VS 100

VOICE SYNTHESIZER

USER MANUAL

ALPHA Products
79-04 Jamaica Ave., Woodhaven, NY 11421

Alpha Products
VS-100 Voice Synthesizer
User Manual

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1. Try out your VS-100 without reading the manual

We know that you would like to hear your VS-100 right away. If you have a two disk system, here are three quick steps to get speech: (If you have a tape or single drive system, please refer to the detailed instructions).

Step 1 : Transferring the programs to your disk
Step 2 : Connecting the hardware
Step 3 : Running the demonstration software

If you have any problems with the quick shortcut instructions described below, refer to the "Detailed installation" chapter.

STEP 1 : Transferring the disk files.

Do NOT plug the VS-100 in yet!

First we must transfer the files from your VS-100 master disk to your own disk. The software is supplied on an 18 track Model I data diskette. Your DOS will read this disk just as easily as a 35 track diskette. Tracks 18 and up are locked out.

Model III users must use the CONVERT utility. (Please refer to your DOS manual if you are not familiar with this utility).

Model I users with two or more drives: insert the VS-100 master disk in drive 1 then use the COPY command (Example COPY VS48/CMD:1 TO VS48/CMD:0) for each file.

The files that you are going to transfer are:

- VS48/CMD -- Text to speech for 48K computers
- VS32/CMD -- Text to speech for 32K computers
- VSEDIT/BAS -- Phoneme editor
- VSDEMO/BAS -- Introduction and test program
- PRTSTAR/TXT -- PRINT* pokes for a MERGE
- QUIET/CMD -- To silence the VS-100

When the six files are transferred to your system

disk, remove your VS-100 master disk from drive 1 and store it safely.

STEP 2: Installing the VS-100.

- Turn the computer off
- Plug the speaker into the VS-100
- Plug the power pack into a wall outlet or preferably a power strip with the rest of your equipment.
- Plug the power pack into the VS-100
- Plug the VS-100 into your computer.
  - Model I : Plug it into left side of expansion interface in the 40-pin bus located in front of the parallel printer port. (Since this bus is rarely used, please clean both sides of the card edge with a pencil eraser). If this port is already used you will need an "X2 Expandabus" cable.
  - Model III : Plug it into the 50-pin bus located underneath the computer in the middle towards the back. Insert the small black plastic shaft into the long lucite shaft. Peel off the adhesive on the small bracket. Firmly, but gently, insert the shaft assembly into the potentiometer on the VS board . Hold the potentiometer while pushing the shaft in. Press the bracket against the bottom right side of the computer case.
- Power up your computer.

  Some continuous tone might be heard. Type QUIET from DOS READY. The VS-100 will also quiet when you load VS48 or VS32

  *NOTE 1: The VS-100 must be powered at the same time as, or before the computer. The computer may lock up until the VS-100 is powered.

  **NOTE 2: At power up, the VS-100 may produce some sound (continuous tone). Turn the volume control

down or from DOS type QUIET <enter> to execute QUIET/CMD. You may also load BASIC and execute the command OUT 11,3:
Model I: type OUT 11,3 then press the ENTER key.
Model III: type OUT 236,16 : OUT 11,3 then press the ENTER key. (The OUT 236,16 is needed to enable the I/O bus).

***NOTE 3: If you turn the computer off and leave the VS-100 on, you might hear a continuous tone. Just unplug the VS-100 power pack. If possible, try to power the VS-100 and the computer from the same master switch.

⇨STEP 3: Loading and running the demonstration software.

- Under DOS, type VS48 for a 48K system or type VS32 for a 32K system. This is the text to speech driver. It loads in high memory and protects itself. NEWDOS+ ver. 2.1 users: you must set memory to 60666 for VS48 or 44277 for VS32.
- Load BASIC (the memory size is already set), and from the READY prompt type RUN"VSDEMO/BAS". You should hear a short introductory message. Menu option 1 lets you type any message you want and press the enter key to hear it. Press the enter key again to hear the message again.
- Adjust the volume control to a comfortable level and enjoy. To get an idea of the capabilities of the text to speech algorithm, try the following sentence:

On March 3rd, Mrs McRuff bought 12.45 ozs. of #4 screws @ 49$ per lb. +6% tax, from J & K Co.

Or type: 12,345,678,901,234.56789

- To get the best results, read the section titled "Text to speech hints".

By now, anyone in earshot wants to try it too. It's time to retreat and read the real manual which follows.

2. Introduction

We thank you for your purchase of the VS-100. We hope that you will be pleased with its performance and versatility.

For the longest time, speech has been the most natural means of communication between people. Although computer speech synthesis has been in existence for several years, it's only very recently that it has become affordable.

Alpha Products is proud of the achievement in price and performance that the VS-100 represents. This is our first attempt. The result is by no means final. The VS-100 project is a continuing one. A lot of time and effort has been devoted to it, and every reasonable attempt has been made to assure compatibility with the many operating systems available. We know from past experience that some of you will have difficulty anyway. If this is the case, we will help you; refer to section titled "Troubleshooting Guide".

3. Features

The VS-100 is capable of producing unlimited vocabulary speech. Words are created by combining basic sounds, such as "s" or "th". These sounds, called "phonemes" can be combined in many ways to reproduce the sounds in any word. Note, however, that the sixty four phonemes in the Votrax chip were designed for the English language.

