Mountain Computer
INCORPORATED

SUPERTALKER
OPERATING MANUAL

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CONTENTS

INTRODUCTION

The MCI SUPERTALKER installs in the Apple II, Apple II+ and Apple IIe* and provides the user with the ability to digitize human speech and store it on diskettes. SUPERTALKER can replay the stored digitized speech information via the speaker supplied with the system.

The software includes the Vocal Preparation System (VPS). **VPS** allows the user to develop a phrase diskette. This diskette can contain numerous tables containing user developed phrases. Each phrase table can contain words, phrases, or complete sentences.

The user can select, via software, the audio quality and level of the recorded speech data. The quality of recorded data is dependent on the selected digitizing rate. The higher the rate the better the quality. Four rates can be selected: 512 Bytes/ Sec, 2048 Bytes/Sec, 2048 Bytes/Sec, and 4096 Bytes/Sec. The playback volume has four software selectable levels.

* Apple II, Apple II+ and Apple IIe are trademarks of Apple Computer, Inc., Cupertino, CA.

Section 1

INSTALLATION

SUPERTALKER comes with a 16 sector diskette containing a Vocal Preparation System (VPS) and two demonstration programs: Accent and Talking Color Math. These software packages will only work on a system with a minimum of 48K of RAM, the Applesoft Language card or Mountain Computer RAM+ card, and one disk drive. It is Possible to use the SUPERTALKER without these programs in systems that have less memory.

UNPACKING

Carefully unpack the SUPERTALKER System. Handle the circuit card gently, holding it by the edges. Take note of the way it was packed (save the packing materials) in case you need to repack it for shipping at a later date.

The following items should be included in the SUPERTALKER box:

- This manual

- The SUPERTALKER circuit card

- A microphone

- A speaker

- A SUPERTALKER Diskette (16 sector)

- A Warranty Registration Card

If any of these items are missing, contact your dealer.

Fill out and mail the Warranty Registration Card. This card helps Protect your investment by letting us know where to send updates and improvements that may be developed for your system.

INSTALLATION PROCEDURE

Perform the following steps to install the SUPERTALKER System in your Apple II.

1. Turn the Apple II rear panel Power switch to the OFF position.

2. Remove the Apple II top cover.

3. Insert the microphone connector into SUPERTALKER Circuit Card connector J2 (MICROPHONE INPUT) as shown in Figure 1-1.

SECTION 1   INSTALLATION

4. Insert the speaker connector into SUPERTALKER connector J1 (SPEAKER OUTPUT).

NOTE

J1 can also be connected to the input of a stereo or public address system.
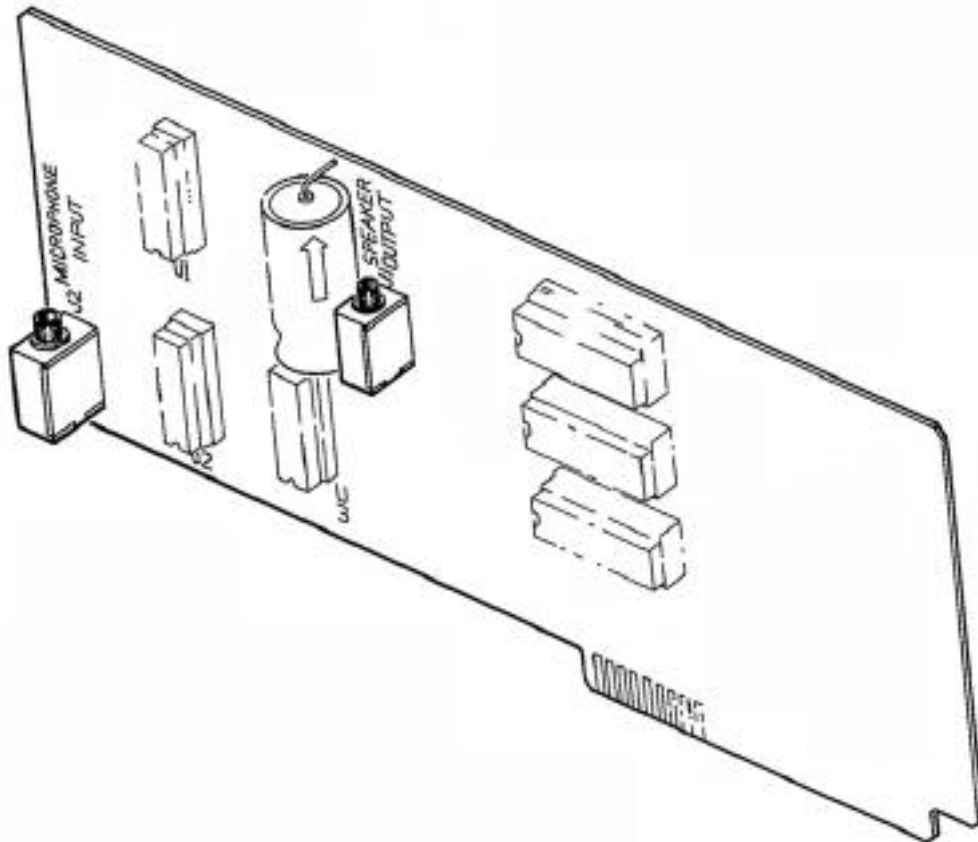
Figure 1—1   SUPERTALKER Microphone and Speaker Jacks

