary to output the time every minute. The BASIC "CLOCK" program in section 5 uses this speech file for that purpose. In the example, we will construct the phrase:

"At the tone the time will be"

In addition, the following words will be included in the speech file, to be named TIME:

"o'clock"

"1" through "20", "30", "40", "50"

"O" as in "At the tone the time will be twelve 'O' four (12:04) p.m."

"a.m."

"p.m."

"(one second pause...)chime sound"

In order to obtain the best possible pronunciation, all the variations for the words will be sampled before constructing the phrase.

Begin by loading the "EDIT85" or "EDIT87" program and pressing the (RUN) key. Use the Include key to include the following words in the resident dictionary.

**Input or Key Stroke**

(include)

AT (END LINE)

(include)

AT1 (END LINE)

**Program Response**

Word/phrase to include?

Word AT is loaded into resident dictionary.

Word/phrase to include?

Word AT1 is loaded into resident dictionary.

**Input or Key Stroke****Include**<T **END LINE**THE, THEE1 **END LINE****Include**TONE **END LINE****Include**TIME **END LINE****Include**TIME1 **END LINE****Include**WILL **END LINE****Include**WILL1 **END LINE****Include**B **END LINE****Include**B1 **END LINE****View**\* **END LINE****Program Response**

Word/phrase to include?

Lists contents of T dictionary. Name above to include?

Block of words THE through THEE1 is loaded into resident dictionary.

Word/phrase to include?

Word TONE is loaded into resident dictionary.

Word/phrase to include?

Word TIME is loaded into resident dictionary.

Word/phrase to include?

Word TIME1 is loaded into resident dictionary.

Word/phrase to include?

Word WILL is loaded into resident dictionary.

Word/phrase to include?

Word WILL1 is loaded into resident dictionary.

Word/phrase to include?

Word B is loaded into resident dictionary.

Word/phrase to include?

Word B1 is loaded into resident dictionary.

Dictionary name?

Lists the resident dictionary.

Dictionary \*

AT  
 AT1  
 THE  
 THE1  
 THE2  
 THE3  
 THE4  
 THEE  
 THEE1  
 TONE  
 TIME  
 TIME1  
 WILL  
 WILL1  
 B  
 B1

The resident dictionary now contains all the word variations for the desired phrase. Use the Listen key to listen to the variations and select the best words for the phrase. Block listening provides easy access to all the variations; for slower pronunciations, listen to words individually.

Input or Key Stroke	Program Response
<b>Listen</b>	Word/phrase to speak?
< * (END LINE)	Lists the resident dictionary for block listening. Name above to speak?
THE , THEE 1 (END LINE)	Pronounces the seven variations of "the."
<b>Again</b>	Repeats pronunciation.
<b>Continue</b>	Returns to main keys.
<b>Listen</b>	Word/phrase to speak?
THE 1 < * (END LINE)	Pronounces word THE 1.
<b>Again</b>	Repeats pronunciation.
<b>Continue</b>	Returns to main keys.

Repeat this sequence (or other listen functions) for other word variations.

After sampling all the word variations, construct the phrase, "at the tone the time will be," from the best sounding word combination.

Input or Key Stroke	Program Response
<b>Listen</b>	Word/phrase to speak?
AT1<* THE1<* TONE<* THE2<* TIME<* WILL1<* B1<* (END LINE)	Pronounces the phrase.
<b>Include</b>	Includes the phrase in the resident dictionary.
<b>Rename</b>	Lists the resident dictionary. Name above to rename?

Move the cursor up to the phrase that was just included and press (END LINE).

AT1 THE1 TONE THE2 TIME WILL1 B1 (END LINE)	Program responds with New name?.
PHRASE1 (END LINE)	Renames the phrase to PHRASE1.

The resident dictionary now contains one phrase and all the variations of the words in the phrase. Before including any more words, delete the unneeded words from the resident dictionary.

Input or Key Stroke	Program Response
<b>Delete</b>	<p data-bbox="719 271 1054 301">Lists the resident dictionary.</p> <pre data-bbox="935 332 1174 896"> Dictionary *  AT AT1 THE THE1 THE2 THE3 THE4 THEE THEE1 TONE TIME TIME1 WILL WILL1 B B1 PHRASE1 </pre>
AT, B1 <b>END LINE</b>	<p data-bbox="719 931 1134 961">Name above to delete?</p> <p data-bbox="719 996 1214 1026">Deletes the block of entries from AT to B1.</p>
<b>View</b>	Dictionary name?
* <b>END LINE</b>	<p data-bbox="719 1125 1385 1181">Lists the resident dictionary. Note that all entries have been deleted except PHRASE1.</p> <pre data-bbox="935 1194 1174 1263"> Dictionary *  PHRASE1 </pre>

Before including the numbers and other words for the TIME file, pack the resident file using the save/get functions. This procedure reduces the amount of computer memory required to store the file. Deleted words/phrases occupy memory in the resident file until stored and reloaded from disc. Store the speech file under the name TIME on an available disc or tape (HP-85 only). We use the volume .AP in this example.

Input or Key Stroke	Program Response
<b>Save</b>	Save RESIDENT dictionary under what name?
TIME .AP <b>END LINE</b>	File is stored as speech file TIME on the volume .AP.
<b>Get</b>	Dictionary to get?
TIME .AP <b>END LINE</b>	Gets the speech file.

Include the word O'CLOCK1 and rename it as shown.

**Input or Key Stroke**

**Listen**

O'CLOCK1 (END LINE)

**Include**

**Rename**

O'CLOCK1 (END LINE)

OCLOCK (END LINE)

Use the Include key to add the words ONE, TWO, THREE, ..., NINETEEN, TWENTY, THIRTY, FORTY, FIFTY to the resident dictionary.

**Input or Key Stroke**

**Include**

ONE (END LINE)

**Include**

TWO (END LINE)

:

Repeat for the remaining number names. Then rename the entries to the corresponding numbers 1, 2, 3 ..., 19, 20, 30, 40, 50.

**Input or Key Stroke**

**Rename**

ONE (END LINE)

1 (END LINE)

:

**Program Response**

Word/phrase to speak?

Pronounces word O'CLOCK1.

Includes O'CLOCK1 in the resident dictionary.

Lists resident dictionary.

Dictionary \*

PHRASE1  
O'CLOCK1

Name above to rename?

New name?

Renames the word to OCLOCK.

**Program Response**

Word/phrase to include?

Includes the word ONE.

Word/phrase to include?

Includes the word TWO.

**Program Response**

Lists the resident dictionary.

Dictionary \*

PHRASE1  
OCLOCK  
ONE  
TWO  
:  
FIFTY

Name above to rename?

New name?

Renames ONE to 1.

Repeat for the remaining numbers, and view the results.

Input or Key Stroke	Program Response
View	Dictionary name?
* END LINE	Lists the resident dictionary.
	Dictionary *
	PHRASE1
	OCLOCK
	1
	2
	3
	4
	5
	6
	7
	8
	9
	10
	11
	12
	13
	14
	15
	16
	17
	18
	19
	20
	30
	40
	50

Include the following words and phrase, and rename them as shown, to complete the TIME file.

Input or Key Stroke	Program Response
Include	Word/phrase to include?
O2 END LINE	Includes the word O2 (variation of "o").
Include	Word/phrase to include?
A.M. END LINE	Includes the word A.M..
Rename	Lists the resident dictionary. Name above to rename?
A.M. END LINE	Newname?
AM END LINE	Renames A.M. to AM.
Include	Word/phrase to include?
P.M. END LINE	Includes the word P.M..
Rename	Lists the resident dictionary. Name above to rename?

**Input or Key Stroke**

P.M. (END LINE)

PM (END LINE)

**Include**

PAUSE10\_CHIME2) (END LINE)

**Rename**

PAUSE10 CHIME2) (END LINE)

CHIME (END LINE)

**Program Response**

New name?

Renames P.M. to PM.

Word/phrase to include?

Includes the phrase.

Lists the resident dictionary. Name above to rename?

New name?

Renames PAUSE10 CHIME2) to CHIME.

Listen to the completed file and save it on an available disc or tape under the name TIME. We use the volume .AP in this example.

**Input or Key Stroke**

**Listen**

\*ALL<\* (END LINE)

**Program Response**

Word/phrase to speak?

Lists and pronounces all resident entries.

Dictionary \*

PHRASE1

OCLOCK

1

2

3

.

.

19

20

30

40

50

02

AM

PM

CHIME

**Save**

TIME.AP (END LINE)

Y (END LINE)

Save RESIDENT dictionary under what name?

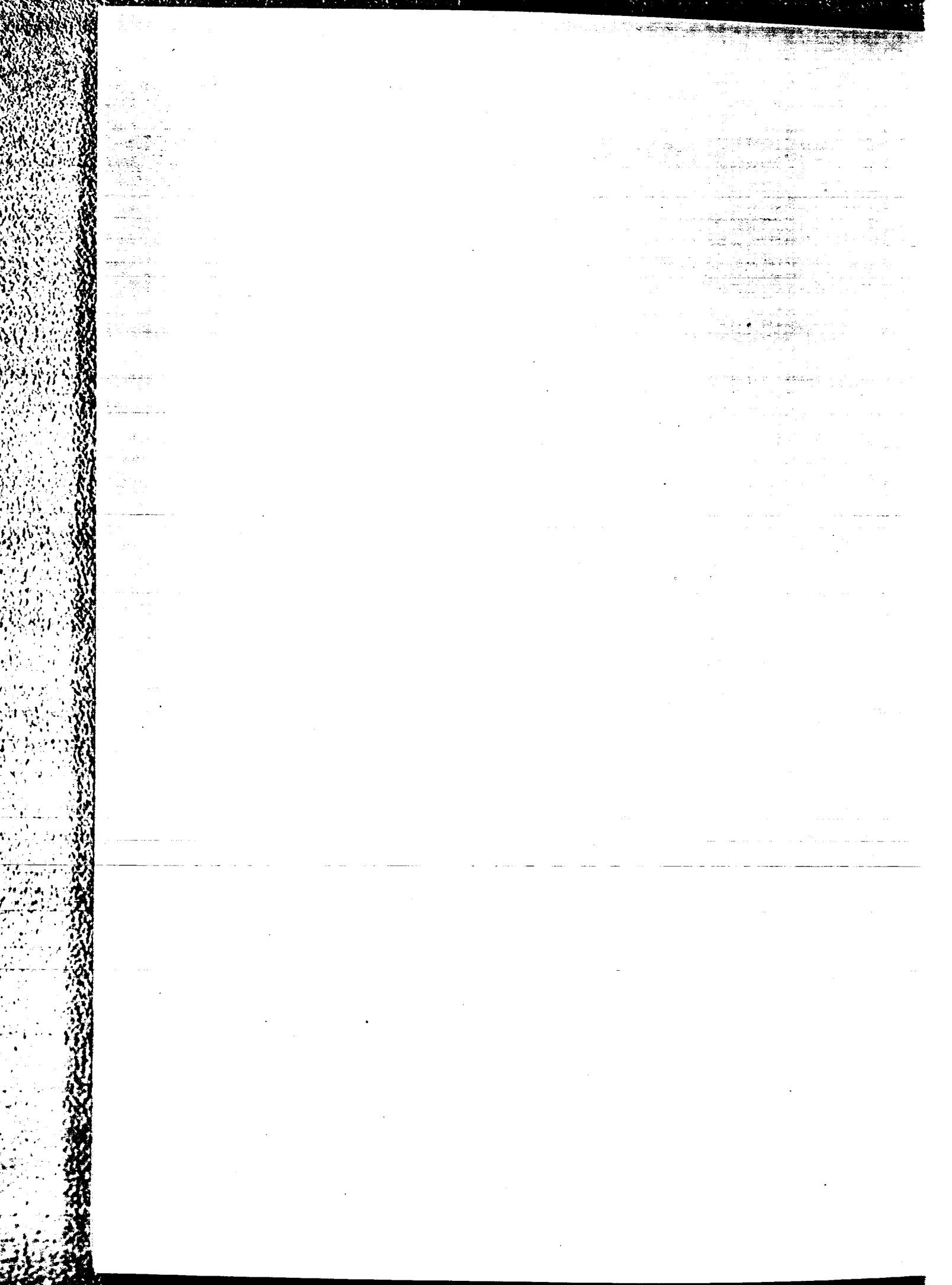
We already stored the preliminary version of this file under the name TIME.AP.

That file exists. Okay to purge it (Y/N)?

Old file is purged and the resident file is stored on the example volume .AP under the name TIME.

The TIME speech file is now complete and ready to be used with the "CLOCK" program in section 5. Continue reading in section 4 to find out how speech files, like TIME, can be used with BASIC application programs.





## Using Synthetic Speech With BASIC

In section 2 the "EDIT85" and "EDIT87" programs were used to create speech files—data files containing the speech output code. To output these files from a Series 80 BASIC program, you need the following:

- Series 80 Personal Computer.
- HP 82967A Speech Synthesis Module.
- Speech binary "SPKB85" (HP-83/85) or "SPKB87" (HP-86/87) stored on disc or tape (HP-85 only).\*
- Speech or vocabulary files stored on disc or tape (HP-85 only).
- Output speaker (eight ohms) and connecting audio cable.
- Disc drive and connecting cable or interface (not necessary if using the HP-85 tape drive).

The HP-83/85 also requires:

- HP 82936A ROM Drawer.
- One of the following ROMs: Mass Storage ROM (part number 00085-15001), Plotter/Printer ROM (part number 00085-15002), or I/O ROM (part number 00085-15003).

### Binary Program

The "SPKB85" and "SPKB87" speech binaries provide the tools to generate synthetic speech from a program written in BASIC. These tools come in the form of three statements and two functions; together, they enable you to perform two major tasks:

- Access speech and vocabulary files from mass storage.
- Output speech to the module.

A BASIC program written to output speech generally contains the following sequence of operations. Steps 3 through 6 use statements and functions provided by the speech binaries.

1. Load the binary program "SPKB85" or "SPKB87" (LOADBIN statement).
2. Open the dictionary file and assign a buffer number (ASSIGN# statement).
3. Load the dictionary file (DLOAD# statement).
4. Obtain the pronunciation parameters (PAR\$ function).
5. Set the volume level (SVOL statement). This is optional, since the volume can be set at the speech module, manually.
6. Output the pronunciation parameters to the speech module (SPEAK statement).

\* It is also possible to output speech without the binary using an I/O ROM. Refer to appendix E for details.

The speech binary also provides the LOC function, which enables you to locate a single word or phrase and load it into memory.

The statements and functions described in this section can be used in most BASIC programs to provide synthetic speech output. Some examples of BASIC speech applications are provided in section 4.

## Dictionary File Structure

To understand how the information contained in dictionary files is accessed and converted into synthetic speech, it is necessary to examine how the speech data is stored in a dictionary file.

Each dictionary file is organized into a name string, located at the beginning of the file, and a group of parameter strings.