Some of the earlier synthesizer chips had a strictly monotonic voice. The VS-100 has automatic inflection which varies the tone of some sounds (phonemes) when they are combined in different ways, resulting in a more natural sounding voice.

In addition, you can also vary the base pitch of the voice under software control. There are four pitch levels.

One of the major features of the VS-100 is its "low data rate requirement". In plain English this means that, compared to other methods of storing and digitizing speech, the VS-100 is very efficient. It only uses about twelve bytes of memory per second of speech, compared to several thousand bytes for some other methods. This means that you could store roughly an hour of continuous speech in memory in a 48K system or five hours on a double density diskette.

Adding speech to your existing programs is very simple. For instance, in 1K, you could add forty messages of about two seconds. (that's five to eight words each).

The VS-100 is easy to operate. You will see later how your computer can say anything by simply typing PRINT*"anything that you want".

4. How does it work?

We will talk about "phonemes", but don't worry, as you will see later, you don't have to know anything about them to be able to use the full power of your VS-100. First, let's see how the VS-100 works.

The hardware

- The heart of the hardware is the now famous Votrax SC-01 Phoneme Synthesizer. A phoneme is one of the basic sounds needed to create spoken English. Speech is synthesized by combining the sixty four different phonemes in the appropriate sequence.
- Each of the sixty four phonemes has a standard Votrax shorthand notation. For example A1 is the code for the sound "A" in MADE. In addition to the shorthand notation, each phoneme has a code used by the computer (a number from 0 to 63). There is a complete phoneme table later in this manual.
- The computer sends the phoneme codes to the VS-100 using one of the 256 ports available. The VS-100 software uses port 11, but the hardware will also respond to some other port numbers.
- When the VS-100 receives the phoneme code, it creates the proper audio waveform to reproduce the sound corresponding to the phoneme. All the waveforms for the sixty four phonemes are permanently stored in the Votrax chip. The synthesizer output is then amplified and sent to the speaker.
- The computer communicates with the VS-100 through the 8 bit data bus. The lower six bits (bits 0-5) are used to select the phonemes. The higher two bits (bits 6 & 7) control the pitch level.

As you can see in the phoneme list, the phonemes have various durations. The computer must know when the VS-100 is ready to accept the next phoneme. This is done on the Model III by the use of a "status bit". Bit 7 of port 11 is low only when the VS-100 is busy talking. On the Model I, the VS-100 generates "wait" states.

The Software

The programs on your disk are the key to the simplicity of the system. The text to speech software translates English words and numbers into the proper sequence of phonemes. This machine language program (about 5K long) implements over FOUR HUNDRED pronunciation rules. These rules take each letter and its context and decide which phonemes are needed.

The text to be spoken is processed by the algorithm, and the codes are sent to the VS-100, which speaks almost immediately. Considering the complexity of English pronunciation, we think that you will be suprised by the performance of this translator.

5. Detailed installation

STEP 1: Transferring the disk files.

Do NOT plug the VS-100 in yet!

First let's transfer the disk files from your VS-100 master disk to your own disk. The software is supplied on an 18 track Model I data diskette. (Higher tracks are locked out; your DOS should have no trouble reading the diskette).

■ MODEL I USERS WITH MORE THAN ONE DRIVE:

Use the BACKUP or COPY command to move the files from the master disk to another disk.

■ MODEL I USERS WITH ONE DRIVE:

If you have -

- NEWDOS: use COPY with the "$" option or the CBF option
  Ex: COPY $VSEDIT/BAS:0 TO VSEDIT/BAS:0
- DOSPLUS: use the COPY1 utility
- LDOS: use COPY with the "X" option
- TRSDOS: we have included on our disk, some TRSDOS system files. We don't include much of it, and we do not provide any documentation for it. This is our effort to protect Tandy Corp.'s copyright. Our program TRANSFER/BAS is included, which allows you to copy the files onto a working TRSDOS disk. To transfer your files, do the following:

1- Boot up with your TRSDOS disk. Go into BASIC.
2- Remove the TRSDOS disk and insert the VS-100 disk.
3- Type: RUN"TRANSFER/BAS" and hit <enter>.
4- Specify one of the files that you want to transfer The file will be read from the disk into memory.
5- You will be told to swap disks. When you do, your TRSDOS disk should be in your drive. Hit <enter>.
6- The file will be written to your TRSDOS disk.
7- You will be told to swap disks again. When done, the VS-100 disk will be in the drive. Hit <enter>.
8- Repeat steps 4 to 7 for each file.

■ MODEL III USERS WITH MORE THAN ONE DRIVE:

If you have -

- TRSDOS: use the CONVERT utility.
  Ex: CONVERT :1 :0 will copy the files on the VS-100 disk in drive 1 to your TRSDOS disk in drive 0
- DOSPLUS or MULTIDOS: If your disk has a write protect tab, you must remove it. Then from DOS type: CONVERT :1 (or whatever drive the VS-100 disk is in). Now you can copy the files from the VS-100 disk with the COPY command.
- NEWDOS: If your disk has a write protect tab, you must remove it. Then set the PDRIVE for a model I disk (TD=A,TC=35,SPT=10). Then use the WRDIRP and COPY commands. A typical sequence would be:
  1- put NEWDOS in drive 0, VS-100 disk in drive 1
  2- type PDRIVE 0,1,TD=A,TC=35,SPT=10,A <enter>
  3- type WRDIRP 1 <enter>
  4- type COPY 1,0,,NFMT,NDMW,CBF,USR <enter>
  5- type PDRIVE 0,1=0,A <enter>
  Notes: The files are now on your NEWDOS disk
  Your PDRIVE is back to normal
- LDOS: use the REPAIR ALIEN command, then COPY or BACKUP by class

■ MODEL III USERS WITH ONLY ONE DISK DRIVE

If you have-

- TRSDOS, LDOS or NEWDOS: you have 3 choices
  1- visit a friend with more than one drive.
  2- ask a friendly Radio Shack manager if you can use his system.
  3- send your DOS to us, we will copy the files onto it.
- DOSPLUS: use CONVERT and COPY1 to move the files

■ TAPE USERS: Your software is recorded once on each side of the tape.