5. Plug the SUPERTALKER Card into an Apple II I/O slot.

6. Verify that the card is firmly seated in the I/O connector, then route the speaker and microphone cables through the Apple II rear panel slots.

7. Verify that an Apple Language card or the Mountain Computer RAM+ card resides in slot 0.

8. Replace the Apple II cover and turn the power on.

SECTION 1   INSTALLATION

SUPERTALKER INSTALLATION TEST

The following test will verify that the SUPERTALKER System is functioning properly.

1. Make a working copy of the MCI SUPERTALKER SD200 diskette (12—00246) (making sure your working copy is not write protected). Creating this backup copy is a safety measure, in case anything should happen to your master copy.

As indicated on the diskette label, two demonstration Phrase Tables (Accent and Talking Color Math) are on the reverse side of the SUPERTALKER SD200 diskette. Make a backup copy of the Phrase Tables also.

2. Boot side 1 of the SUPERTALKER diskette.

3. Type **RUN SUPERTALKER TEST** and press RETURN key.
    The Apple II monitor will display the following prompt:

    SUPERTALKER IS IN SLOT X

    IS THIS CORRECT (Y OR N)?

4. Answer the **Y**es or **N**o question. Enter **N** if the slot is not correct. This will display the following on the monitor.

    ENTER TALKER SLOT 1(1-7)?

5. Enter the slot number. This will display the following prompt:

    CONFIGURING FOR NEW SLOT I

    IT WILL BE SAVED ON DISK

    NOTE:

    Verify that there is no write protect tab on the diskette.

    SUPERTALKER IS IN SLOT 1

    IS THIS CORRECT (Y OR N)?

6. Enter **Y** to display Figure 1-2 on the monitor.

HIT 'E' TO EXIT PROGRAM
HIT 'H' TO CHANGE RATE
HIT 'V' TO CHANGE VOLUME

HIT RETURN KEY WHEN YOU ARE
READY TO BEGIN RECORDING.

HIT RETURN KEY A SECOND TIME
WHEN YOU ARE DONE RECORDING.
Figure 1—2 SUPERTALKER Test Menu

7. Follow the instructions displayed in Figure 1-2 and verify
   that the recorded voice data is reproduced by the speaker.
   You are ready to begin recording when the blinking square
   appears on the monitor. Press RETURN and record. To play
   back what you have recorded, press RETURN again. The process
   can be repeated each time the blinking square appears.

NOTE

    For best results the microphone should be held
about an inch away from your mouth. You
should attempt to speak at a constant level
(don't breathe directly into the microphone).
Be aware of the background noise when you are
recording; excessive noise will be recorded
along with your voice input.

Try recording at several rates and volume levels to determine the
quality and level of audio reproduction required for your
application. <u>Remember,</u> <u>the</u> l o w e r <u>the</u> <u>rate</u> <u>the</u> l e s s <u>memory</u>
<u>required</u> When you are finished recording, press E to exit the
program. (See VOCAL CREATION LEVEL in Appendix A.)

This completes the SUPERTALKER Test.

Section 2

APPLICATION DEMONSTRATION PROGRAMS

The following programs provide brief examples of SUPERTALKER system applications.

ACCENT DEMONSTRATION PROGRAM

The Accent program demonstrates the potential for SUPERTALKER language education applications. To run Accent, perform the following steps:

1. Verify that the SUPERTALKER is located in an Apple I/O slot. (If the audio portion of the demonstration is missing, you may have keyed in the wrong I/O slot number.) The floppy disk drive interface card must be installed in slot 6 for this program. (The slot numbers are above the connectors in the rear of the Apple motherboard.)