The name string contains all the word and phrase names for the entire dictionary file. For example, the X vocabulary file name string contains the word names X, X1, X2, X3, XRAY, and XRAY1. A speech file name string might contain names like PHRASE#1, HELLO CHARLIE, and other renamed or concatenated phrases. The name string contains other information: the length of each name, the location (record number) of the parameter string, and the number of concatenations in each phrase.

The name string is organized as follows:

**Byte 1:** name length. Number of characters in the phrase name (or word name if phrase consists of a single word). Limited to a maximum of 95 (HP-83/85) or 159 (HP-86/87) characters.

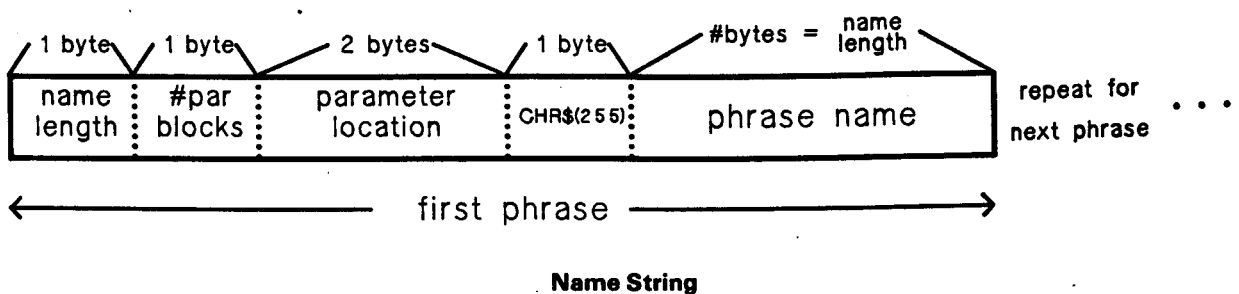
**Byte 2:** number of parameter blocks. Number of concatenations contained in the phrase. All words in the supplied vocabulary files, with the exception of PAUSE2 and PAUSE1Ø, use one parameter block. A two-word phrase (HELLO CHARLIE) uses two parameter blocks, and so on. Maximum number of parameter blocks is 254.

**Bytes 3 and 4:** parameter location. Refers to the logical record number where the parameter string for the phrase begins. This value "points" to the location, on disc or tape, of the speech code for the phrase.

**Byte 5:** search tag, CHR\$(255). The ■ character (CHR\$(255)) is used to locate a phrase in the name string (locates a single word in a vocabulary file name string). It must not appear elsewhere in the name string.

**Bytes 6 through length of name:** word/phrase name. The word(s) used to identify the phrase (or single word). Contains the number of characters specified by the name length (byte 1). Maximum value is 95 (HP-83/85) or 159 (HP-86/87).

The above pattern is repeated for each phrase or single word in the dictionary file.



Each parameter string contains the speech parameters for all the words concatenated to form one phrase. There is a one-to-one correspondence between phrase names and parameter strings in each dictionary file. Parameter strings always begin on one of the 25-byte logical record boundaries. The location of this boundary is given by the parameter location pointer in the name string.

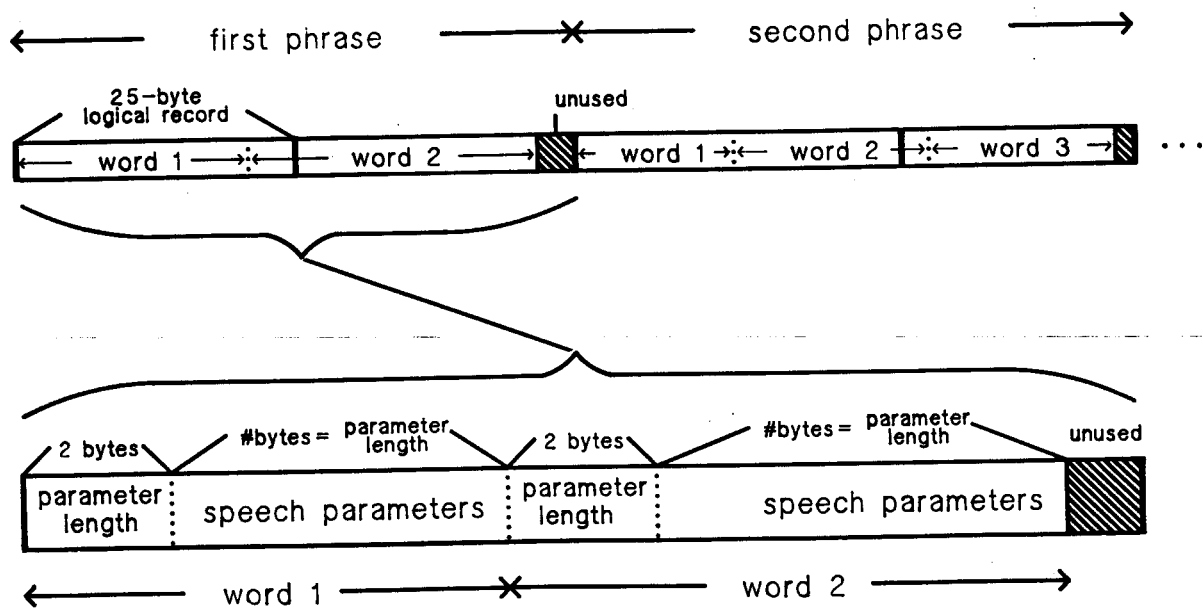
A single parameter string is organized as follows:

**Bytes 1 and 2:** parameter length. The first two bytes of a parameter string contain the length in bytes of the speech parameter set for the first word in the phrase.

**Bytes 3 through parameter length:** speech parameters. The next group of bytes (number determined by parameter length) contains the speech parameters for the first word in the phrase.

**Remaining bytes:** The next two bytes contain the parameter length for the next word in the phrase, followed by the speech parameters for the word.

The pattern is repeated for all the words in the phrase. For a single word phrase, the pattern appears only once. Words in the phrase use consecutive bytes for the parameter length and speech parameters, overlapping the 25-byte record boundaries if needed. Any bytes remaining in the 25-byte wide record behind the last word in the phrase are unused. When a dictionary is loaded into RAM, the parameter strings are packed together into a single string, removing the empty space present between parameter strings stored on disc or tape.



Parameter Strings

## Statements and Functions

Before entering any of the statements and functions described below, the speech binary must be loaded into memory. Execute

```
LOADBIN "SPKB85.SPEECH" (HP-83/85)
```

or

```
LOADBIN "SPKB87.SPEECH" (HP-86/87)
```

either as a keyboard command or from within a BASIC program before attempting to use these statements and functions.

### Loading a Dictionary (DLOAD#)

```
DLOAD# buffer number ; name string variable , parameter string variable
```

<i>buffer number:</i>	integer from 1 through 10 corresponding to the buffer assigned to the dictionary file.
<i>name string variable:</i>	string variable for dictionary file name string.
<i>parameter string variable:</i>	string variable for dictionary file parameter strings.

The DLOAD# statement loads a dictionary file into memory. The *buffer number* identifies the dictionary to be loaded, from the corresponding buffer number in a previously executed ASSIGN# statement (see the example below). The contents of the dictionary file (the name string and the set of parameter strings) are assigned to the *name string* and *parameter string variables*. All the parameter strings for the dictionary file are linked together, in order of their placement, to form a single parameter string.

DLOAD# automatically replaces record pointer numbers in the loaded copy of the name string with string pointers that reference phrase positions in the parameter string. This change of pointers is necessary so PAR\$ can locate a single phrase in the linked together parameter strings.

#### Example:

```

:
180 DIM Name$[2000],Param$[5000],Proun$[5000]
190 LOADBIN "SPKB87.SPEECH"
200 ASSIGN# 1 TO "A.SPEECH"  Opens the "A" dictionary data file, located on volume
                               ".SPEECH", and assigns it to buffer number 1.
210 DLOAD# 1 ; Name$,Param$  Loads the buffer number 1 dictionary file
                               ("A.SPEECH") and assigns the name string to the
                               variable Name$ and the parameter strings to the
                               variable Param$.
:

```

A similar example is easily constructed for the HP-83/85.

## Parameters Function

**PAR#** (*word name* , *name string variable* , *parameter string variable* )

**word name:** name of word or phrase to be pronounced.  
**name string variable:** name string for previously loaded dictionary (using DLOAD#).  
**parameter string variable:** parameter string for previously loaded dictionary (using DLOAD#).

The PAR# function returns the speech parameters to be used with the SPEAK statement. The *name string variable* and *parameter string variable* correspond to the variables in the DLOAD# statement. The string returned by the PAR# function is direct input for the SPEAK statement.

### Example:

```
80 DIM Name#[2000],Param#[5000],Proun#[5000]
90 LOADBIN "SPKB87.SPEECH"
00 ASSIGN# 1 TO "A.SPEECH"
10 DLOAD# 1 ; Name#,Param#
20 Proun# = PAR#("ATTENTION",Name#,Param#)
```

Assigns the speech parameters for the word ATTENTION to the string variable Proun#.

## Setting the Volume

**SVOL** *select code* ; *level*

**select code:** numeric expression that selects the output device for which the volume is set. The speech module is preset to select code 10.  
**level:** numeric expression that determines the volume setting. The range of values is 0 to 15, 15 being the loudest.

The SVOL statement sets the maximum volume level on the speech module. The manual volume control (on the speech module) must be turned all the way clockwise to output the maximum level. The maximum level set by SVOL remains active until the computer is turned off or the (RESET) key resets it to the default, level 15. The manual control on the module can be used to adjust the volume between the maximum and zero output levels.

### Example:

```
180 DIM Name#[2000],Param#[5000],Proun#[5000]
190 LOADBIN "SPKB87.SPEECH"
200 ASSIGN# 1 TO "A.SPEECH"
210 DLOAD# 1 ; Name#,Param#
220 Proun# = PAR#("ATTENTION",Name#,Param#)
230 SVOL 10 ; 3
```

Sets the volume on the speech module (select code 10) to level 3.

## Outputting Speech (SPEAK)

**SPEAK** *select code* ; *speech parameters*

**select code:** numeric expression that selects the speech output device. The speech module is preset to select code 10.

**speech parameters:** character string expression containing the speech parameters (assigned by PAR\$ function).

The SPEAK statement sends the speech parameters to the speech module for output. Select code 10 identifies the speech module as the output device (as it is shipped from the factory).

### Example:

```
180 DIM Name$[2000],Param$[5000],Proun$[5000]
190 LOADBIN "SPKB87.SPEECH"
200 ASSIGN# 1 TO "A.SPEECH"
210 DLOAD# 1 ; Name$,Param$
220 Proun$ = PAR$ ("ATTENTION",Name$,Param$)
230 SVOL 10 ; 3
240 SPEAK 10 ; Proun$
```

Outputs the speech parameters contained in the string Proun\$ to the speech module (select code 10).

Alternatively, the PAR\$ function may appear directly in the SPEAK statement. Line 220 and 240 can be combined into one statement:

```
240 SPEAK 10 ; PAR$ ("ATTENTION",Name$,Param$)
```

### CAUTION

It is possible to send invalid data to the speech module, causing it to lock up, using the SPEAK statement. Invalid data is any character string which cannot be identified as speech code by the module. In the event that the module locks up, it will not accept any further data. To verify that the speech module is locked up, press **RESET**. If the computer displays Error 119, the module is locked up. To restore operation of the module, you must turn the computer off, then on.

## Locate Function

**LOC** (*word name* , *name string*)

**word name:** name of word or phrase to be located and pronounced.

**name string:** dictionary file name string; must contain *word name* to be located.

The LOC function returns the mass storage record number of the parameter string for the specified word or phrase. The LOC function requires the dictionary name string for the location process; this string must

be read into memory with a READ# statement prior to using LOC. The parameter location (record number) can be used with a PRINT# statement followed by a READ# statement to locate and load an individual parameter string; the parameter string can be used with the SPEAK statement to output the word or phrase.

The LOC function provides a more efficient way of selectively loading individual words or phrases from a dictionary; only the desired parameter string(s) need be loaded. Recall that the DLOAD# statement loads the entire set of parameter strings for all the words/phrases in the dictionary. Remember, you must load the dictionary name string with a READ# statement before using the LOC function. The name string is always located at the beginning of the dictionary file.

**Note:** Do not use LOC on a name string previously loaded with DLOAD#. DLOAD# replaces the record numbers with string pointers in the name string.

**Example:**

```
380 DIM Name#[2000],Proun#[5000]
```

```
390 LOADBIN "SPKB87.SPEECH"
```

```
400 ASSIGN# 1 TO "FILE1:D701"
```

Opens the dictionary file named "FILE1" located by msus "D701".

```
410 READ# 1; Name$
```

Reads the name string from the beginning of "FILE1"; assigns it to the variable Name\$.

```
420 L = LOC ("GOOD LUCK CHARLIE",Name$)
```

Locates the parameter string for the phrase GOOD LUCK CHARLIE. Assigns record number to variable L.

```
430 PRINT# 1,L
```

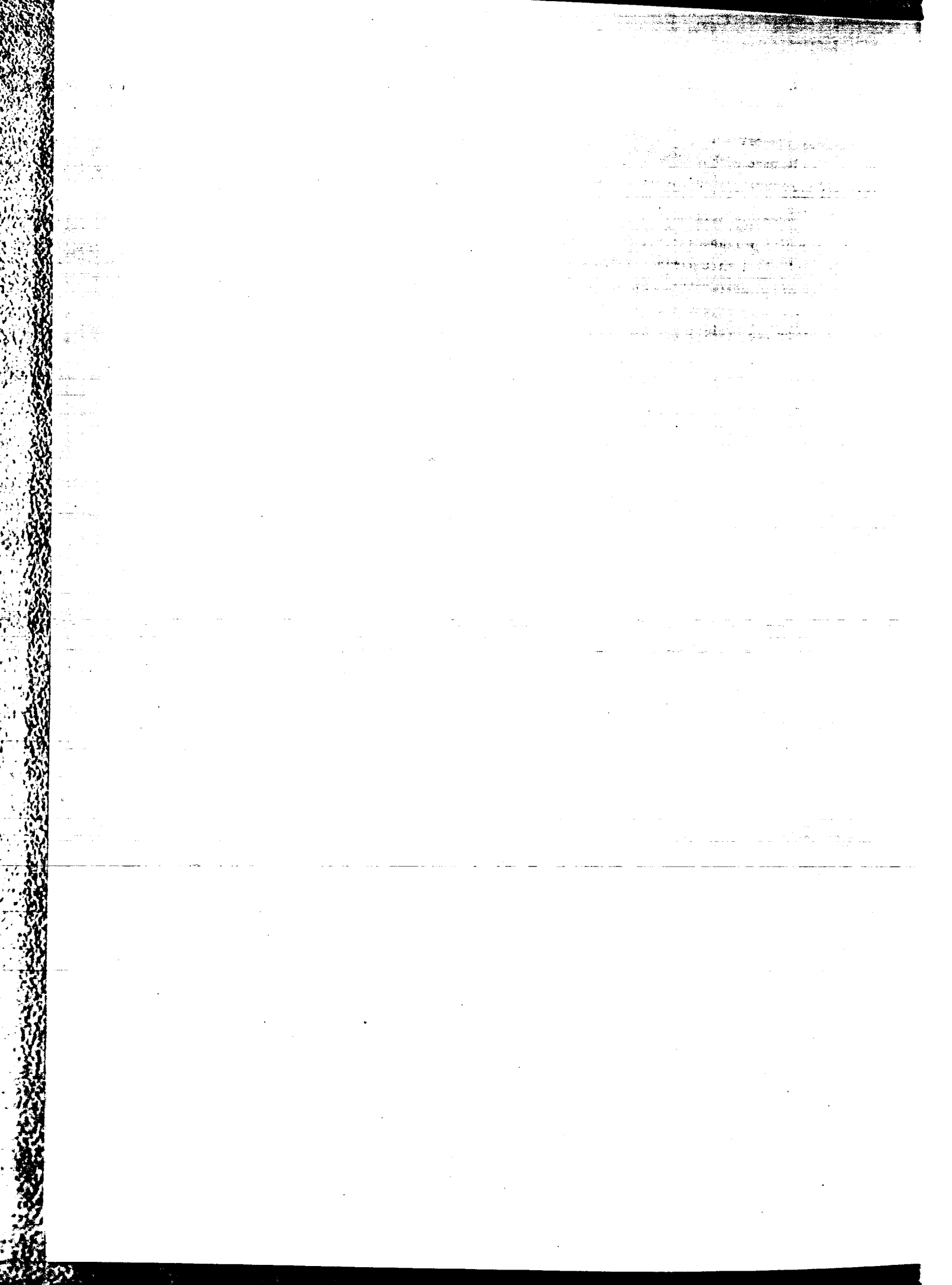
Moves the file pointer to beginning of L record.

```
440 READ# 1;Proun$
```

Reads the parameter string into the string variable Proun\$.

```
450 SPEAK 10;Proun$
```

Outputs the parameter string to the speech module.