STEP 2: Installing the VS-100

To operate, the VS-100 needs three components: the power supply, the speaker, and the VS-100 module. Follow the step by step instructions below to install them.

- Turn the computer off.
- Plug the speaker into the VS-100 (larger jack)
  If you AREN'T using an Alpha Products speaker, you may connect any small 8 ohm speaker using a 1/8" plug, (Radio Shack part number 274-286). The VS-100 is not designed to drive large stereo speakers.
- Plug the power pack into a wall outlet or preferably a power strip with the rest of your computer equipment.
  •U.S. version: The power pack takes standard 115V AC and converts it to a low DC voltage (8-12 volts).
  •Foreign: You will need to supply a power pack that converts 220V AC to about 9V DC filtered. It must supply at least 100 milliAmperes. The power jack on the VS-100 is either a 2.5 mm or a 3.5 mm plug (depending on the power supply we are currently using). The tip should be positive (+). Please be careful, reversing the polarity may damage your unit.
- Plug the VS-100 into your computer.
- Before you do so, it is a good idea to carefully clean the card edge on the computer. Radio Shack card edges are not gold plated and some oxidation may create contact problems. Use a pencil eraser to rub both sides of the board, then wipe them with a cloth, preferably one dampened with rubbing alcohol.
  Model I with expansion interface: Plug the VS-100 on the left side of the expansion interface in the 40 pin bus located in front of the parallel printer port. The board should extend downwards from the connector.
  *NOTE 1: Most expansion interfaces have large rubber feet. If yours doesn't, you will have to raise it

about 1/2". Radio Shack sells rubber feet (part number 64-2346).

**NOTE 2: If you are using a Radio Shack Model I "System desk" you will need to either raise the expansion interface or purchase an extender cable. (Order our special VS cable. $9.95 +$2.50 S&H)

- Model I keyboard only system: Plug the VS-100 into the back left of the keyboard, hanging down.
- Model III : Plug the VS-100 into the 50-pin bus located underneath the computer in the middle towards the back. The board should extend towards the back, away from the keyboard. Insert the small black shaft into the long lucite shaft. Peel off the adhesive on the small bracket. Firmly, but gently, insert the shaft assembly into the potentiometer on the VS board. Hold the potentiometer while pushing the shaft in. Press the bracket against the bottom right side of the computer case.
- Other "compatible" systems : Be very careful, compatibility sometimes covers only the software. Refer to your manuals for more information.
- Limitations : The VS-100 is specified up to 4MHz, faster systems may not operate reliably. If you have a speed up modification on your computer, you must switch it back to the normal speed prior to sending speech codes to the VS-100. Most "speed up mods" can be turned on and off under software control (usually using an OUT command). Check their manual for the proper code.

■ Power up your computer.

*NOTE 1: Some continuous tone might be heard. It will quiet when you load VS48 or VS32. If you want to silence it right away, you just type QUIET from DOS. This very short (15 bytes) command file will simply output code 3 (silence) to the VS-100, and return to

DOS. You may also, under BASIC, execute the command OUT 11,3.

•Model I: type OUT 11,3 and press ENTER.

•Model III: type OUT 236,16 : OUT 11,3 and press ENTER. (The OUT 236,16 enables the I/O bus).

**NOTE 2: The VS-100 must be powered at the same time as, or prior to the computer. The computer may lock up until the VS-100 is powered.

***NOTE 3: If you turn the computer off and leave the VS-100 on, you might hear a continuous tone. Just unplug the VS-100 power pack. If possible, try to power the VS-100 and the computer from the same master switch.

STEP 3: Loading and running the demonstration software.

■ DISK USERS:

•Under DOS, type VS48 for a 48K system or type VS32 for a 32K system. This is the text to speech driver. It loads in high memory and protects itself. NEWDOS+ ver. 2.1 users must set memory to 60666 for VS48 or 44277 for VS32.

•Load BASIC (the memory size is already set), and from the READY prompt type RUN"VSDEMO/BAS". You should hear a short introductory message, then you can try out the various capabilities of the system. Follow the instructions in the program. Type 1 to try the text to speech demonstration, then you can type any message you want and press the enter key to hear it. Press the enter key again to hear the message again.

■ TAPE USERS:

Model III users must use the "Low" speed setting on the cassette. (answer "L" to the Cass? question)
Note: One side of the cassette is for 16K machines, and the other side is for 48K machines. The VOICE and "V" programs

are each recorded twice on each side in the following sequence: "VOICE", "V", "VOICE", "V". Recordings start at about 10 on the tape counter.

Type SYSTEM <enter>

At the ?* type VOICE <enter>.

The VOICE program should load. Then you will see another ?*. Type / <enter>.