                              NOTE

     If you are a first time user, be sure to run
     the SUPERTALKER Installation Test first to
     verify that the system is operational.

2. Boot the SUPERTALKER diskette and type **RUN   ACCENT.** Press the RETURN key. This will display Figure 2-1 on the monitor.

<div align="center">

MOUNTAIN COMPUTER, INC.
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PRESENTS
****
*   ACCENT ON WORDS   *
*   VERSION 2.0   *
****

CONFIGURED FOR 1 DISK DRIVES

DISKETTES IN DRIVE X, SLOT X

SUPERTALKER IN SLOT X

CONFIGURATION CORRECT (Y OR N)?

</div>

Figure 2—1 SUPERTALKER System Configuration

4. Verify that the system configuration is as shown in Figure 2—1, depending on whether you are using one or two drives. Type N to change the system configuration to match your requirements. This will display Figure 2—2.

SECTION 2 APPLICATION DEMONSTRATION PROGRAMS

SUPERTALKER SLOT NUMBER (1 - 7) ?

NO. OF DISK DRIVES BEING USED (1 OR 2)?

PROGRAM'S SLOT NUMBER (1 - 7)?

PROGRAM'S DRIVE NUMBER (1-2)?

Figure 2—2 Configuration Modification

Answer the questions as they appear. Once the modification is complete, the monitor will display the following message:

NEW CONFIGURATION IN **PROGRESS.**
IT WILL BE SAVED ON DISK.

The monitor then returns to Figure 2—1 for verification.

5. Type **Y** to display the following message:

REMOVE PROGRAM DISK AND THEN
PLACE PHRASE TABLE DISKETTE INTO
THE DRIVE - HIT RETURN THEN READY

6. a) If you are using a single drive, turn the SUPERTALKER
    SD200 diskette over.

   b) If you are using two drives, ignore the above message.
    Leave the SUPERTALKER SD200 diskette in drive one. Place
    the backup copy you have made of the Phrase Tables in
    drive two (see Section 1). There will be a variation of
    the configuration of Fig. 2-2.

Press the RETURN key to display the following message:

DO YOU WANT INSTRUCTIONS (Y OR N)?

and an audio prompt from the SUPERTALKER speaker will occur.
Type Y to display Figures 2—3 and 2-4.

'ACCENT ON WORDS' IS A PHRASE
TRANSLATOR. IT ALSO LETS YOU PRACTICE
YOUR ACCENT.
TO HEAR A PHRASE TRANSLATED TYPE IN
THE NUMBER CORRESPONDING TO THE LANGUAGE
DESIRED. TO PRACTICE YOUR ACCENT TYPE IN
THE NUMBER 3, LISTEN TO THE PHRASE
SPOKEN, THEN SAY IT YOURSELF. TO SELECT
A NEW PHRASE FOR TRANSLATION ENTER THE
NUMBER 2.
REMEMBER--ENTER THE COMMAND NUMBER
ONLY WHEN YOU SEE A BLINKING SQUARE.

Figure 2-3 Accent Instructions

SECTION 2 APPLICATION DEMONSTRATION PROGRAMS

1 STOP THE SESSION
2 NEXT PHRASE SELECTED
3 **PRACTICE YOUR ACCENT**
4 PHRASE TRANSLATED TO GERMAN
5 PHRASE TRANSLATED TO FRENCH

THE CURRENT PHRASE:

XXX   XXX   XXXX

THE SELECTED LANGUAGE -
COMMAND NUMBER?

Figure 2-4 Accent Menu

7. Follow the instructions and select one of the items listed in Figure 2—4

NOTE

If you have difficulty in exiting one of the
demonstration programs, press CTRL-C to return
to Applesoft BASIC.

To end the session, press the 1 key. After a brief message, the
following will appear on the monitor:

REMOVE PHRASE DISKETTE AND THEN
PLACE PROGRAM DISKETTE INTO
THE DRIVE AND HIT RETURN WHEN READY

(If you are using one disk drive, turn the diskette over.)

This completes the Accent demonstration.

TALKING COLOR MATH DEMONSTRATION

The Talking Color Math program demonstrates the potential for
SUPERTALKER education applications. The program was developed
for use with a color monitor; however, a black and white monitor
is acceptable. For this program you must have an MCI RAM+ Card
or an Apple language card in Apple I/O slot 0. To run the Talk-
ing Color Math program, perform the following steps:

1.   Verify that the SUPERTALKER card is installed in an Apple I/O
      slot. (If the audio portion of the demonstration is missin
      you may have keyed in the wrong I/O slot number.)