## BASIC Speech Applications

There are two examples of speech output provided in this section. Both programs are written in BASIC and will work with any one of the Series 80 Personal Computers.

The first example is a program named "CLOCK" that speaks and displays the time every minute. It uses the "TIME" speech file created in section 3 that contains the following words/phrases:

Name	Word/Phrase
PHRASE1	AT1_THE1_TONE_THE2_TIME_WILL1_B1
OCLOCK	O'CLOCK1
1	ONE
2	TWO
3	THREE
4	FOUR
5	FIVE
6	SIX
7	SEVEN
8	EIGHT
9	NINE
10	TEN
11	ELEVEN
12	TWELVE
13	THIRTEEN
14	FOURTEEN
15	FIFTEEN
16	SIXTEEN
17	SEVENTEEN
18	EIGHTEEN
19	NINETEEN
20	TWENTY
30	THIRTY
40	FORTY
50	FIFTY
02	02
AM	A.M.
PM	P.M.
CHIME	PAUSE10_CHIME2)

The "CLOCK" program requires the Plotter/Printer ROM when used on the HP-83/85. Use the correct speech binary file name in the LOADBIN statement ("SPKB85" for the HP-83/85 or "SPKB87" for the HP-86/87). In the example, the speech file "TIME" is stored on the volume ".AP". This can be changed to the appropriate volume or msus for your application.

```

10 ! CLOCK Program
20 ! This program announces the time each minute while displaying a
30 ! digital clock on the CRT graphics display.
40 !
50 !
60 DIM A$[500],P$[5000],Z$[575],Z1$[125]
70 LET M,M1,H,T=0 @ N$,Z$,Z1$="" @ F=1
80 S=10 ! Assigns speech module select code.
90 CLEAR @ DISP "PLEASE WAIT"
100 ON ERROR GOTO 120
110 LOADBIN "SPKB87.SPEECH" ! Substitute SPKB85 for HP-83/85.
120 OFF ERROR
130 !
140 ASSIGN# 1 TO "TIME.AP"
150 DLOAD# 1 ; A$,P$ ! Load the TIME dictionary file.
160 ASSIGN# 1 TO *
170 !
180 CLEAR
190 !
200 ! Get the speech parameters for the phrase "at the tone the time will be"
210 ! and the word "o'clock."
220 !
230 Z$=PAR$ ("PHRASE1",A$,P$)
240 Z1$=PAR$ ("OCLOCK",A$,P$)
250 !
260 !
270 DISP "INPUT THE CURRENT TIME TO SET THE COMPUTER CLOCK - HOUR,MIN,AM/PM"
280 INPUT T$,M$,N$ ! T-HOUR,M-MIN,N$-AM/PM
290 T=VAL (T$) @ M=VAL (M$)
300 T=T*60 ! Convert hours to minutes.
310 T=(T+M)*60 ! Convert minutes to seconds.
320 SETTIME T,0 ! Set computer clock.
330 !
340 ! ** CALCULATE THE CURRENT TIME **
350 !
360 GRAPH
370 H=IP (TIME /3600) ! Find the current hour.
380 M=IP ((TIME -H*3600)/60) ! Find the current minute.
390 IF M=60 THEN M=0 @ H=H+1
400 IF H>12 THEN H=H-12 ! Adjust 24 hour clock to 12.
410 IF H=0 THEN H=12
420 IF H<12 THEN F=0 ! Reset AM/PM flag.
430 IF H=12 AND F=0 THEN 440 ELSE 460
440 IF N$="AM" THEN N$="PM" ELSE N$="AM"
450 F=1 ! Set flag so AM/PM will not be toggled again.
460 IF M<10 THEN M$="0"&VAL$ (M) @ M1$="02" ELSE M$=VAL$ (M) @ M1$=""
470 IF M<21 THEN M2$=VAL$ (M) ELSE M2$=VAL$ (M-IP (M/10)*10) @ M1$=VAL$ (IP (M/10)*10)
480 IF M#0 AND M1#M THEN GOSUB 520 @ GOSUB 650 ! Disp, speak the current time.
490 IF M=0 AND M1#M THEN GOSUB 520 @ GOSUB 740 ! Speak the hour.
500 GOTO 340
510 !
520 ! ** DISP TIME ON THE SCREEN **
530 !
540 GCLEAR
550 CSIZE 40,.9,0 ! Use CSIZE 19,.5,0 for the HP-83/85.
560 FOR I=1 TO 5
570 MOVE (I-1)*.2,40 ! Use MOVE (I-1)*.2,50 for the HP-83/85.
580 LABEL USING "K" ; H,"":M$
590 NEXT I
600 CSIZE 13,.7,0
610 MOVE 0,0
620 LABEL USING "K" ; "*" ;N$;" *"
630 RETURN
640 !
650 ! ** SPEAK THE TIME EACH MINUTE **
660 !
670 SPEAK S ; Z$&PAR$ (VAL$ (H),A$,P$)&PAR$ (M1$,A$,P$)&PAR$ (M2$,A$,P$)&PAR$ (N$,A$,P$)
680 SPEAK S ; PAR$ ("CHIME",A$,P$)
690 M1=M
700 RETURN
710 !
720 ! ** SPEAK THE TIME ON THE HOUR **

```

```

730 !
740 SPEAK S : Z*&PAR$ (VAL$ (H),A$,P*)&Z1*&PAR$ (N$,A$,P*)&PAR$ ("CHIME",A$,P$)
750 M1=M
760 RETURN
770 END

```

The second example program is called "SPELLBEE", a synthetic spelling bee game. "SPELLBEE" uses two speech files named "SPELL" and "MESGE". "SPELL" contains the words/phrases for the spelling bee. Any speech or vocabulary file (within the DIM limits) can be used. The "correct" spelling for the words/phrases in "SPELL" is determined by the word/phrase names in the "SPELL" file name string. The second file, "MESGE", contains some game messages to inform the player that the spelling is right or wrong.

"MESGE" contains the following phrases:

Name	Phrase
LINE1	WELCOME_TO_THE3_SPEECH_B
LINE2	RISING_WHISTLE) CONGRATULATIONS
LINE3	TONE2) WRONG__TRY_AGAIN

An example "SPELL" file is:

```

ACCELERATED
ACKNOWLEDGE
CONDUCTIVITY
LICENSE
PROFESSOR
REPRESENTATIVE
SUPERVISOR
ZULU

```

```

10 ! SPELLBEE Program
20 ! Spelling bee game program. Press [CONT] to start the clock. Enter
30 ! each word that is pronounced; to repeat the pronunciation, press
40 ! [END LINE] by itself. Time is displayed after completing all the words.
50 !
60 !
70 DIM N1$(2000),P1$(4000)
80 DIM N2$(2000),P2$(4000),W$(100),U$(100)
90 DIM N3$(2000)
100 !
110 S=10 ! Assigns speech module select code.
120 CLEAR @ DISP "PLEASE WAIT"
130 ON ERROR GOTO 150
140 LOADBIN "SPKB87.SPEECH" ! Substitute SPKB85 for HP-83/85.
150 OFF ERROR
160 ! Load the MESGE dictionary file containing the game messages.
170 ASSIGN# 1 TO "MESGE.AP"
180 DLOAD# 1 ; N1$,P1$
190 ! Load the SPELL dictionary file containing the spelling bee words.
200 ASSIGN# 2 TO "SPELL.AP"
210 DLOAD# 2 ; N2$,P2$
220 N3%=N2$
230 !
240 CLEAR
250 SPEAK S ; PAR$ ("LINE1",N1$,P1$) ! Speaks introductory message.
260 DISP "***** SPEECH BEE *****"
270 DISP USING "/,K" ; "AFTER A WORD IS PRONOUNCED, TYPE IN THE CORRECT"
280 DISP "SPELLING AND PRESS [END LINE]."
```

290 DISP "PRESS [CONT] WHEN YOU'RE READY TO BEGIN. YOU WILL BE TIMED."

```

300 PAUSE
310 !
320 ! Begin spelling bee; turn on timer.
330 !
340 SETTIME 0.0
350 L=NUM (N3%)
360 W%=N3%[6,5+L]
370 CLEAR
380 SPEAK S ; PAR$ (W%,N2$,P2$) ! Speaks spelling bee word from SPELL file.
390 DISP "SPELLING"
400 INPUT U$
410 IF U$="" THEN GOTO 370 ! Repeats word for null string input.
420 U%=UPC$ (U$)
430 IF U##W% THEN 500 ! Branches if spelling incorrect.
440 SPEAK S ; PAR$ ("LINE2",N1$,P1$) ! Speaks message for correct spelling.
450 IF LEN (N3%)=5+L THEN GOTO 530 ! Branches to end if word list is completed.
460 N3%=N3%[6+L]
470 GOTO 350 ! Repeats loop for next word in SPELL file.
480 !
490 ! Spelling is incorrect.
500 SPEAK S ; PAR$ ("LINE3",N1$,P1$) ! Speaks message for incorrect spelling.
510 GOTO 370
520 ! Spelling bee completed.
530 CLEAR
540 DISP "THAT'S ALL."
550 DISP "YOUR TIME WAS ";TIME ;" SECONDS."
560 END
```

**Notes**



## Maintenance and Service

### Maintenance

The speech synthesis module and disc do not require routine maintenance. However there are several areas of caution that you should note. They are:

#### WARNING

Do not place fingers, tools, or other foreign objects into the plug-in ports. Such actions may result in minor electric shock hazard and interference with some pacemaker devices. Damage to plug-in port contacts and the computer's internal circuitry may also result.

#### CAUTION

- Always switch off the computer and any peripherals involved when inserting or removing modules. Use only plug-in modules designed by Hewlett-Packard specifically for your computer. Failure to do so could damage the module, the computer, or the peripherals.
- If a module jams when inserted into a port, it may be upside down or designed for another computer. Attempting to force it may damage the computer or the module. Remove the module carefully and reinsert it.

#### CAUTION

Back up your speech synthesis disc, and use the back up copy for all routine speech operations. Reserve the original disc for making copies. Failure to back up the speech synthesis disc could make your system inoperative if the disc was accidentally destroyed, erased, or damaged.

### Service

If at any time you suspect that your Series 80 speech system is malfunctioning, do the following:

1. Turn the computer and all peripherals off. Disconnect all peripherals and remove any plug-in modules from the ports. Turn the computer back on. If it does not respond or displays **Error 23 : SELF TEST**, the computer requires service.
2. Turn the computer off. Install the speech module into any port, leaving all other ports empty. Turn the computer back on.
  - If **Error 119** is displayed, the speech module is malfunctioning and requires service.
  - If the cursor does not appear, the system is not operating properly. To help determine what is causing the malfunction, repeat step 2 with the speech module installed in a different port. Repeat also with different plug-in modules to determine whether an individual port or module is malfunctioning.
3. Turn the computer and all peripherals off. Check that the speech module, accessory memory modules, and ROM drawer are installed properly (the Mass Storage ROM is required for the HP-83/85 to use the dictionary editing program). Check that the disc drive is connected properly to the computer.

4. Turn on the disc drive and then your computer. Insert the speech disc into drive 0 and execute:  
CAT ".SPEECH"

5. If your computer does not respond or displays an error, mass storage is malfunctioning. Some possible errors are:

Error 110 : I/O CARD

Interface has failed self-test or has failed after interrupting the computer.

Error 111 : I/O OPER

Illegal operation.

Error 112 : M.S. ROM

Mass storage ROM has failed self-test. Refers to the plug-in HP-83/85 ROM or the internal HP-86/87 ROM.

Error 120 : NO M.S. DEVICE

No mass storage device is currently active.

Error 125 : VOLUME

The specified volume label cannot be found.

Error 129 : MEDIUM

Damaged mass storage medium.

Error 130 : DISC

Disc drive latch is open.

Error 131 : TIMEOUT

Disc drive hardware has failed.

6. Refer to Obtaining Repair Service for information on repair service for the malfunctioning device.

## Obtaining Repair Service

Not all Hewlett-Packard facilities offer service for your computer. For information on obtaining service in your area, consult the service information included in the Service Information Sheet packaged with your computer, or contact your authorized HP Series 80 dealer or the nearest Hewlett-Packard sales and service facility.

If your Speech Synthesis Module or computer requires repair, you can help assure efficient servicing by following these guidelines:

1. Leave the configuration of the computer exactly as it was at the time of the malfunction; any plug-in modules and flexible discs in use at that time should be kept in place.
2. Write a description of the malfunction symptoms for service personnel.
3. Save printouts or any other materials that illustrate the problem.
4. Have on hand a sales slip or other proof of purchase to establish warranty coverage period.

## Serial Number

Each Series 80 computer carries an individual serial number plate on the rear panel. We recommend that owners keep a separate record of this number. Should your unit be lost or stolen, the serial number is often necessary for tracing and recovery, and for any insurance claims.

Hewlett-Packard does not maintain records of individual owners of Series 80 computers and unit serial numbers.

## General Shipping Instructions

Should you ever need to ship your computer, be sure it is packed in a protective package to avoid in-transit damage. Use the original shipping case if possible. Shipping damage is not covered by the warranty. All customs and duties are the customer's responsibility.

Hewlett-Packard recommends that the customer always insure shipments.