—The text to speech software is now loaded. You could at this point get speech with PRINT* or a USR call. A few pokes (described later) are required. But now, for demonstration purposes, let's load the "V" program.

—This BASIC program is saved on your tape right after the VOICE program.

—Type CLOAD"V" <enter>. When the program loads type RUN <enter>. You now have most of the commands of VSEDIT/BAS. (see "Adding speech to your programs, Method 3").

—Type "I" to insert some words, then type "It works!". The VS-100 will say "It works!", and you will see the phonemes on the screen. If you want to try out another phrase, type K to clear, Y to confirm, and I to insert again. This part of the program uses a BASIC "INPUT" statement, therefore don't use "," or ":" in your input. If you do, you will get an EXTRA IGNORED message and the text following the "," won't be pronounced.

—If you just want to try out a lot of phrases without going through the K-Y-I sequence each time, you can type in the following one line program:

```
10 INPUT X$ : PRINT* X$; : GOTO 10
```

(the POKES necessary for PRINT* to function were automatically executed when you ran the editor program)

6. Text to speech hints

The text to speech success rate is better than 90%. By using the following methods, you will be able to get a perfect score.

• Misspell the word. If the word comes out wrong, try spelling it phonetically. For example, the word "read" will be pronounced like "reed", even if you want it to sound like "red". If you want it to sound like "red", spell it "red".

• To say initials, such as TRS-80 or IBM, simply put a space between the letters (that is T R S 80 or I B M). For a more natural sound, insert dashes instead of spaces between letters. Each space adds a pause. Dashes separate words or letters for pronunciation rules, but do not add a pause. Try T-R-S-80. Also compare "thank you" with "thank-you".

• Spaces, periods, commas, and exclamation points add pauses. Other punctuation like ";:?()" do not. They are treated as "word separators" for pronunciation rules.

• Any number up to ninety nine trillion will be spoken correctly. (You can use commas and decimals)
Example: 12,345,000.67

• For ordinal numbers add the proper ending, i.e. 1st, 2nd, 3rd, 4th, ... 2,345th, etc.

• Some abbreviations are supported: Mr., Mrs., Ms., Co., lb., oz., ft., Dr., etc.

• The following punctuation symbols are pronounced: #, $, %, &, @, *, =, +, /

• Frequently, you will use the "-" (dash or minus sign) to link and split words to improve pronunciation. Use "--" if you mean "minus". Example: 49--43=6

• The VS32 and VS48 programs accept 255 character strings as input. Generally, this will mean roughly 255 phonemes (about 25 seconds of speech) if you type only words. If

you use numbers, abbreviations or symbols, you may create very long phoneme lists. If the resulting phoneme list is larger than 300 phonemes, it will overwrite some of the rules. This is not a problem as messages in practice will rarely exceed 10-15 seconds.

• The VSEDIT program will accept up to 175 phonemes per message. Excess phonemes will be spoken the first time you hit enter, and then they will be lost.

7. Adding speech to your programs

There are four methods to generate speech with your VS-100. These methods evolved as we developed the system. We will describe each below, starting with the latest development.

■ METHOD 1: PRINT* (pronounced "print star")

PRINT*"something that will be said"

This is a new BASIC command. BASIC will recognize the PRINT*"any string" statement and say the string. In order to do so, you must:

•From DOS type VS48 for 48K systems (and press ENTER)
or type VS32 for 32K systems

This loads the text to speech program in high memory and protects itself, (except NEWDOS+ ver. 2.1).

VS48 resides from 60662 to 65535,
VS32 resides from 44278 to 49151

IMPORTANT: If you have a 48K system and you need the high memory, (For example: LDOS uses high memory for drivers) you can use VS32. We are working on a self relocatable version of VS (should be available February 1984).

•You must also add the following POKEs to your program: (It need only be executed once and it will remain intact until you exit from BASIC)

-For 48K systems:

```
5 IF PEEK(16844)<>237 THEN POKE -4852, PEEK(16843) :
POKE -4851, PEEK(16844) : POKE 16843,9 : POKE 16844,237
```

-For 32K systems:

```
6 IF PEEK(16844)<>173 THEN POKE -21236, PEEK(16843) :
POKE -21235, PEEK(16844) : POKE 16843,9 : POKE 16844,173
```

-For 16K tape systems:

```
7 POKE 16842,195 : POKE 16843, 9 : POKE 16844,109
```

If you really want to know, these pokes detour the

DOS exit in ROM that checks for PRINT# to disk.

For your convenience, these lines are supplied on your disk saved in ASCII format (the file name is PRTSTAR/TXT). To avoid typing error and save time, you can MERGE"PRTSTAR/TXT" to your program. Make sure your program doesn't already use line numbers 5 or 6.

IMPORTANT: only one of the lines should be in your program

- 48K systems: delete line 6 (keep line 5)
- 32K systems: delete line 5 (keep line 6)

NOTE: This line can be renumbered anywhere, provided it is executed once prior to using PRINT*.

The following are examples of speech output commands that become valid:

```
PRINT* "Hello"
PRINT* A$
PRINT* LEFT$(B$,3)
PRINT* "My name is "+A$
```

Like the PRINT command, PRINT* can be abbreviated ?*. In addition, any valid string expression can be used with PRINT* and ?*.