2.   Verify that an MCI RAM+ Card or an Apple language card is
      installed in Apple I/O slot 0.

3.   Boot the SUPERTALKER SD200 diskette and type **RUN TALKING**
      COLOR MATH. Press the RETURN key.

SECTION 2   APPLICATION DEMONSTRATION PROGRAMS

4.   The following message will be displayed on the monitor:

SUPERTALKER SLOT?

5.   Enter the Apple I/O slot number that the SUPERTALKER resides in and press the RETURN key. The following will appear o the monitor:

REMOVE PROGRAM DISKETTE AND THEN

PLACE PHRASE DISKETTE INTO

DRIVE X, SLOT X - HIT RETURN WHEN READY

6.   Verify that your Apple disk drives are configured as indicated on the monitor, depending on whether you are using one or two drives.

7.   Place the Phrase Tables diskette into the proper drive a press the RETURN key. (See Accent demonstration program, step 6.) This will display the following message on monitor:

*******   COLOR MATH   *******

I'LL GIVE YOU THE MATH PROBLEMS, AND YOU GIVE ME THE ANSWERS. IF YOU GET IT RIGHT, I'LL SMILE

TO STOP -- TYPE AN 'S' INSTEAD OF THE ANSWER

At this point SUPERTALKER should be talking and math problems should be displayed on the monitor. Answer each ma question by typing in the appropriate number and pressing the RETURN key. (Try giving several wrong answers in succession!)

8.   To terminate the demonstration type S. This will display the following message:

REMOVE PHRASE DISKETTE AND PLACE PROGRAM DISKETTE INTO THE DRIVE HIT RETURN WHEN READY

(If you are using one disk drive, turn the diskette over.)

This completes the Talking Color Math demonstration.

Section 3
PHRASE TABLE DEVELOPMENT

VPS

The Vocal Preparation System (VPS) allows the user to produce custom phrase tables that can be stored on diskettes. Each phrase diskette must be initialized by VPS. VPS stores identification and phrase directory information on track 0 at sector 0. The remaining sectors (16 sector format) are available for digitized speech and the strings associated with each phrase. Up to 147 phrase tables can be stored on one diskette.

A phrase table is the smallest unit that can be loaded from the diskette into Apple memory. Each phrase table can contain up to sixty-four phrases. Once the phrase table has been loaded into the Apple main memory, a user program can access any phrase within the table.

PHRASE TABLE EXAMPLE

CREATION OF A PHRASE TABLE DISKETTE

This section of the manual is an example session. Read carefully. The phrase tables created in this session can be used with the Color Math SUPERTALKER Demo program. Follow along with the examples below and create your own phrase tables for use with the Color Math program. This session uses many of the commands described in Appendix A.

Before you may use your SUPERTALKER with VPS in your application program, you must first create one or more phrase tables with the VPS. Each table may contain one or more phrases. Although we use the term "phrase" throughout this manual, one "phrase" could be one spoken word, many spoken words, or an entire sentence. It is important to realize that this "phrase" is the basic data element accessible by SUPERTALKER. This means that you may pick any phrase from a phrase table for playback over the loudspeaker, but you cannot playback one-half of a phrase.

By way of example, let's suppose we wanted to speak a number that was the result of a calculation. This number would be a whole number between 0 and 9999. Clearly, we would have one phrase for each one of the ten thousand different numbers.

The problem here is that we need a lot of memory to store ten thousand phrases. there is a much better way. We store the words "thousand", "hundred", "ninety",..."thirty", "twenty", and each number from 19 to 0 inclusive. In this manner, we need to store only 30 phrases and just put them together in the correct sequence. For example, to speak the number 75143, we speak the phrases "seven", "thousand", "five", "hundred", "forty", "three". SUPERTALKER is fast enough to concatenate the phrases into an understandable spoken number.

SECTION 3   PHRASE TABLE DEVELOPMENT

We use the VPS (Vocal Preparation System) to produce our phrase diskettes. Each phrase diskette is initialized by VPS with information which identifies the diskette as a phrase diskette.

The Main Command Level of the command structure is indicated by a colon (:) prompt appearing on the screen. The commands on this level will generally affect whole phrase tables.

The next or middle level of the command structure is the Edit Command Level. It is entered from the Main Command Level and is indicated by an exclamation point (I) prompt. The commands on the Edit Level affect the one current phrase table which you are editing.