## Warranty Information

The complete warranty statement is included in the information packet shipped with the HP 82967A Speech Synthesis Module. Please retain this statement for your records.

If you have any questions concerning this warranty, please contact:

**In the U.S.:** One of the six Field Repair Centers listed on the Service Information Sheet packaged with your owner's documentation.

**In other countries:** Contact your nearest sales and service facility. If you are unable to contact that facility, please contact:

**In Europe:**

Hewlett-Packard  
7, rue du Bois-du-Lan  
P.O. Box  
CH-1217 Meyrin 2  
Geneva  
Switzerland

Tel. (22) 82 70 00

**Other countries:**

Hewlett-Packard Intercontinental  
3495 Deer Creek Rd.  
Palo Alto, California 94304  
U.S.A.

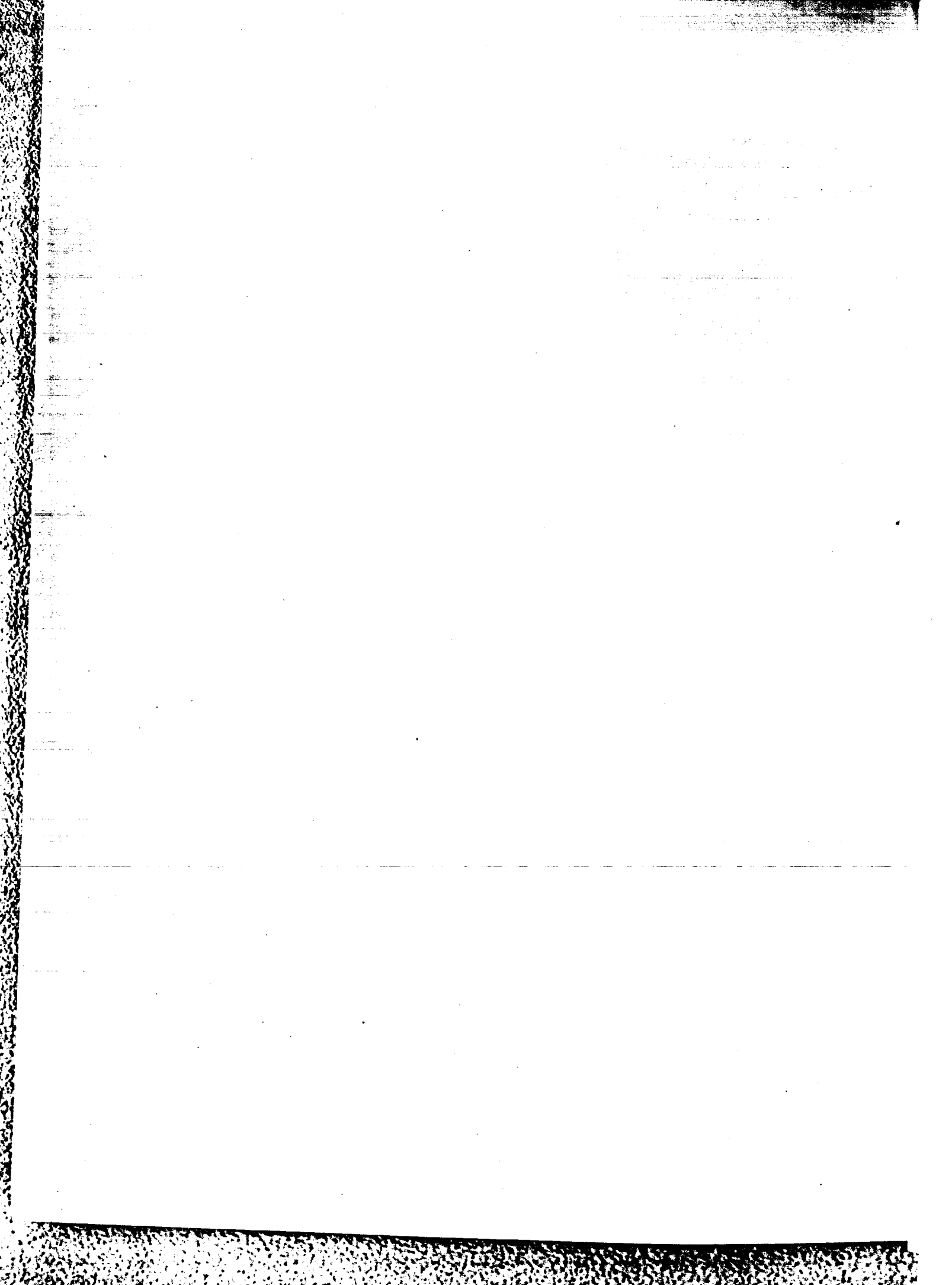
Tel. (415) 857-1501

## Potential for Radio/Television Interference

The Speech Synthesis Module uses radio frequency energy and may cause interference to radio and television reception. The module has been type-tested and found to comply with the limits for a Class B computing device in accordance with the specifications in Subpart J of Part 15 of the FCC Rules. These specifications provide reasonable protection against such interference in a residential installation. However, there is no guarantee that interference will not occur in a particular installation. If the module does cause interference to radio or television, you can try to eliminate the interference problem by doing one or more of the following:

- Change the position of the audio cable that connects the speech module to the output speaker.
- Reorient the receiving antenna.
- Change the position of the computer with respect to the receiver.
- Move the computer away from the receiver.
- Plug the computer into a different outlet so that the computer and the receiver are on different branch circuits.

If necessary, consult an authorized HP dealer or an experienced radio/television technician for additional suggestions. You may find the following booklet, prepared by the Federal Communications Commission, helpful: *How to Identify and Resolve Radio-TV Interference Problems*. This booklet is available from the U.S. Government Printing Office, Washington, D.C. 20402, Stock No. 004-000-00345-4.



## Speech Vocabulary

The following list contains all the words in the A through Z vocabulary files. The number appearing to the right of each word, in parentheses, is the length of the parameter string (in bytes) for that word.

A (110)	AGAIN (138)	ANSWER (122)
A1 (43)	AGAIN1 (119)	ANSWERED (85)
A2 (48)	AHEAD (131)	ANTE UP (127)
A3 (41)	AIR (112)	APPOINTMENT (149)
A.M. (97)	AIR1 (66)	APPROACH (127)
A.M.1 (168)	AIR BRAKES (155)	APPROACHES (167)
ABEAM (132)	AIRCRAFT (142)	APPROVED (151)
ABORT (108)	AIRPORT (110)	APRIL (92)
ABORT1 (131)	AIRSPEED (144)	APU (206)
ABOUT (95)	ALARM (143)	ARE (60)
ABOVE (104)	ALERT (117)	AREA (85)
AC (104)	ALERT1 (82)	AREA1 (98)
ACCELERATED (173)	ALERT2 (90)	ARRIVAL (155)
ACCEPT (122)	ALERT3 (106)	AS (119)
ACCEPT (75)	ALIEN (74)	AS1 (61)
ACCEPTED (134)	ALL (107)	ASKED (95)
ACCEPTED1 (117)	ALL1 (57)	ASSOCIATED (164)
ACCESS (115)	ALL2 (60)	ASTERISK (152)
ACCESSING (137)	ALOFT (121)	AT (49)
ACCOUNT (149)	ALPHA (102)	AT1 (60)
ACCOUNT1 (106)	ALTERNATE (136)	ATIS (87)
ACE (61)	ALTIMETER (153)	ATTACK (83)
ACES (106)	ALTITUDE (157)	ATTENTION (136)
ACKNOWLEDGE (172)	AM (118)	ATTENTION1 (118)
ACTION (104)	AMERICAN EXPRESS (229)	AUGUST (121)
ADD (104)	AMOUNT (135)	AUTHORIZATION (193)
ADDRESS (138)	AMOUNT1 (135)	AUTHORIZATION1 (192)
ADJUST (99)	AMPS (61)	AUTO (73)
ADSORBER (147)	AN (91)	AUTOMATIC (128)
ADVISE (140)	AN1 (48)	AUTOMATIC1 (123)
AERIAL (135)	AND (129)	AUTOMATICALLY (168)
AFFIRMATIVE (182)	AND1 (89)	AUXILIARY (152)
AFTER (103)	AND2 (107)	AVAILABLE (147)
AFTERNOON (156)	AND3 (73)	AVAILABLE1 (160)
B (52)	BASE1 (62)	BETWEEN (94)
B1 (78)	BASKET (83)	BID (98)
BACK (82)	BAT HITTING BALL > (49)	BIG (89)
BAD (118)	BATTLE (80)	BIRTH (63)
BALANCE (104)	BEEN (91)	BLIND (97)
BALL (63)	BEFORE (163)	BLOCKED (62)
BALL BEING CAUGHT > (42)	BEGIN (142)	BLOWING (126)
BAND (123)	BEHIND (176)	BONUS (83)
BANDIT (116)	BEING (110)	BOOKLET (78)
BANK (86)	BELL (57)	BOOST (62)
BANK1 (99)	BELOW (126)	BOTH (86)
BASE (51)	BET (42)	BOTTOM (66)

BOX (71)  
BRAKE (90)  
BRAKING (115)  
BRAVO (82)  
BREAK (70)  
BROKEN (97)  
BUFFER (106)

BUGLE CALL (1469)  
BUILD (116)  
BUS (55)  
BUSINESS (106)  
BUSINESS1 (111)  
BUSY (96)  
BUSY1 (90)

BUT (63)  
BUTTON (69)  
BUTTON1 (85)  
BUTTON2 (51)  
BY (112)

C (93)  
C1 (68)  
C2 (81)  
CABIN (110)  
CALENDAR (124)  
CALIBRATE (118)  
CALL (101)  
CALL1 (80)  
CALL2 (111)  
CALL3 (102)  
CALL4 (62)  
CALL5 (102)  
CALL6 (86)  
CALL7 (89)  
CALL8 (122)  
CALL9 (100)  
CALLING (92)  
CALM (122)  
CAN (111)  
CANCEL (72)  
CANCEL1 (133)  
CANCEL2 (111)  
CANCELLED (143)  
CANNOT (77)  
CAPACITANCE (160)  
CAR (56)  
CARD (90)  
CARD NUMBER (184)  
CARDHOLDER (185)  
CARDS (116)  
CARTE BLANCHE (136)  
CASING (127)  
CAUTION (93)  
CAUTION1 (113)  
CEILING (107)  
CELSIUS (176)

CENT (103)  
CENT1 (92)  
CENTER (85)  
CENTER1 (124)  
CENTI (105)  
CENTS (124)  
CENTS1 (104)  
CHANGE (107)  
CHANGED (112)  
CHARLIE (83)  
CHARLIE1 (100)  
CHECK (58)  
CHECK1 (54)  
CHECK2 (53)  
CHIME1 (78)  
CHIME2 (42)  
CHOICE (100)  
CIRCUIT (93)  
CLEAN (109)  
CLEAR (102)  
CLEAR1 (93)  
CLEARANCE (116)  
CLEARANCE DELIVERY (248)  
CLIMB (116)  
CLOCK (79)  
CLOCK1 (68)  
CLOSE (143)  
CLOSED (129)  
CLOSED1 (124)  
CODE (110)  
CODE1 (100)  
COIN (117)  
COIN1 (90)  
COLD (1109)  
COLLECT (82)  
COLLECT1 (92)

COME (69)  
COMMAND (163)  
COMPANY (114)  
COMPLETE (108)  
COMPLETE1 (107)  
COMPONENT (169)  
COMPUTER (157)  
CONDUCTIVITY (174)  
CONFERENCE (165)  
CONGRATULATIONS (167)  
CONGRATULATIONS1 (202)  
CONNECT (79)  
CONTACT (124)  
CONTAMINATED (181)  
CONTINUE (151)  
CONTROL (170)  
CONTROL1 (120)  
CONVERGING (156)  
COPY (73)  
CORRECT (103)  
COUNT (87)  
COURSE (78)  
COURT (68)  
COWL (97)  
CRANE (86)  
CRANE1 (85)  
CREASE (102)  
CREDIT (69)  
CROSS (109)  
CROSSWIND (156)  
CROWD NOISE (237)  
CRYSTALS (98)  
CURRENT (93)  
CUSTOMER (93)  
CYCLE (80)  
CYCLE1 (105)  
CYLINDER (127)

D (118)  
D' (34)  
D1 (87)  
D2 (54)  
DANGER (136)  
DANGER1 (85)  
DANGER2 (149)  
DATE (82)  
DATE1 (65)  
DAY (95)  
DAY1 (75)  
DAYS (68)

DC (110)  
DEATH (57)  
DECEMBER (132)  
DECLINED (179)  
DECREASE (111)  
DECREASING (165)  
DEFENSE (93)  
DEGREE (136)  
DEGREES (85)  
DELTA (85)  
DELTA1 (93)  
DELTA2 (85)

DEMONSTRATION (168)  
DENIED (124)  
DEPARTMENT (135)  
DEPARTURE (136)  
DEPARTURE1 (150)  
DEPOSIT (144)  
DESTROY (99)  
DESTROYED (143)  
DESTROYED1 (123)  
DETAILS (117)  
DETERGENT (159)  
DEVICE (80)

DIAL (95)  
 DIAL1 (95)  
 DIFFICULTIES (142)  
 DIGITAL (109)  
 DIGITS (113)  
 DIMENSION (126)  
 DINER'S CLUB (203)  
 DINNER (78)  
 DIRECTION (112)  
 DIRECTORY (133)  
 DIRECTORY1 (120)  
 DISK (104)  
 DISPENSER (132)  
 DISPLAY (93)

DISPLAY1 (143)  
 DISTANCE (109)  
 DISTRIBUTION (167)  
 DIVIDED (110)  
 DO (48)  
 DO1 (83)  
 DO2 (81)  
 DOCUMENT (116)  
 DOES (119)  
 DOLLAR (92)  
 DOLLAR1 (202)  
 DOLLARS (148)  
 DOOMSDAY DEVICES (247)  
 DOOR (77)

DOORS (134)  
 DOUBLE (65)  
 DOUBLE1 (75)  
 DOWN (89)  
 DOWN1(82)  
 DOWN2 (92)  
 DOWNWIND (151)  
 DRAIN (121)  
 DRIVE (163)  
 DRIVER'S (109)  
 DRIZZLE (101)  
 DUPLICATE (117)  
 DUST (90)

E (91)  
 E1 (110)  
 E2 (56)  
 EACH (87)  
 EARLY (94)  
 EAST (68)  
 EAST1 (104)  
 ECHO (68)  
 ED' (60)  
 EDITING (113)  
 EIGHT (66)  
 EIGHT1 (78)  
 EIGHT2 (66)  
 EIGHT3 (63)  
 EIGHTEEN (114)  
 EIGHTH (64)  
 EIGHTH1 (77)  
 EIGHTS (77)  
 EIGHTY (84)  
 ELECTRICIAN (106)  
 ELECTRONIC (170)  
 ELEVATION (181)