NOTE 1: In some cases, PRINT will cause a line feed on your screen. To avoid this, simply add a semicolon (;) at the end of your PRINT* statement. Example: PRINT* A$+B$;

**NOTE 2: PRINT* is set to use pitch 2 only.

Here are some more elaborate examples:

```
?* STRING$(34,"E")   ' long EEEE sound like a buzzer
?* MID$(TIME$,10,5)  ' the current time
?* STR$(X)           ' say value of variable X
```

PRINT* can be used only with strings. Numeric expressions must be converted to strings using the BASIC STR$ function.

PRINT* is the easiest way to generate speech with your VS-100.

■ METHOD 2: USR call

You can use the VS text to speech program directly from BASIC via a USR call.

From DOS type VS48 for a 48K system (and press ENTER)
or VS32 for a 32K system

This loads the text to speech program in high memory it protects itself (ED00H to FFFFH for 48K, AD00H to BFFFH for 32K, 6D00H to 7FFFH for 16K tape systems).

You don't need any pokes as with PRINT*. Instead a DEFUSR is required:

DEFUSR0=&HED00 or DEFUSR0=-4864 for a 48K system
DEFUSR0=&HAD00 or DEFUSR0=-21248 for a 32K system

NOTE: It doesn't have to be USR0. In the examples below, "USR" is used instead of "USR0", as they are identical.

Tape systems: Nondisk BASIC (Level II) has no DEFUSR command, instead the following line must be executed:

```
10 POKE 16526,0 : POKE 16527,109
```

Note: The POKES don't have to be line 10, they just have to be executed before the first USR call.

Once the USR is defined as above, a simple USR call, such as B$=USR("any string") will produce speech.

Here is an example:

```
10 DEFUSR0=&HED00 'for 48K. Use DEFUSR=&HAD00 for 32K.
   ' for Level II 16K use POKE 16526,0 : POKE 16527,109
20 CLS: CLEAR 500 'clear some space for input string
30 LINE INPUT"Type something!";A$
40 B$=USR(A$) ' speaks it
50 GOTO 30
```

When line 50 is executed, the content of A$ is spoken; A$ remains unchanged. (B$ contains the list of the phoneme codes just spoken. Each byte is the ASCII character for the phoneme codes 64 to 127). In the direct mode, a speech command could be:

```
B$=USR("Good morning")
```

■ METHOD 3: VSEDIT/BAS (disk) or V (tape)

—Tape users: The "V" program is similar to the VSEDIT/BAS program, except that the subroutine lines are not created. (There is no way to MERGE them to your program). You can use the "V" program to find the proper phonemes.

—VSEDIT/BAS is a BASIC program that allows you to create short message subroutines which can be merged later with your existing programs.

—The advantage of this method is that once you have created the subroutines, you do not need to keep the VS text to speech program in high memory. You can also "fine tune" the messages by editing the phonemes or trying different spellings.

—Each subroutine is one line long and self contained. Once the message is developed, you only need that single line to speak it. The line ends with a RETURN, so you just use a GOSUB. The limitation is that you must have all the messages pre-planned. Let's see it in action.

If it's not yet done, from DOS:

type VS48 for 48K systems (and press ENTER)
  or VS32 for 32K systems

then enter BASIC and type RUN"VSEDIT/BAS".

You will see a menu on the bottom of the screen with the following commands:

—I - Insert words. This is similar to the VSDEMO/BAS program. Simply type the words you want to hear and press ENTER; they will be spoken. In addition, the phonemes will appear at the top of the screen. Each one is preceeded by a graphic dot representing the pitch. (We will explain that later).

—By pressing "I" again, you can insert new words. Press ENTER, and the addition will be spoken and the new phonemes will be displayed.

- <ENTER> - Say all. Each time you press <ENTER>, the whole text will be spoken.
- S - Say one word. The word under the cursor is pronounced.
- ARROW KEYS - Move cursor. The four arrow keys let you move the cursor in the four directions.
- SHIFT LEFT or SHIFT RIGHT ARROWS - Move cursor back or forth one word at a time. To say all the text one word at a time, move the cursor to the top left, then use S and SHIFT RIGHT ARROW alternately.
- R - Remove word. The word under the cursor is deleted.
- K - Clear all. You will be asked if you really want to clear the whole text (as a safety precaution). Type Y if you want to, N if you don't. Remember to type I to enter new text.
- A - Add phoneme. The program will ask you for a valid Votrax phoneme. (See chart). Then you are asked for a pitch level. We will explain that later; for now simply press ENTER.
- D - Delete. The phoneme under the cursor is deleted.
- C - Change. The phoneme is deleted and you are asked to put a new one in its place as in the "A" (Add phoneme) command.
- Now is the time to discuss pitch control. The VS-100 is capable of saying phonemes at one of four pitch levels. The pitch is the frequency of the sound. For example, a man's voice has a lower pitch than a woman's. To the base pitch are added very small variations, called inflections. Your VS-100 will automatically add these inflections, making the speech sound more natural.
- SHIFT UP or SHIFT DOWN ARROW - contols the base pitch. (Note that SHIFT DOWN ARROW will not work on the Model III and on some Model I's).

Let's work with an example:

Type K to clear the screen,

—Y to proceed,

and I to insert text.

Type "Hello hello" and hit ENTER.

You will hear the VS-100 say hello twice, and the screen will show twice the four phonemes required, followed by the pause code PA0. You will also notice the graphic dot in front of each phoneme. This dot is a representation of one of the four pitch levels we can choose.

—With the left arrow key, move the cursor to the first "H" phoneme. Now hit shift up arrow four times. You will see the graphic representation of the four levels.