ELEVEN (125)  
 ELEVEN1 (98)  
 ELEVEN2 (124)  
 ELSE (99)  
 EMERGENCY (160)  
 EMERGENCY1 (201)  
 EMPTY (86)  
 EN ROUTE (141)  
 END (123)  
 END1 (91)  
 ENEMY (91)  
 ENEMY1 (75)  
 ENGINE (134)  
 ENTER (96)  
 ENTER1 (54)  
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X3 (37)  
XRAY (102)  
XRAY1 (123)

Y (145)  
Y1 (124)  
Y2 (68)  
Y3 (73)  
YANKEE (101)  
YARD (89)  
YEAR (129)

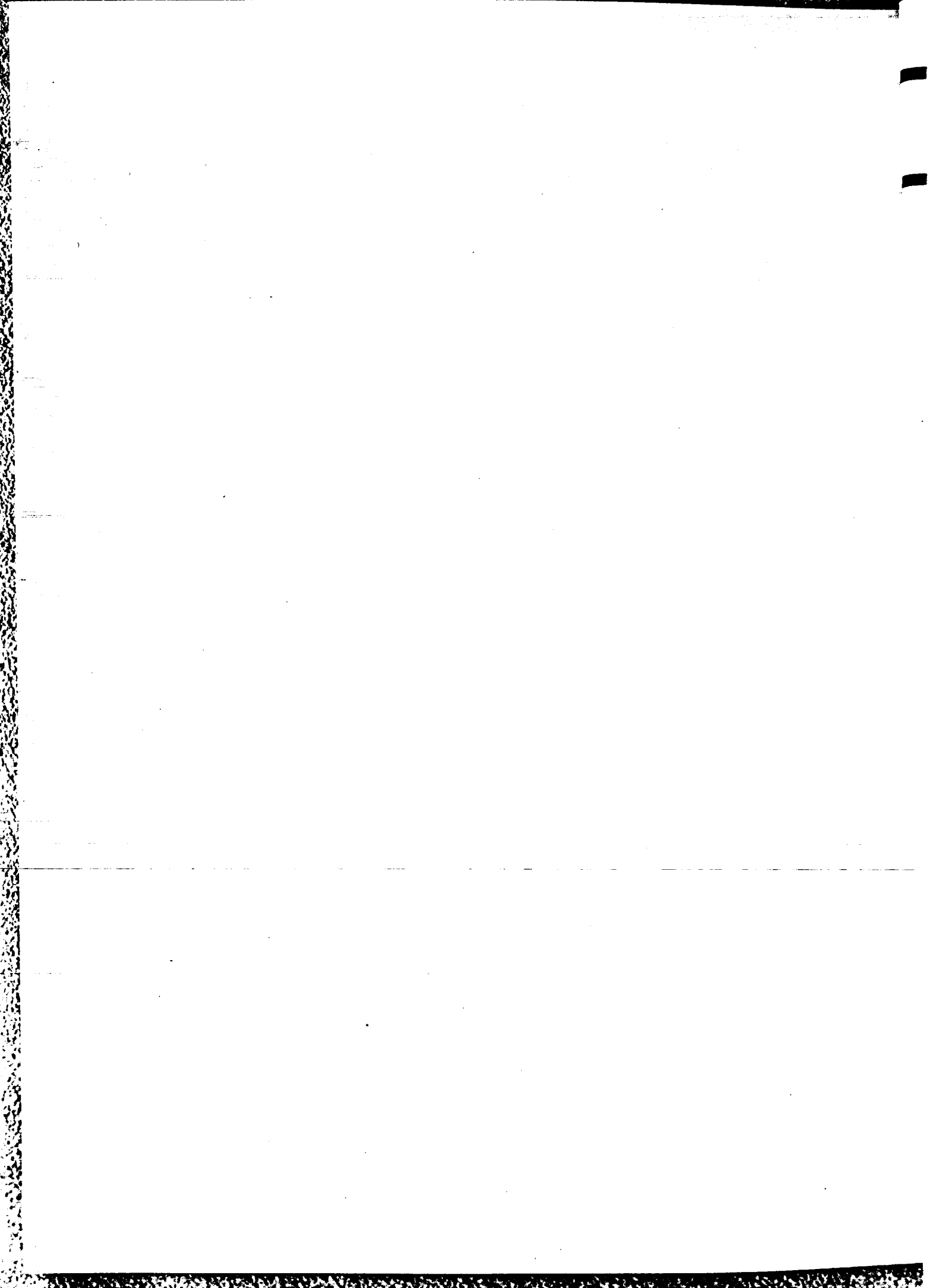
Z (28)  
Z1 (170)  
Z2 (53)  
ZERO (79)  
ZERO1 (135)

YELLOW (154)  
YELLOW1 (91)  
YELLOW2 (84)  
YES (109)  
YESTERDAY (153)  
YOU (73)  
YOU HAVE MAIL (253)

ZERO2 (79)  
ZERO3 (102)  
ZERO4 (126)  
ZERO5 (136)  
ZERO6 (79)

YOU1 (60)  
YOUR (150)  
YOUR NUMBER IS (301)  
YOUR1 (104)  
YOUVE (134)

ZEROS (103)  
ZONE (81)  
ZONE1 (134)  
ZULU (75)



## Speech Syntax Summary

### Syntax Guidelines

The syntax for speech statements and functions is presented in the same manner as syntax for BASIC statements and commands. The following conventions apply:

- DOT MATRIX** Items in **DOT MATRIX** are keywords that must be entered exactly as shown, except that lowercase letters may be substituted for uppercase letters.
- []** Brackets are used to enclose optional items.
- italics* Items in *italics* are numeric and string expressions that must be included in the statement (unless enclosed by brackets).
- stacked items* When *items* are placed one above the other, one and only one must be chosen.
- ... An ellipsis placed after an item or a series of items enclosed by brackets indicates that the item or the contents of the brackets may be repeated.

## Dictionary Editing Keys

The table below summarizes the available input options for each special function key in the BASIC "EDIT85" and "EDIT87" programs. An "X" in the box signifies that this is a valid input for the indicated key.

Dictionary Editing Key Inputs

Input	View	Listen	Include	Delete	Rename	Save	Get
<b>END LINE</b>	X	X	X	X	X	X	X
*CAT	X						
*ALL	X			X			
*	X						
<i>vocabulary file specifier</i>	X						X
<i>speech file specifier</i>	X					X	X
<i>phrase name</i> [ <i>&lt; dictionary file specifier</i> ] [ <i>phrase name</i> [ <i>&lt; dictionary file specifier</i> ]... ] <i>word name</i> [ <i>&lt; dictionary file specifier</i> ] [ <i>_ word name</i> [ <i>&lt; dictionary file specifier</i> ]... ]							
		X	X				
*ALL <i>&lt; dictionary file specifier</i>		X	X				
<i>&lt; dictionary file specifier</i>		X	X				
<i>phrase name</i> <i>word name</i>		X*	X*	X	X		
<i>phrase name1 , phrase name2</i> <i>word name1 , word name2</i>		X*	X*	X			
<i>vocabulary file specifier , S</i>							X
<i>speech file specifier , S</i>							X

\* Follows *< dictionary file specifier* input.

## Binary Functions

PAR# (*word name* , *name string variable* , *parameter string variable*)

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LOC (*word name* , *name string*)

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## Binary Statements

DLOAD# *buffer number* ; *name string variable* , *parameter string variable*

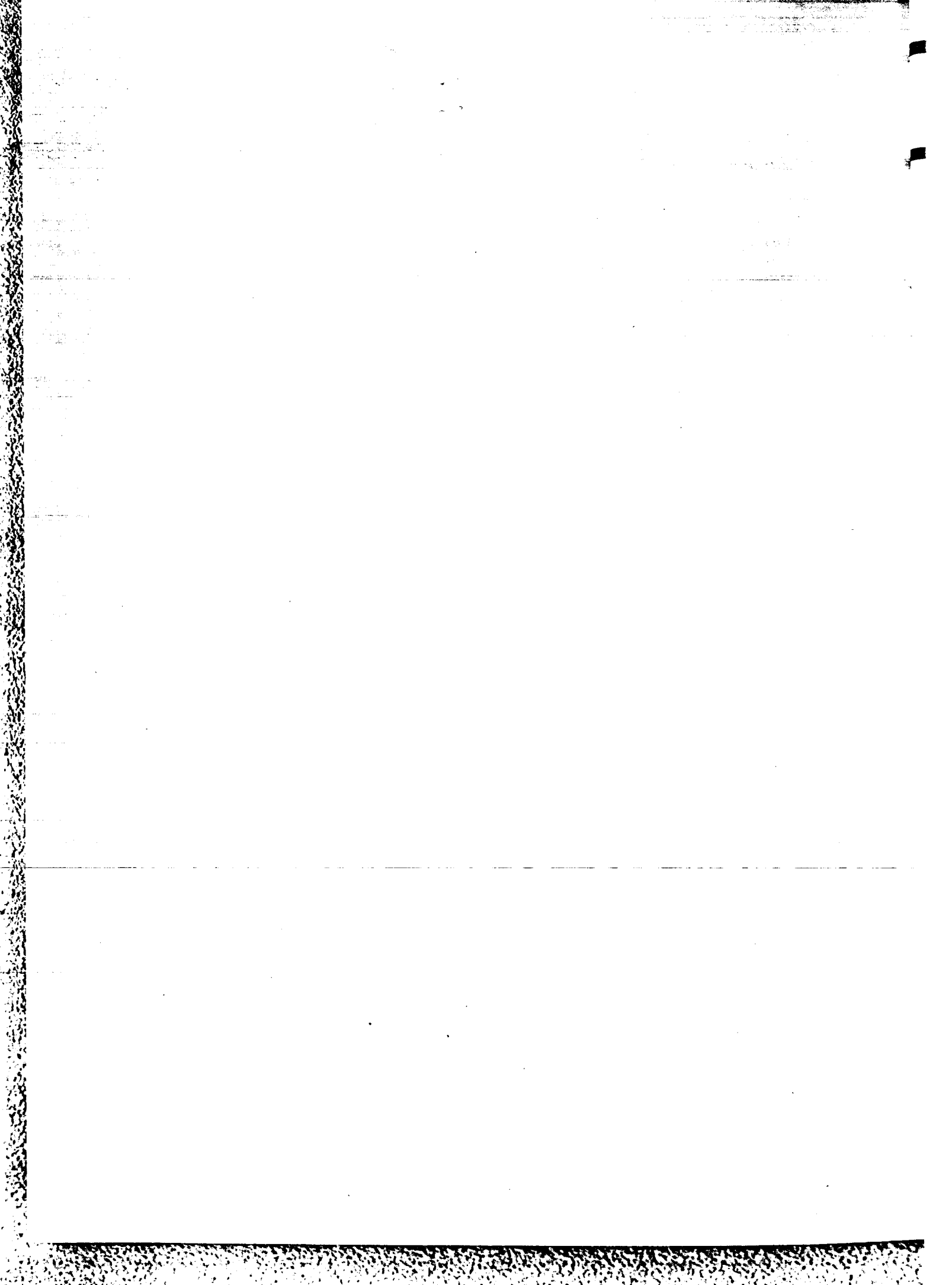
Page 52

SPEAK *select code* ; *speech parameters*

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SVOL *select code* ; *level*

Page 53



## Dictionary Editing Error Messages

Message	Condition
Error 19 on line 90 : MEM OVF	Available memory is not sufficient for DIM statement (line 90). More memory must be added to the system, or the DIM parameters must be altered.
Dictionary <i>file</i> <i>specifier</i> not found	Vocabulary or speech file cannot be found. Check that the file exists on the disc being accessed.
No RESIDENT entries	Resident dictionary file is empty. Note that the resident file is erased whenever (RUN), (RESET), or (INIT) is pressed, or the dictionary editing program is altered.
Word <i>name</i> not found	Selected word cannot be found. Make sure that the spelling and punctuation of the word matches what is shown in the dictionary file. Check that the proper dictionary is accessed.
Size limits exceeded	Number of words concatenated exceeds 254. To correct, delete words from the phrase to reduce the number of concatenations to 254.
String overflow on line number	The available memory is insufficient to add the selected phrase or dictionary to the resident file. Select a smaller phrase/dictionary or add memory to the system. The dimension statement in line 90 must be revised to access additional memory.
That file exists. Okay to purge it (Y/N)?	Attempt to save a file under an existing file name. If you wish to use the name, enter Y or N; enter any other character to select another name.
Insufficient mass storage	Insufficient space on the disc to store the resident file. Use another disc, or pack the one in use and repeat the save operation.
Dictionary name size exceeded	Dictionary file name limit is 17 characters (includes <i>msus</i> or <i>volume label</i> )
Illegal use of < or _	Underline may not precede or follow <.
No deletions, <i>name</i> appears more than once	Delete function has been cancelled because there is more than one occurrence of the word/phrase name to be deleted. Use the rename function to rename duplicate entries.
Error number on line number	Refers to an error condition originating from your computer. Refer to your computer's owner's manual for an explanation of the specific error.

Speech module not  
found...

Speech module is not located at specified select code. Check that the module is installed and the variable S1 in line 100 of "EDIT87" or "EDIT85" is assigned the correct value.

Missing binary  
program...

"SPKB85" or "SPKB87" cannot be located at the current volume/msus assigned in line 121 of "EDIT85" or "EDIT87". Check that the program is located at the specified volume/msus.

Volume *.volume label/msus*  
not found...

Specified mass storage volume or msus cannot be located.

Cannot chain to CH85...

Error for the HP-83/85 only. The "CH85" program cannot be loaded from the current volume/msus as specified in line 121 of "EDIT85".





## Setting the Module Select Code

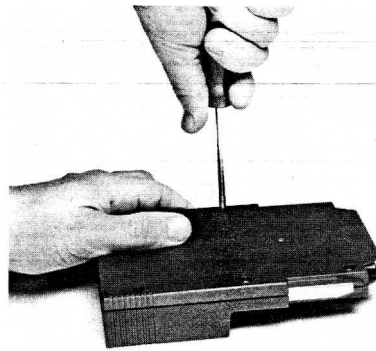
### Disassembling the Speech Module

#### CAUTION

Before disassembling the module, ensure that you have taken adequate precautions regarding electrostatic protection. You should not touch IC's immediately after quickly moving across a rug, for example. It is a good idea to touch a grounded object before performing the procedures listed below. If a grounded workbench is available, you should use it.

Figure D-1 on page 88 illustrates how parts of the speech module are assembled. Refer to figure D-1 as you read through the disassembly procedure.

1. Place the speech module on a flat surface with the bottom cover facing up and the thicker part to the left.
2. Use a Pozidriv® screwdriver to remove the screws holding the top and bottom housings together. Notice that the two screws holding the thicker end together are longer than the other four. Set the screws aside.



3. Hold the speech module parts together as you carefully turn it over so that the top housing is facing up and the thick portion is still to the left.
4. Lift the top housing to expose the speech module printed-circuit assembly.

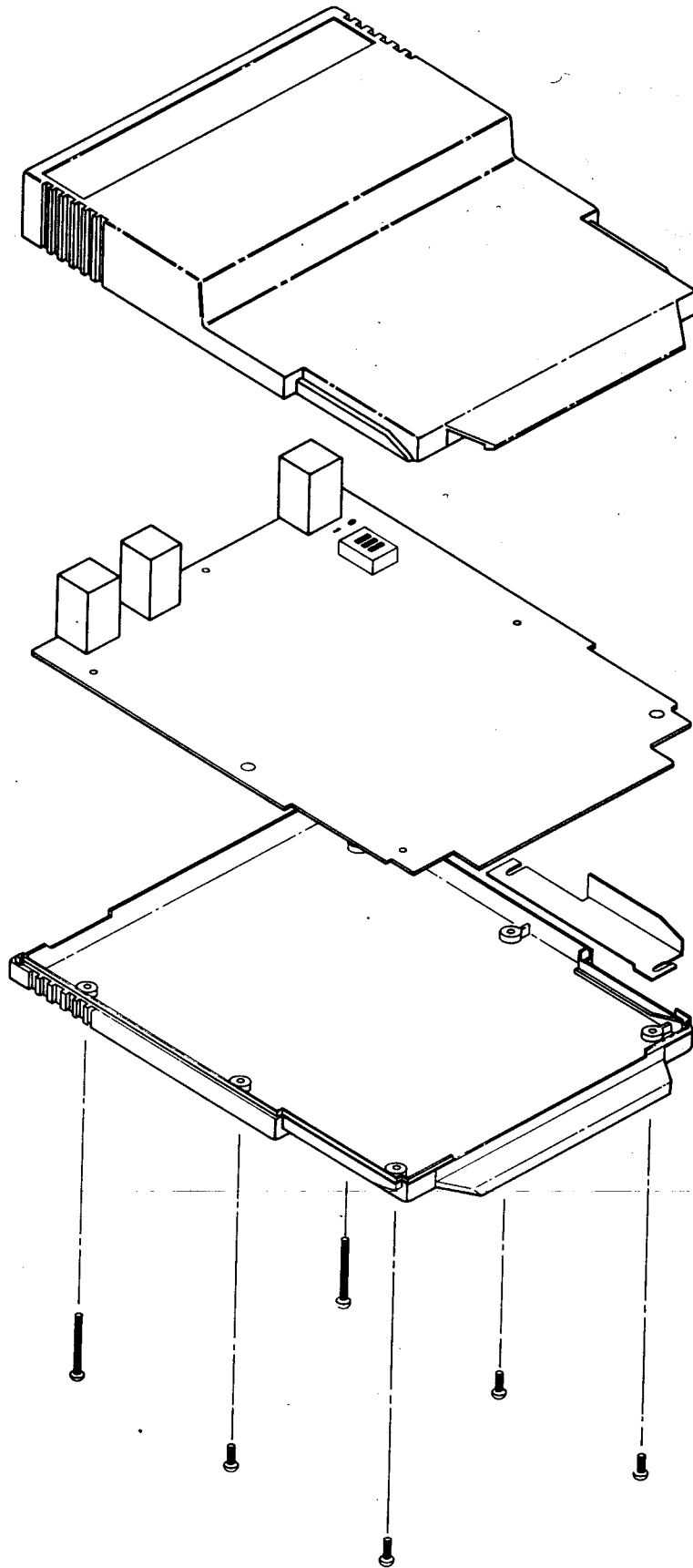
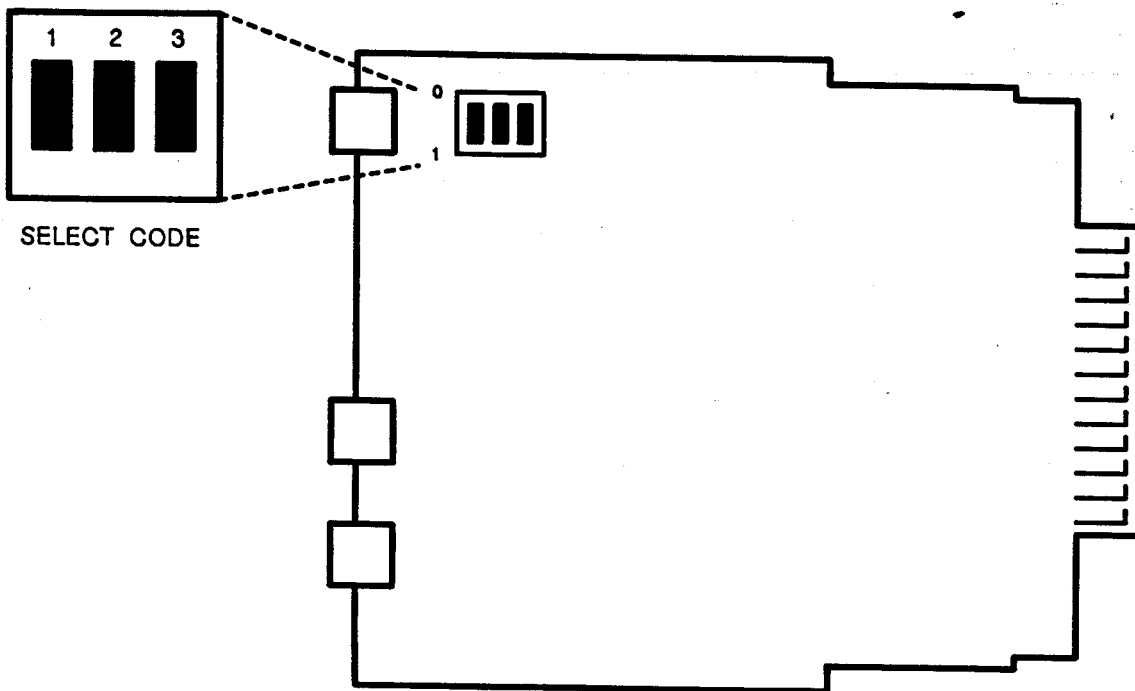


Figure D-1. Disassembly

## Module Select Code Switches

The bank of three switches inside the speech module allows a choice of eight select codes. Each of the three switch segments can be set independently to the 1 or 0 position. These positions are marked on the printed-circuit board. The select code was preset to 10 at the factory by setting the switch segments to the positions shown in figure D-2. You can change the select code to any integer from 3 through 10 by changing switch segments 1, 2, and 3, according to the table in figure D-2.



SELECT CODE	Segment	Segment	Segment
	1	2	3
3	0	0	0
4	0	0	1
5	0	1	0
6	0	1	1
7	1	0	0
8	1	0	1
9	1	1	0
Preset 10	1	1	1

Figure D-2. Speech Module Select Code Switch Assignments

**Note:** If you reset the select code, make sure you change the proper switch segments. Use an instrument small enough to change one switch setting at a time without disturbing adjoining switch segments. The small tip of a pencil or similar object is recommended for this purpose. Failure to set switch segments properly will produce an unexpected module select code and erroneous results.

## Reassembling the Speech Module

To reassemble the speech module, reverse the procedure for disassembly. Before replacing the top housing, be sure the printed-circuit assembly is correctly positioned in the bottom housing. The metal strip that is exposed on the outside of the module is the ground contact. The ground contact should be seated between the printed-circuit assembly and the bottom housing, and in the upper right-hand corner when the module is oriented as described for changing the switch segments.

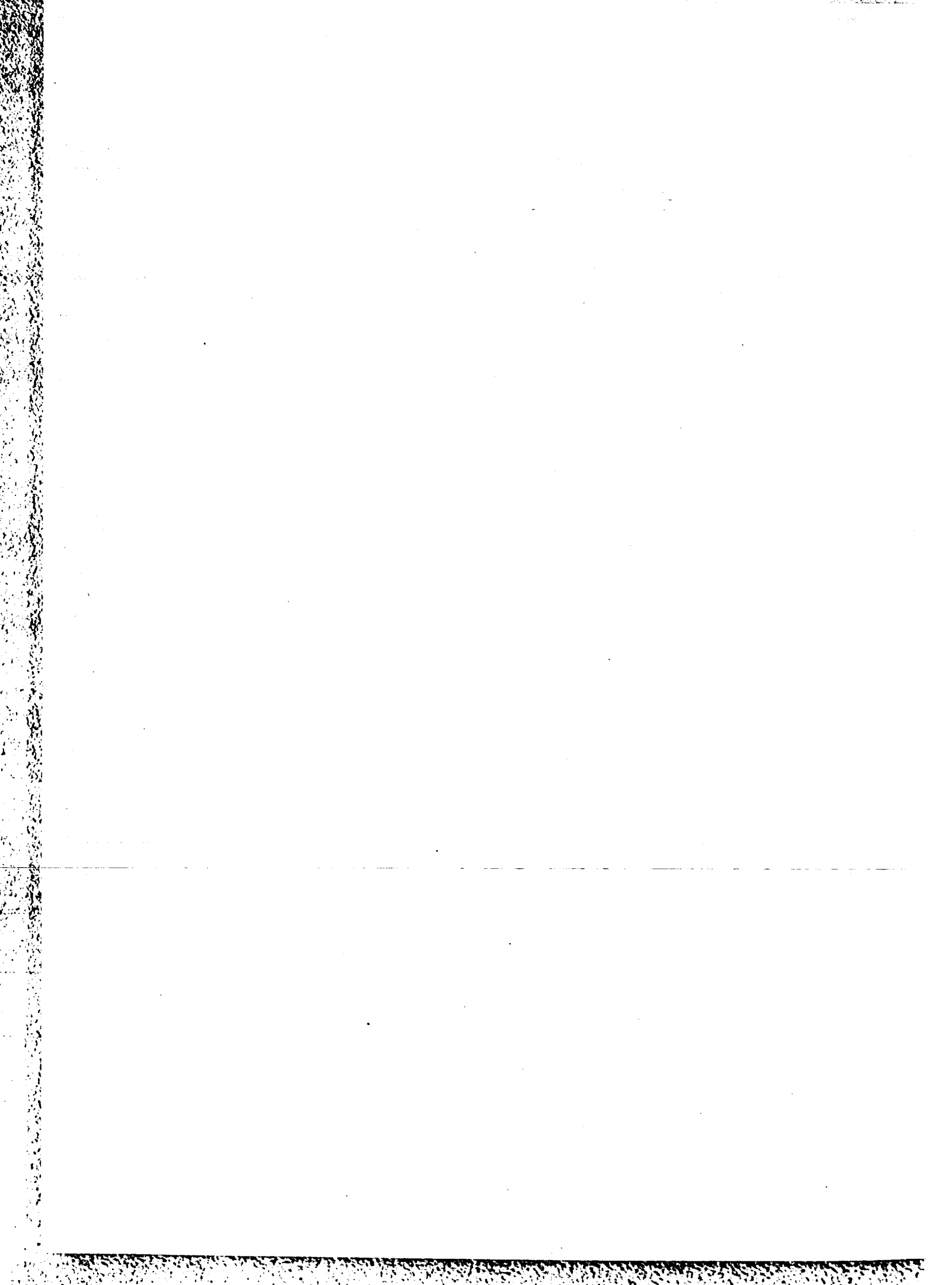
## Dictionary Editing Select Code

The dictionary editing programs were written to output speech code to the module at select code 10. If you change the switch settings as described in this appendix, you must also change the select code assignment in the dictionary editing program. The select code of the speech module is assigned in line 100 of "EDIT87" (for the HP-86/87) and "EDIT85" (for the HP-83/85):

```
100 S1=10
```

Enter the new select code (integer 3 through 10) and store the new version of "EDIT87" or "EDIT85", if desired, for future use. Remember also in your BASIC speech applications programs, that the select code parameter in the SPEAK and SWOL statements must match the select code for the speech module.





## I/O ROM Statements for Speech Output

In applications where it is not desirable to use the "SPKB85" or "SPKB87" binaries, the I/O ROM can be used to output speech code and read or write to speech module control registers.

The material in this appendix is a brief overview of I/O ROM statements as they apply to synthetic speech. For a more complete discussion of the I/O ROM, refer to the *Series 80 I/O Programming Guide*.

In addition to the I/O ROM discussion, there is an example of how to load a dictionary file (from tape or disc) and locate speech parameters using BASIC statements instead of the binary `DLOAD#`, `PAR#`, and `LOC` routines.

### Status and Control Registers

There are four accessible registers on the HP 82967A Speech Module, identified by the register numbers 0, 1, 2, and 3. Registers 0 and 1 are available for status information; registers 1, 2, and 3 are control registers.

**Status register 0:** module identification. This register contains the HP 829678A Speech Module identification number, equal to 7.

**Status/control register 1:** read/write module volume level. This register provides a means of controlling the maximum volume level on the speech module. A value of 15 sets the volume to the maximum level; 0 sets the volume to a minimum. At reset, the module defaults to volume level 15. The highest order 4 bits are ignored.

**Control register 2:** speech chip reset. When the value 0 is sent to register 2, the TMS 5220 speech chip is reset. This operation is sometimes necessary when the module has been sent invalid data (data that cannot be interpreted as valid speech code), causing it to lock up. If the control register 2 reset does not restore output capability to the module, the computer must be turned off, then on (power-on reset to the module).

**Control register 3:** speech module test tone. When the value 0 is sent to register 3, the speech module outputs a tone indicating that it is functioning normally.

### Reading Status Registers

Status information is obtained through the I/O ROM `STATUS` statement:

```
STATUS select code , register number ; numeric variable
```

***select code:*** numeric expression that selects the module for the status enquiry. Range of values is 3 through 10. The speech module is preset to select code 10.

***register number:*** a numeric expression that evaluates to an integer. Valid status registers for the speech module are 0 and 1.

***numeric variable:*** any numeric variable intended as a destination for the status information.

The STATUS statement could be used to:

- Check that the speech module is set to a certain select code, by looking for the identification number 7 in register 0 at that select code.
- Check the current volume level.

#### Examples:

```
STATUS 10,0;I1
```

Assigns status of register 0 at select code 10 to variable I1. Register 0 of the speech module is the identification register, and contains the value 7. Requires the I/O ROM.

```
STATUS 3,1;V1
```

Assigns status of register 1 at select code 3 to variable V1. Register 1 of the speech module contains the volume level setting (ranges from 0 through 15). Requires the I/O ROM.

### Writing to Control Registers

The I/O ROM CONTROL statement can be used to write data to the speech module control registers. Alternatively, you can use the SETI/O statement provided in the HP-86/87 computer and in the HP-83/85 Plotter/Printer ROM.

```
CONTROL select code , register number ; control byte
```

```
SETI/O select code , register number , control byte
```

**select code:** numeric expression that selects the module for register writing. Range of values is 3 through 10. The speech module is preset to select code 10.

**register number:** a numeric expression that evaluates to an integer. Valid control registers for the speech module are 1, 2, and 3.

**control byte:** a numeric expression that evaluates to an integer 0 through 255 containing data to be written to specified register.

CONTROL and SETI/O can be used to:

- Set the volume level by writing to register 1. The highest order four bits are ignored in the data byte. This performs the same function as the SVOL statement provided by the "EDIT85" and "EDIT87" speech binaries.
- Reset the speech chip by writing the value 0 to register 2.
- Test the speech module by writing the value 0 to register 3.