Level 1: no dot (lowest) Level 2: ■ Level 3: ■ Level 4: (highest) ■

The VS-100 automatically sets the phonemes at level 2.

—Use the shift up arrow to manually change the 4 phonemes of the first "Hello" to the highest pitch. Then press ENTER to hear the result of the change. Now you are ready to try out different variations of pitches.

—* - Save message (disk version only). This is a powerful function, so we'll explain it in detail.

—The VSEDIT program allows you to save on disk as many coded messages as you want, each one up to 15 seconds long. The purpose of the "Save message" command is to create a single line of BASIC code. This line, when executed will speak your message WITHOUT the help of the VS32 or VS48 text to speech programs. All the phonemes codes and the BASIC commands needed to say them are stored within the BASIC line. The line ends with a "RETURN", so it becomes a simple subroutine.

Example of line created by VSEDIT "*" command:

```
20000 OUT236,16:FORVS%=1TO6:OUT11,ASC(MID$("  XFC",VS%)):
NEXTVS%:RETURN
```

*<u>NOTE 1:</u> OUT236,16 is needed only on the model III to enable the input/output bus. It has no effect on the model I.

**NOTE 2: " XFC" is the ASCII representation of the phoneme code list.

•The line is created by VSEDIT, which saves the line to disk as an ASCII file. This file can later be added to your program with the "MERGE" command. Simply make certain that your program lines don't conflict with the new ones created by VSEDIT.

Let's use an actual example:

We want to use a large number of pre-set warning or welcome messages. Each one will be created by the following sequence:

•Type your message and fine tune it.

•Type *. (Use shift key)

•The computer will ask you for the disk file name.

•Answer with any valid disk file that you AREN'T using yet. Let's use VOICE/TXT (TXT is the standard extension for ASCII files). You can of course specify any drive number as well i.e. VOICE/TXT:1.

•Press enter, then you are asked for a line number.

•Pick a line number that isn't used in your program.

•When you press enter, VSEDIT will take a few seconds to create the BASIC line, then it will save it to the disk file you chose.

•After saving the file, VSEDIT asks if you want to clear the phonemes. Answer "Y" or "N". You then return to the menu.

•You can create many messages and save them in the same manner.

*NOTE 1: Except for TRSDOS on the model I, you can save more than one subroutine in each file. (Be sure to use different line numbers). If you are using TRSDOS on the Model I, use different file names for each message.

**NOTE 2: If you are using NEWDOS/80 Version 2.0, then the line numbers must be in ascending order. NEWDOS doesn't order the lines when you MERGE, other DOSes do.

***NOTE 3: It's a good idea to keep track of the messages and corresponding line numbers that you use. It will make it easier to add them to your programs later.

**NOTE 4: NEWDOS+ 2.1 users: you will have to disable the automatic conversion of lower case to upper case if you want to use pitch 2.

IMPORTANT: There are some limitations involved in saving messages with various pitches. Refer to the "Pitch Control" section of this manual if you want to use pitches other than the default pitch.

—? - Recall from disk (disk version only). This lets you get one of the messages that you saved to disk so that you can change it. You are asked for the file name. Type it in and press <enter>. The file must be an ASCII (text) file for VSEDIT to work. You will then be asked for the line number. Type the line corresponding to the message you want to edit and press <enter>.

NOTE : When you save the changed message, note that VSEDIT will add the new line to the end of the existing file. It will not overwrite the previous line with that number until it is LOADed into BASIC (NEWDOS/80 version 2.0 will not work if the lines aren't in order).

■ METHOD 4: Phoneme direct output from BASIC

—This method is described for reference only. Considering the convenience of the methods 1,2 and 3, we don't see any reason to use it.

—You can use the phoneme table (later in this manual) to create words by looking up the proper codes for each sound in the word. For example, let's say you want to add the word "daddy". The first sound is "d" which is code number 30. The "a" sounds like the "a" in "dad" (on the table) therefore, the phoneme is "AE" which is number 46. If you keep doing this you will get all the phonemes for the "daddy": D,AE,D,D,E or codes 30,46,30,30,44.

—To get speech, you must output each code to the VS-100. Use the OUT 11,X statement, where "X" is the code number.

—The VS-100 for the Model I&III sends a "busy" signal back othe computer while the VS is talking. The software mustlook at this "status bit" before it sends the next phoneme. Bit 7 of port 11 is low while the VS is busy. If you really want to use this method, you must use a short subroutine which checks the status bit prior to sending each phoneme code.

Ex: 100 IF INP(11)>127 THEN RETURN ELSE 100

Also remember that you have to enable the Model III I/O bus by with an OUT 236,16.

Our "Daddy" line above would be:

```
10 OUT 236,16 : GOSUB 100 : OUT 11,30 : GOSUB 100 : OUT
11,46 : GOSUB 100 : OUT 11,30 : GOSUB 100 : OUT 11,30 :
GOSUB 100 : OUT 11,44
```

8. Pitch control

—This paragraph is a bit technical, but it should be understandable.

—The computer communicates with the VS-100 via an eight bit byte. The VS-100 Votrax chip uses the lower six bits to select one of the sixty four phonemes. The remaining two bits are used to select a base pitch. Two bits give us four possibilities, so there are four base pitches. The four pitches are numbered 1 to 4. Phonemes with the lowest pitch use numbers 0 to 63. Phonemes with pitch 2 use the numbers 64 to 127, phonemes with pitch 3 use numbers 128 to 191, and phonemes with pitch 4 use numbers 192 to 255. Note that phoneme codes 0,64,128 and 192 are the same sound, only at different pitches. To select pitch 2,3 or 4, add 64, 128 or 192 to the phoneme code in the table.