**Examples:**`CONTROL 10,1;12`

Writes the value 12 (in decimal) to control register 1 at select code 10. For the speech module (select code 10), this sets the volume level to 12. Requires the I/O ROM.

`SETI/O 10,1,12`

Performs the same function as the above CONTROL statement. Requires the Plotter/Printer ROM for the HP-83/85.

`SVOL 10;12`

Speech binary statement that performs the same function as the above two statements. Requires "SPKB85" or "SPKB87" binary program.

`CONTROL 6,2;0`

Writes the value 0 to control register 2 at select code 6. For a speech module set to select code 6, this statement would reset the TMS 5220 speech chip. Requires the I/O ROM.

`CONTROL 6,3;0`

Writes the value 0 to control register 3 at select code 6. This statement is used to send a test tone to a speech module at select code 6. Requires the I/O ROM.

## Speech Output

The I/O ROM OUTPUT statement can be used in place of the speech binary SPEAK statement to output synthetic speech. It is necessary to use the # and K image specifiers in the format string to suppress trailing blanks and the EOL (end-of-line) sequence.

`OUTPUT select code USING "#,K"; speech parameters`

*select code:* numeric expression that selects the module for output. Range of values is 3 through 10. The speech module is preset to select code 10.

*speech parameters:* character string expression containing the speech parameters. The speech parameters are normally obtained by the binary DLOAD# statement and PAR# function (refer to section 4). However, these parameters can also be obtained using BASIC statements and functions (refer to the following discussion).

**Example:**`OUTPUT 10 USING "#,K";Param#`

Outputs speech parameters contained in Param# to the module at select code 10.

**CAUTION**

It is possible to send invalid data to the speech module, causing it to lock up, using the OUTPUT statement. Invalid data is any character string which cannot be identified as speech code by the module. In the event that the module locks up, it will not accept any further data. To verify that the speech module is locked up, press **RESET**. If the computer displays Error 119, the module is locked up. To restore operation of the module, execute the CONTROL *select code*, 2; @ statement; if still unsuccessful, turn the computer off, then on.

**Loading a Dictionary in BASIC**

The following example programs perform the equivalent of the DLOAD#, PAR\$, and LOC routines provided by the "SPKB85" and "SPKB87" binaries. The program is written in BASIC for the HP-86/87, but the subroutines DLOAD:, PAR:, and LOC: can be translated into HP-83/85 compatible BASIC (by removing the statement labels). These programs provide an example for loading dictionaries and locating speech parameters without using the speech binary statements and functions. The subroutines can be used as a template for your own BASIC applications. Note the use of the OUTPUT statement (requires the I/O ROM) to send the speech parameters to the module.

```

10 ! Load Dictionary & Speak Selections
20 ! This is a sample program to bring an entire dictionary into main memory
30 ! (as with DLOAD#), select word/phrase parameters from the loaded
40 ! dictionary (as with PAR$), and speak them using the OUTPUT statement from
50 ! the I/O ROM.
60 !
70 ! A$ is the dictionary name string.
80 ! B$ holds the parameters for a phrase when loading dictionary or speaking.
90 ! D$ contains the dictionary name.
100 ! W$ contains the name of a dictionary entry to be spoken.
110 ! P$ contains the loaded dictionary word/phrase parameters.
120 !
130     DIM A$[1710],B$[2300],D$[17],W$[159],P$[11000]
140 !
150 ! Set select code then choose dictionary.
160     S=10
170     CLEAR @ DISP "Dictionary name";@ INPUT D$
180     ASSIGN# 1 TO D$
190 !
200 ! Go load the dictionary
210     GOSUB DLOAD
220 !
230 ! Choose a name to speak.
240     CLEAR @ DISP "Word to speak";@ INPUT W$
250 !
260 ! Go get the parameters for the chosen word.
270     GOSUB PAR
280 !
290 ! Speak the chosen word and loop back for another.
300     OUTPUT S USING "#,K" ; B$
310     GOTO 240
320 DLOAD:
330 ! Read in the ASCII name string from beginning of dictionary file.
340     READ# 1 ; A$
350 !
360 ! Find tag at start of each phrase name.
370     P1=1 @ P=0 @ S$=CHR$ (255) @ P$=""
380     Q=POS (A$[P+1],S$)
390     IF NOT Q THEN RETURN
400     P=P+Q
410 !
420 ! Position to starting record for phrase parameters and read them in.
430     PRINT# 1,NUM (A$[P-2])255+NUM (A$[P-1])
440     READ# 1 ; B$

```

```

450 !
460 ! Modify record pointer in A$ to point to phrase parameters in P$.
470 !   A#[P-2,P-1]=CHR# (P1 DIV 255)&CHR# (P1 MOD 255)
480 !
490 ! Add phrase parameters onto the end of P$.
500 !   T1=LEN (P#) @ T2=LEN (B#)
510 !   P#[T1+1,T1+T2]=B# @ P1=P1+T2
520 !   GOTO 380
530 PAR:
540 ! Find pointer to start of parameters in P$ for the chosen phrase.
550 !   GOSUB LOC
560 !
570 ! Check that the phrase was found.
580 !   IF L=0 THEN B#="" @ RETURN
590 !
600 ! Tally parameter lengths for each word concatenation forming phrase.
610 !   Z,I=L
620 !   K=NUM (A#[P-4])
630 !   FOR J=1 TO K
640 !     I=I+NUM (P#[I])*256+NUM (P#[I+1])+2
650 !   NEXT J
660 !
670 ! Place parameters for whole phrase in B$.
680 !   B#=P#[Z,I-1]
690 !   RETURN
700 LOC:
710 ! Locate tag identifying start of chosen phrase W$ within A$.
720 !   P=1 @ S#=CHR# (255) @ L=LEN (W#)
730 !   Z=POS (A#[P],S#&W#)
740 !   IF Z=0 THEN L=0 @ RETURN
750 !   P=P+Z
760 !
770 ! Insure it's W$ by requiring matching lengths.
780 !   IF L#NUM (A#[P-5]) THEN 730
790 !
800 ! Return pointer to phrase parameters in L.
810 !   L=NUM (A#[P-3])*255+NUM (A#[P-2])
820 !   RETURN
830 !   END

```

```

10 ! Load & Speak Single Selection from Dictionary
20 ! This is a sample program to retrieve from mass storage the parameters for
30 ! a single selection from a dictionary (as with LOC) and speak them using
40 ! the OUTPUT statement from the I/O ROM.
50 !
60 ! A$ is the dictionary name string.
70 ! B$ holds the parameters for a phrase when loading or speaking.
80 ! D$ contains the dictionary name.
90 ! W$ contains the name of a dictionary entry to be spoken.
100 !
110 !   DIM A#[1710],B#[2300],D#[17],W#[159]
120 !
130 ! Set select code then choose word and dictionary.
140 !   S=10
150 !   CLEAR @ DISP "Word";@ INPUT W#
160 !   DISP "Dictionary name";@ INPUT D#
170 !   ASSIGN# 1 TO D#
180 !
190 ! Read the dictionary ASCII name string into A$.
200 !   READ# 1 ; A#
210 !
220 ! Go find pointer to word parameters on mass storage.
230 !   GOSUB LOC
240 !
250 ! Check that the phrase was found.

```

```

260         IF L=0 THEN 150
270         !
280         ! Set position to starting record of parameters on mass storage.
290         PRINT# 1,L
300         !
310         ! Read the word/phrase parameters into B$.
320         READ# 1 ; B$
330         !
340         ! Speak the phrase using OUTPUT statement and loop back for another.
350         OUTPUT S USING "#,K" ; B$
360         GOTO 150
370 LOC:
380         ! Locate tag identifying start of chosen phrase W$ within A$.
390         P=1 @ S#=CHR$ (255) @ L=LEN (W$)
400         Z=POS (A#[P],S#&W$)
410         IF Z=0 THEN L=0 @ RETURN
420         P=P+Z
430         !
440         ! Insure it's W$ by requiring matching lengths.
450         IF L#NUM (A#[P-5]) THEN 400
460         !
470         ! Return pointer to phrase parameters in L.
480         L=NUM (A#[P-3])*255+NUM (A#[P-2])
490         RETURN
500         END

```

# Speech Vocabulary

This tear-out card contains a list of the vocabulary supplied with the HP 82967A Speech Synthesis Module. All the words must be entered exactly as shown. Sound effects are denoted by words ending in a right parenthesis ); prefixes and suffixes end in an apostrophe '. Three of the words generate pauses: PAUSE1 (.1 second), PAUSE2 (.2 second), and PAUSE10 (1 second).

A	AUTOMATIC1	CENT1	DENIED	ESTIMATED	FOURTEEN1	HIGH1	L1
A1	AUTOMATICALLY	CENTER	DEPARTMENT	ETA	FOURTH	HIGH2	L2
A2	AUXILIARY	CENTER1	DEPARTURE	EVACUATE	FOXTROT	HIGH3	L3
A3	AVAILABLE	CENTI	DEPARTURE1	EVACUATION	FOXTROT1	HIGHER	LABEL
A.M.	AVAILABLE1	CENTS	DEPOSIT	EVEN	FREEDOM	HIKE	LABORATORIES
A.M.1	B	CENTS1	DESTROY	EVENING	FREEDOM	HIM	LAND
ABEAM	B1	CHANGE	DESTROYED	EVER	FREQUENCY	HIS	LANDING
ABORT	BACK	CHANGED	DESTROYED1	EXCEEDS	FREQUENCY1	HIT	LANDING GEAR
ABORT1	BAD	CHARLIE	DETAILS	EXCELLENT	FRISBEE	HOLD	LARGE
ABOUT	BALANCE	CHARLIE1	DETERGENT	EXCELLENT1	FROM	HOLD1	LASER
ABOVE	BALL	CHECK	DEVICE	EXCHANGE	FROM1	HOLD2	LASER)
AC	BALL BEING CAUGHT)	CHECK1	DIAL	EXIT	FROM2	HOME	LAST
ACCELERATED	BAND	CHECK2	DIAL1	EXPECT	FRONT	HONOR	LATE
ACCEPT	BANDIT	CHIME1)	DIFFICULTIES	EXPIRATION	FUEL	HOOK	LAUNCH
ACCEPT1	BANK	CHIME2)	DIGITAL	EXPIRATION1	FUEL1	HOOK1	LEAKAGE
ACCEPTED	BANK1	CHOICE	DIGITS	EXPLORATORY	FUEL2	HOT	LEAN
ACCEPTED1	BASE	CIRCUIT	DIMENSION	EXPLOSION)	FULL	HOUR	LEFT
ACCESS	BASE1	CLEAN	DINER'S CLUB	EXTENSION	FULL1	HOURS	LEFT1
ACCESSING	BASKET	CLEAR	DINNER	EXTENSION1	FULL2	HOUSE	LEFT2
ACCOUNT	BAT HITTING BALL)	CLEAR1	DIRECTION	EZ	FUNCTION	HOW	LEG
ACCOUNT1	BATTLE	CLEARANCE	DIRECTION	F	G	HUNDRED	LESS
ACE	BEEN	CLEARANCE DELIVERY	DIRECTORY	FACE	G1	HUNDRED1	LESS THAN
ACES	BEFORE	CLIMB	DISK	FAHRENHEIT	G2	I	LEVEL
ACKNOWLEDGE	BEGIN	CLOCK	DISPENSER	FAIL	GAGE	I1	LEVEL1
ACTION	BEHIND	CLOCK1	DISPLAY	FAIL1	GALAXY	I2	LEVEL2
ADD	BEING	CLOSE	DISPLAY1	FAILED	GALLEY	I3	LEVEL OFF
ADDRESS	BELL	CLOSED	DISTANCE	FAILURE	GALLON	I4	LICENSE
ADJUST	BELOW	CLOSED1	DISTRIBUTION	FAIR	GALLONS	I.O.	LIGHT
ADSORBER	BET	CODE	DIVIDED	FALSE	GAME	ICE	LIGHT1
ADVISE	BETWEEN	CODE1	DO	FAN	GAME1	ICING	LIGHT2
AERIAL	BID	COIN	DO1	FARAD	GAS	IDENTIFICATION	LIGHTS
AFFIRMATIVE	BIG	COIN1	DO2	FAST	GATE	IDENTIFICATION1	LIKE
AFTER	BIRTH	COLD	DOCUMENT	FAST1	GEAR	IDENTIFY	LIMA
AFTERNOON	BLIND	COLLECT	DOES	FEATURE	GEY	IDENTITY	LIMIT
AGAIN	BLOCKED	COLLECT1	DOLLAR	FEBRUARY	GET1	IDLE	LIMIT1
AGAIN1	BLOWING	COME	DOLLAR1	FEET	GIVE	IF	LIMIT2
AHEAD	BONUS	COMMAND	DOLLARS	FEET1	GLIDE	IF1	LINE
AIR	BOOKLET	COMPANY	DOOMSDAY DEVICES	FIELD	GO	IGNITE	LINE1
AIR1	BOOST	COMPLETE	DOOR	FIELD1	GO1	IGNITION	LINES
AIR BRAKES	BOTH	COMPLETE1	DOORS	FIF'	GO2	IMMEDIATELY	LIST
AIRCRAFT	BOTTOM	COMPONENT	DOUBLE	FIFTEEN	GOAL	IMPLEMENTED	LIST1
AIRPORT	BOX	COMPUTER	DOUBLE1	FIFTEEN1	GOLF	IN	LOCALIZER
AIRSPEED	BRAKE	CONDUCTIVITY	DOWN	FIFTH	GOOD	IN1	LOCATED AT
ALARM	BRAKING	CONFERENCE	DOWN1	FIFTY	GOOD LUCK	IN2	LOCATION
ALERT	BRAVO	CONGRATULATIONS	DOWN2	FILE	GOOD1	INBOUND	LOCATION1
ALERT1	BREAK	CONGRATULATIONS1	DOWNWIND	FILE1	GOOD2	INCH	LOCKBOX
ALERT2	BROKEN	CONNECT	DRAIN	FILE2	GOODBYE	INCREASE	LONG
ALERT3	BUFFER	CONTACT	DRIVE	FILED	GOVERNMENT	INCREASING	LONG1
ALIEN	BUGLE CALL)	CONTAMINATED	DRIVER'S	FILL	GRAIN	INCREASING TO	LOOP
ALL	BUILD	CONTINUE	DRIZZLE	FILL UP	GRAM	INDIA	LOSE
ALL1	BUS	CONTROL	DUPLICATE	FINAL	GREAT	INDICATED	LOSS
ALL2	BUSINESS	CONTROL1	DUST	FIND	GREAT1	INFLIGHT	LOST
ALOFT	BUSINESS1	CONVERGING	E	FIRE	GREEN	INFORMATION	LOW
ALPHA	BUSY	COPY	E1	FIRES	GREEN1	ING'	LOW1
ALTERNATE	BUSY1	CORRECT	E2	FIRING	GREEN2	INNER	LOW2
ALTIMETER	BUT	COUNT	EACH	FIRST	GREENWICH	INSPECTOR	LOW3
ALTITUDE	BUTTON	COURSE	EARLY	FIRST1	GROSS	INSTRUMENT	LOWER
AM	BUTTON1	COURT	EAST	FIRST2	GROUND	INSUFFICIENT	LOWER1
AMERICAN EXPRESS	BUTTON2	COWL	EAST1	FIVE	GROUND1	INTERCEPT	LUCK
AMOUNT	BY	CRANE	ECHO	FIVE1	GROUND2	INTERCEPTION	LUNCH
AMOUNT1	C	CRANE1	ED	FIVE2	GROUP	INTEREST	M
AMPS	C1	CREASE	EDITING	FIVE3	GUNDISH	INTRUDER	M1
AN	C2	CREDIT	EIGHT	FIVES	GUNSHOT)	INVALID	M2
AN1	CABIN	CROSS	EIGHT1	FLAME OUT	GUSTING TO	INVASION	MACHINE
AND	CALENDAR	CROSSWIND	EIGHT2	FLAP LOAD	H	INVOICE	MADE
AND1	CALIBRATE	CROWD NOISE)	EIGHT3	FLAPS	H1	IS	MAGNETOS
AND2	CALL	CRYSTALS	EIGHTEEN	FLEET	H2	IS1	MAIL
AND3	CALL1	CURRENT	EIGHTH	FLIER	HAD	IS2	MAIN
ANSWER	CALL2	CUSTOMER	EIGHTH1	FLIGHT	HAIR	IS3	MAINTAIN
ANSWERED	CALL3	CYCLE	EIGHTS	FLIGHT1	HALF	ISSUER	MAKE
ANTE UP	CALL4	CYCLE1	EIGHTY	FLIGHT WATCH	HALF1	IT	MAKES
APPOINTMENT	CALL5	CYLINDER	ELECTRICIAN	FLOOR	HAND	ITEM	MANAGER
APPROACH	CALL6	D	ELECTRONIC	FLOW	HANDLE	ITS	MANUAL
APPROACHES	CALL7	D'	ELEVATION	FLOW1	HANDLER	J	MANUAL1
APPROVED	CALL8	D1	ELEVEN	FLUID	HANG	J1	MANUALLY
APRIL	CALL9	D2	ELEVEN1	FLUSH	HANG UP	J2	MARCH
APU	CALLING	DANGER	ELEVEN2	FLY	HAS	JACKS	MARCH1
ARE	CALM	DANGER1	ELSE	FOG	HAS1	JANUARY	MARK
AREA	CAN	DANGER2	EMERGENCY	FOLLOW	HAS BEEN	JETS	MARKER
AREA1	CANCEL	DATE	EMERGENCY1	FOLLOWING	HAVE	JULIET	MARKET
ARRIVAL	CANCEL1	DATE1	EMPTY	FOOT	HAVE1	JULY	MASTER CARD
AS	CANCEL2	DAY	EN ROUTE	FOR	HAZARDOUS	JUNE	MAY
AS1	CANCELLED	DAY1	END	FOR1	HAZE	K	MAY1
ASKED	CANNOT	DAYS	END1	FOR2	HE	K1	MAYDAY
ASSOCIATED	CAPACITANCE	DC	ENEMY	FORTY	HE1	K2	ME
ASTERISK	CAR	DEATH	ENEMY1	FORTY1	HEADING	K3	MEAN
AT	CARD	DECEMBER	ENGINE	FORTYFIVE	HEAVY	KEEP	MEASURE
AT1	CARD NUMBER	DECLINED	ENTER	FORWARD	HELLO	KEY	MEASURED
ATIS	CARDHOLDER	DECREASE	ENTER1	FOUL	HELLO1	KEY1	MEET
ATTACK	CARDS	DECREASING	ENTIRE	FOUR	HELP	KICK	MEETING
ATTENTION	CARTE BLANCHE	DEFENSE	EQUAL	FOUR1	HENRY	KILO	MEGA
ATTENTION1	CASING	DEGREE	EQUALS	FOUR2	HER	KILO1	MEMORY
AUGUST	CAUTION	DEGREES	EQUIPMENT	FOUR3	HERE	KIND	MERCHANT
AUTHORIZATION	CAUTION1	DELTA	ERROR	FOUR4	HERTZ	KING	MERCHANT NUMBER
AUTHORIZATION1	CEILING	DELTA1	ERROR1	FOUR5	HERTZ1	KINGS	MERCHANT1
AUTO	CELSIUS	DELTA2	ERROR2	FOURS	HEWLETT PACKARD	KNOTS	MESSAGE
AUTOMATIC	CENT	DEMONSTRATION	ESTABLISHED	FOURTEEN	HIGH	L	MESSAGE1

MESSAGE2	ON1	PRINTER	SAV	STABILIZER	TIME	VOLTS
MESSAGES	ON2	PROBE	SCATTERED	STALL	TIME1	VOLUME
METER	ON LINE	PROCEEDING	SCHEDULE	STAR	TIMER	VOR
MICRO	ONE	PROCESS	SCORE	START	TIMES	VORTAC
MIDDLE	ONE HALF	PROCESSED	SCORE1	START1	TO	W
MIDPOINT	ONE1	PROCTOR	SCREEN	START2	TOC)	W1
MIG	ONE2	PRODUCT	SECOND	STATE	TOC1)	WAIT
MIKE	ONE3	PRODUCTION	SECOND01	STILL	TODAY	WAIT1
MILE	ONE4	PROFESSOR	SECONDS	STOCK	TOMORROW	WAKE
MILES	ONLY	PROFIT	SECONDTN	STOLEN	TOPE	WAKE UP
MILL	OPEN	PROGRAM	SECRET	STOLEN1	TOPE)	WALK
MILLI	OPEN1	PROGRESS	SECRETARY	STOP	TOPE1	WANTED
MILLI1	OPEN2	PROPS	SECURITY	STOP1	TOPE2)	WARIN
MILLION	OPENLY	PROVIDE	SECURITY1	STOPPED	TOPE2)	WARNING
MINUS	OPERATOR	PULL	SELCAL	STORM	TONIGHT	WARNING)
MINUTE	OPERATOR1	PULL1	SELECT	STRAIGHT	TOO LOW	WARNING1
MINUTES	OR	PUMP	SELECT1	STRIKE	TOOL	WARNING2
MISMATCHED	OR1	PUMPS	SELL	STRIKING	TOP	WASH
MISS	ORDER	PURCHASE	SEND	SUCCESSFUL	TOP1	WATCH
MIST	ORGANIZATION	PUSH	SEPTEMBER	SUDDEN	TORNADO	WATCH1
MISTER	ORIGINALS	PUT	SEQUENCE	SUPERIOR	TOTAL	WATER
MIXTURE	OSCAR	Q	SERVICE	SUPERVISOR	TOTAL1	WATER1
MOBILE	OTHER	QUARTER	SERVICE1	SUPPLY	TOUCH	WATT
MODEM	OUNCE	QUARTER1	SET	SUSPECT	TOUCH1	WATTS
MODERATE	OUT	QUEBEC	SET1	SWITCH	TOUCHDOWN	WAY
MODULE	OUT1	QUEENS	SET2	SWITCH1	TOWER	WAY1
MONTH	OUT OF	QUESTION	SET3	SWITCH2	TRADED	WE
MORE	OUTER	QUIET	SEVEN	SYMBOL	TRAFFIC	WE1
MORE THAN	OVER	R	SEVEN1	SYSTEM	TRAIN	WEATHER
MORN	OVER1	R1	SEVEN2	SYSTEM1	TRAIN)	WELCOME
MORNING	OVER2	R NAW	SEVEN3	T	TRANSACTION	WELL
MOTOR	OVER3	RADAR	SEVEN4	T1	TRANSACTION1	WERE
MOVE	OVER LIMIT	RADIAL	SEVEN5	TACAN	TRANSACTIONS	WEST
MOVING	OVERCAST	RADIO	SEVEN6	TAKE	TRANSFERRED	WEST1
MUCH	OVERSPEED	RADIOS	SEVEN7	TANGO	TRAY	WHAT
MY	P	RAIN	SEVENS	TANGO1	TRIM	WHEN
N	P O S	RAISE	SEVENTEEN	TANK	TRIPLE	WHERE
N1	P1	RANGE	SEVENTH	TANK1	TROUBLE	WHICH
NAME	P.M.	RATE	SEVENTY	TANK2	TRUCK	WHILE
NANO	P.M.1	RATE1	SEVERE	TAPE	TRUE	WHISKEY
NATIONAL	PAIR	RATIO	SHALL	TARGET	TRUE1	WHISTLE)
NATURAL	PAIRS	REACHED	SHE	TARGET1	TRY	WHITE
NEAR	PAPA	READ	SHIELDS	TAXI	TRY1	WHO
NEED	PAPER	READY	SHIELDS1	TEEN	TURBULANCE	WILL
NEED1	PARDON ME	READY1	SHIP	TEEN1	TURN	WILL1
NEGATIVE	PARTIALLY	READY2	SHORT	TELEPHONE	TURN1	WIND
NET	PARTY	REAR	SHORT1	TELEPHONE1	TURN2	WINDOWS
NEW	PARTY1	REBOUND	SHOT	TEMPERATURE	TWELVE	WING COMMANDER
NEW1	PASS	RECOGNIZE	SHOULD	TEMPERATURE1	TWELVE1	WINNER
NEWS	PASS1	RECOPI	SHOWERS	TEN	TWELVE2	WINNER1
NEXT	PASS2	RECORDED	SHOWING	TEN1	TWENTY	WITH
NEXT1	PASS3	RED	SHUT	TEN2	TWENTY1	WITH1
NEXT TRANSACTION	PASSED	RED1	SIDE	TEN3	TWENTYFIVE	WORD
NICE	PATH	RED2	SIDES	TEN4	TWICE	WORD1
NIGHT	PATH1	RED3	SIERRA	TENS	TWIST	WORDY
NINE	PATHWAYS	REDIAL	SIERRA1	TENS	TWO	WORK
NINE1	PAUSE1	REE'	SIGMET	TERMINAL	TWO1	WORLD
NINE2	PAUSE10	REENTER	SIGNALING	TERMINAL1	TWO2	WORLD
NINE3	PAUSE2	REFERRAL	SIGNATURE	TEST	TWO3	WRONG
NINER	PAV	REFUELING	SINGLE	TEST1	TWO4	WRONG1
NINES	PAYMENT	REFUND	SIX	TEST2	TWO5	WRONG2
NINETEEN	PBX	REJECT	SIX1	TEST3	TWO6	X
NINETY	PELLETS	RELAY	SIX2	TESTING	TWO7	X1
NINETY1	PENALTY	RELEASE	SIX3	TEXT	TWO8	X2
NINTH	PER	REMAINS	SIXES	TEXT1	TYPE	X3
NO	PERCENT	REMARK	SIXTEEN	TH'	TYPE1	XRAY
NO1	PERIOD	REPAIR	SIXTEENTH	THAN	U	XRAY1
NOISY	PERMITTED	REPAIR1	SIXTH	THANK	UNCHANGED	Y
NOON	PERSONAL	REPEAT	SIXTY	THANKYOU	UNIFORM	Y1
NORMAL	PHASER)	REPEAT1	SLEET	THAT	UNIT	Y2
NORTH	PHONE	REPORTED	SLOPE	THE	UNIT1	Y3
NORTH1	PHONE NUMBER	REPORTING	SLOT	THE1	UNIT TEST	YANKEE
NORTHEAST	PHONE	REPRESENTATIVE	SLOW	THE2	UNIX	YARD
NORTHWEST	PICK	REQUEST	SLOW1	THE3	UNKNOWN	YEAR
NOT	PICD	RESISTANCE	SLOW2	THE4	UNLIMITED	YELLOW
NOT1	PICTURE	RESPONSE	SMALL	THEE	UNLIMITED1	YELLOW1
NOTAM	PILOT	REVERSE	SMOKE	THEE1	UNTIL	YELLOW2
NOTIFY	PLACE	REVERSE1	SMOKE1	THEN	UNTIL1	YES
NOVEMBER	PLACE1	REVERSE2	SMOKE2	THEORETICAL	UP	YESTERDAY
NOVEMBER1	PLAN	RICH	SNOW	THERE	UP1	YOU
NOW	PLANE	RIGHT	SOLVENT	THEY	UP2	YOU HAVE MAIL
NOW1	PLASMA	RIGHT1	SOME	THIN	UP3	YOU1
NOW2	PLAY	RIGHT2	SOON	THING	UP TO	YOUR
NOW3	PLAYER	RINGER	SORRY	THINLY	USE	YOUR NUMBER IS
NUMBER	PLAYER1	RINSE	SORSBY	THIR'	USE1	YOUR1
NUMBER1	PLEASANT TONE)	ROCKET	SOUND)	THIRD	USE2	YOUVE
NUMBER2	PLEASE	ROLLOUT	SOUND1)	THIRD1	USER	Z
NUMBER3	PLEASE1	ROMEO	SOUND2)	THIRTEEN	USER1	Z1
0	PLEASE2	ROOM	SOUND3)	THIRTY	V	Z2
01	PLEASE3	ROYAL	SOUND4)	THIS	V1	ZERO
02	PLEASE4	RUN	SOUND5)	THIS1	V2	ZERO1
03	PLUS	RUN1	SOUND6)	THIS IS	VACUUM	ZERO2
O'CLOCK	PLUS1	RUNWY	SOUND7)	THOUSAND	VALUE	ZERO3
O'CLOCK1	POINT	S	SOUTH	THOUSAND1	VALVE	ZERO4
O.K.	POINT1	S1	SOUTH1	THREE	VALVE1	ZERO5
OBSCURED	POINT2	S2	SOUTHWEST	THREE1	VARIABLE	ZERO6
OBTAINED	POINTS	S3	SPEECH	THREE2	VECTORS	ZEROS
OCTOBER	POSITION	SACKED	SPEECH SYNTHESIS	THREE3	VENDOR	ZONE
OF	POSSIBLE	SAFE	SPEED'	THREE4	VENDOR1	ZONE1
OF1	POUND	SAFE1	SPEED	THREE5	VERIFY	ZULU
OF2	POWER	SAFE2	SPEED2	THREE6	VERY	
OFF	PRACTICE	SAFE3	SPEEDS	THREE7	VICTOR	
OFF1	PREMISES	SAFETY	SPORTS	THREE8	VICTOR1	
OFF2	PREMIUM	SAM	SPRAY	THREES	VICTORY	
OFFENSE	PREPARE	SAME	SQUADRON	THU	VISIBILITY	
OFFICE	PRESS	SAME	SQUADRON LEADER	THUNDERSTORMS	VOLATILITY	
OHMS	PRESS1	SAMSYN	SQUAWK	TIC	VOLT	
OIL	PRESSURE	SAND	SQUAWKING	TIC1)	VOLTAGE	
OLD	PRICE	SAVE	SSS'			
ON	PRINT					



**HEWLETT  
PACKARD**

**Personal Computer Division  
1010 N.E. Circle Blvd., Corvallis, OR 97330, U.S.A.**

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