—If you are using VSEDIT, keep in mind the following: If you save messages with pitch 2 (the default), you will get ASCII codes 64-127 embedded in the message line. These codes are a mixture of upper and lower case and some other characters. They will not affect your listing in any way. If you use pitches 3 or 4, you will see that your line is filled with keywords (i.e. FORPRINTCHR$(INKEY$) because codes above 127 are "tokens" for BASIC keywords. The line will run correctly, however it will look odd in listings. (There might be a problem if the line gets longer than 255 characters on the screen. Everything will work fine unless you try to EDIT the line or if you try to save it in a ASCII file).

—If you use pitch 1, the program line will contain ASCII control characters, such as "clear screen" and "form feed". This line will execute properly, but it will produce strange effects on the screen, during listings. This is because the control characters are executed when that line is listed. Again, this has no effect on the

execution of the program. The same applies to LLIST, for example, the printer may skip a page if it receives a "form feed" code.

—Also, pitch 1 phoneme codes 0, 13 and 34 are automatically replaced with codes 1, 77, and 41. The former codes (which correspond to null, CR, and ") cannot be embedded in the BASIC line, so they are converted by VSEDIT to the closest equivalent phoneme.

9. Machine language programming

—This section is only for machine language programmers. To add VS48 or VS32 with machine language software, you must do the following:

- Create a three byte pointer to a string containing the words to be spoken. (first byte is the length; second and third bytes are string location).
- Store the location of this pointer in 4121H.
- CALL 0ED00H for VS48 or 0AD00H for VS32 (CALL 06D00H for 16K tape users).
- The VS-100 will speak and the phomeme codes will be stored in string. The location of the pointer to this string will be in 4121H.

Example: You want the computer to say: "Good morning".

The string "Good morning" is stored at 8000H - 800BH. Your pointer would be 0C,00,80. Let's say you stored this pointer at 7F00H. Store 7F00H in 4121H and use the command

```
CALL     0ED00H  ; for VS48,  or
CALL     0AD00H  ; for VS32   or
CALL     06D00H  ; for 16K tape users
```

That's all that you have to do. All registers are saved and restored.

10. Future releases

—As we mentioned earlier, the VS-100 is an ongoing project. We are preparing a suggestion/ satisfaction card. If this card isn't enclosed with this manual, you will receive one shortly in the mail. We are gathering all comments and criticisms. All improvements will be included in subsequent releases of our text to speech programs. Watch our ads for availability of new releases. When the releases are ready, we will advertise them. If you are the first user to find a legitimate bug and send us some details, we will fix the software and update your disk with the latest version free of charge.

—Many enhancements to the VSEDIT and the VS programs are being planned. (For example, variable pitch in PRINT* statements, a text editor in VSEDIT etc.). Your feedback is appreciated.

—At the time of this printing, we have preliminary versions of text to speech converters for the following languages:

Spanish
Italian
Esperanto

We have also begun research on:

Japanese
Latin
German

—Some languages, such as French, Portugese and some Chinese dialects, use sounds that are not available in the Votrax chip. Only crude pronunciation could be achieved, so they will not be implemented.

—Some other languages, such as Russian, can be spoken on the VS-100, however their use of a different alphabet makes it difficult to implement on the TRS-80.

11. Troubleshooting guide

➖Your VS-100 is fully tested before shipment. The final inspection is done with the unit actually plugged into a TRS-80 computer.

➖Before you return your VS-100 to us, please check if the solution can be found below.

A. Computer "locks up"	- Is the power pack plugged in? - Is it connected to the VS-100? - Is the module plugged in upside down?
B. No sound at all	- Is volume turned up? - Is speaker OK? Test it using a radio or tape recorder "ear" jack. - Clean the TRS-80 edge connector.
C. Continuous sound (at power up)	- This is usually normal. The VS-100 will silence when you run VS32 or VS48.
D. Continuous sound (when TRS-80 off)	- This is normal. Your VS-100 should be turned off with the computer.
E. Program crashes	- Try to reproduce and note the details and send them to us. - Some DOSes (especially LDOS) use high memory for drivers. Use VS32 instead of VS48, or disable the drivers.

Remember, opening the unit will void your warranty.

12. Customer support

Alpha Products hopes that the software supplied with your VS-100 is adequate and bug-free. If, however, you have a suggestion, problem or complaint, we would really like to know. Please do not call Alpha Products directly, as the order-taking personnel will not be able to help you with technical matters. The technical staff works at a different location and is not available over the phone. We would greatly appreciate it if you took the time to write your comments and send them to us. Please include a daytime and/or evening phone number, so that we can reach you. It may take a few days to find a solution, but we will get back to you with an answer. Send all correspondence to:

ALPHA PRODUCTS
Technical Support
79-04 Jamaica Avenue
Woodhaven, NY 11421

Be sure to include the following:

- Computer Model
- DOS used
- VS-100 software version (stamped on disk label)

13. Phoneme list

Ph.	Code	As in	Duration	Ph.	Code	As in	Duration
A	32	day	185mS	ER	58	bird	146mS
A1	6	made	103	F	29	fast	103
A2	5	enable	71	G	28	get	71
AE	46	dad	185	H	27	hello	71
AE1	47	after	103	I	39	pin	185
AH	36	mop	250	I1	11	inhibit	121
AH1	21	father	146	I2	10	inhibit	80
AH2	8	honest	71	I3	9	inhibit	55
AW	61	call	250	IU	54	you	59
AW1	19	lawful	146	J*	26	judge	47
AW2	48	salty	90	K	25	trick	80
AY	33	jade	65	L	24	land	103
B	14	bag	71	M	12	mat	103
CH*	16	chip	71	N	13	sun	80
D	30	paid	55	NG	20	thing	121
DT	4	butter	46	O	38	cold	185
E	44	meet	185	O1	53	aboard	121
E1	60	be	121	O2	52	for	80
EH	59	get	185	OO	23	book	185
EH1	2	heavy	121	OO1	22	looking	103
EH2	1	enlist	71	P	37	past	103
EH3	0	jacket	59	PAO	3	no sound	47

Codes are for pitch 1. For pitch 2,3 or 4 add 64,128 or 192

* To produce the "CH" sound, T must precede CH.
To produce the "J" sound, D must precede J.

Ph.	Code	As in	Duration	Ph.	Code	As in	Duration
PA1	62	no sound	185mS	UH	51	cup	185mS
R	43	red	90	UH1	50	uncle	103
S	31	pass	90	UH2	49	about	71
SH	17	shop	121	UH3	35	mission	47
STP	63	no sound	47	V	15	van	71
T	42	tap	71	W	45	win	80
TH	57	thin	71	Y	41	any	103
THV	56	the	80	Y1	34	yard	80
U	40	move	185	Z	18	zoo	71
U1	55	june	90	ZH	7	pleasure	90

Note 1: The numbers in the phonemes (Ex: UH2) have no effect on the sound, they only affect the duration. Higher numbers mean shorter sounds.

Note 2: The phoneme duration is indicated in milliseconds. They are shown for comparison purposes only.

DIPTHONG CHART

A1-AY-Y	maid,late	AH1-EH3-Y	side,find
UH3-AH2-Y	white,might	AH1-I3-UH3-L	smile,mile
O1-UH3-Y	boy,joy	O1-I3-UH3-L	spoil,boil
AH1-O2-U1	now,found	UH3-AH2-U1	house,joust
O1-U1	tote,float	Y1-IU-U1	music,few
AY-I1	beer,fear		

14. Applications

As you will probably find out, the VS-100 will generate a lot of interest. For the first time, we noticed that people who usually ignore the computer would gather around, wanting to try their own message.
Here are some examples of possibilities to explore:

- Talking party games
- Typing tutor with voice feedback
- Terminal for the blind
- Talking adventure games
- Speak and Spell emulation
- Talking clock and appointment reminder
- Program reader (for proofing)
- Talking calculator
- Language tutor
- Reeducation for speech disorders
- Intelligent alarm system
- Communication for the disabled (with proper interface)

The VS-100 invites many game and business applications. If you create a high quality program, please contact us for possible distribution. We are particularly interested in developments involving help to the handicapped since the VS-100's low cost opens up many new and exciting possibilities.

15. Warranty

LIMITED WARRANTY

•Your VS-100 is warranted to the original consumer only, for 90 days, to be free from defects in materials and workmanship under normal use. Our obligation under this warranty is limited solely to repairing the product, without charge. Please send any defective units to us insured and properly packed to prevent loss or damage during shipping. Alpha Products is not liable for incidental or consequential damages for failure or malfuntion of the product, and any recovery may not be greater than the purchase price paid for this product. This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

•Alpha Products shall have no liability or responsibility to the purchaser or any other person regarding liability, loss, or damage caused, or alleged to be caused, directly or indirectly, by use of the programs or the program manual. This includes, but is not limited to, any loss of business or anticipated profits resulting from such loss of usiness, or any interruption of service or consequential damages, whether physical, monetary, material, or of any other kind, resulting from use of such programs or the program manual.

•Important: Opening the unit will void your warranty.

ALPHA Products

17. Trademarks and other credits

Votrax is a trademark of Federal Screw Works
TRSDOS and TRS-80 are trademarks of Tandy Corp.
LDOS is a trademark of Logical Systems Inc.
VS-100 is a trademark of Alpha Products.
Speak and Spell is a trademark of Texas Instruments.
IBM is a trademark of International Business Machines.

We would like to thank the Naval Research Laboratory, for their excellent research which served as the backbone for our work on the text to speech translator.

18. Bibliography

—If you want to know more about speech synthesis, we highly recommend one of the latest works in the field: J. Cater, Electronically Speaking: Computer Speech Generation, Indianapolis: Howard W. Sams & Co, Inc., 1983.

—This book offers clear and complete overview of the different techniques used in speech synthesis. It's an excellent "next step" in this area. It's available from Alpha Products ($14.95 + $2.50 S&H) or from Howard W. Sams & Co., Inc.

—Below is a list of some books and articles on the subject.

■ W.A. Ainsworth,"A System for Converting English Text into Speech," IEEE Trans. Audio Electroacoust., vol. AU-21, pp. 288-290, June 1974.
■ J. Allen, "Speech Synthesis from Unrestricted Text," IEEE Convention Digest, 1971, pp. 108-109
■ N. Chomsky and M. Halle, The Sound Patterns of English. New York: Harper & Row, 1968.