The bottom level is the Vocal Creation Level. This level is entered from the Edit Level and is indicated by a number followed by the phrase to be created. On this level, you will be creating the vocal phrases for the current phrase table.

Take two diskettes which have been initialized with DOS's INIT routine. Use one diskette to create a backup copy of SUPERTALKER
SD200 diskette (see Section 1). Use the other one for the new Phrase Table diskette.

Insert the new MCI SUPERTALKER diskette in drive 1. Run the VPS program by typing RUN VPS and pressing RETURN. (Wait approximately 20 seconds.) The following will appear on the screen:

<div align="center">

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</div>

```
********************************************************
*   PREPARATION OF VOCAL PHRASE TABLES    *
*              VPS VERSION 2.0             *
********************************************************
```

CONFIGURED FOR 2 DISK DRIVES

PROGRAM DISKETTE IN DRIVE 1, SLOT 6

PHRASE DISKETTE IN DRIVE 2, SLOT 6

SUPERTALKER IN SLOT 14

CONFIGURATION CORRECT (Y OR N)?

<div align="center">

Figure 3—1

</div>

Confirm your APPLE'S configuration. Enter **Y** to display the following:

      PLACE PHRASE DISKETTE INTO
      DRIVE 2, SLOT 6 - HIT RETURN WHEN READY

SECTION 3 PHRASE TABLE DEVELOPMENT

Insert a blank phrase table diskette in drive 2, press RETURN, and observe this on the screen. Type in the missing words as you are prompted.

> **PHRASE TABLE DISKETTE IS UNRECOGNIZABLE**
> **DO YOU WANT IT INITIALIZED (Y OR N)? Y**
> **ENTER NAME FOR PHRASE DISK** – **MATH**
> **INITIALIZING NEW PHRASE TABLE DISK**
> **NEW PHRASE DISK, NAME** – **MATH**

Be sure to name the phrase diskette **"MATH".** You also see a command prompt (:) telling you that the VPS is ready to create your first phrase table.

The SUPERTALKER is now in the record mode. Place the microphone switch to the ON position and talk into the microphone. For best results hold the microphone an inch or more away and pointed at your mouth (angled slightly). Speak at a constant level of loudness and try not to breathe directly into the microphone.

In this particular program, you should be trying to conserve memory. Enter FØ to set the silence in front of a phrase to zero, and press RETURN. Enter EYE and press RETURN to edit a new phrase table as shown in Figure 3—2.

> **:FØ**
> **:E13**
> **NEW PHRASE TABLE**
> **!A**
> **WAIT FOR SPEAK TO BLINK BEFORE TALKING**
> **HIT RETURN WHEN FINISHED**
> **1—**

Figure 3-2

NOTE

> Excessive background noise will override the pause compression feature. This will cause a marked reduction in the ability to store usable data (both speech and noise will be stored).

Now, start creating your new table. (Begin by typing Ø first.) Speak the numbers zero through nine. (Hit RETURN for SPEAK to blink.) After each prompt, type the next number and press RETURN; then speak the number and press RETURN.

SECTION 3 PHRASE TABLE DEVELOPMENT

```
               1—0
               2—1
               3—2
               4-3
               5-4
               6—5
               7—6
               8—7
               9—8
              10—9
              11—<
               !T
```

When 11 appears, press CTRL-T to make prompt **!** appear. Then type **T** (for Talk) and press RETURN to play back what you have recorded.

Suppose you don't like the way numbers 7 and 8 sound, and 6 was clipped in the beginning. Delete phrase numbers 7, 8 and 9 by typing D7—9 (D for Delete) after the **!** prompt on the screen. Press RETURN. Then insert new phrases starting at phrase number 7 by typing IT (I for insert). Press RETURN. You may also add one unit of silence in front of the number 6.

```
          !D7—9
          !I7
          WAIT FOR SPEAK TO BLINK BEFORE TALKING
          HIT RETURN WHEN FINISHED
          7—(1,O) 6
          8—7
          9—8
          1 O-<
```

Press CTRL—T to cause the I prompt to appear. Now, play back the phrases by typing T and pressing RETURN. If they sound good, check the statistics to see how much memory you have used and how much is left in your table by typing S and pressing RETURN. The following will appear:

```
          !T
          !S
          BYTE SUMMARY
            PHRASE #    BYTES
            1          785    (311)
            2          772    (304)
            3          783    (30F)
            4          741    (2E5)
            5          840    (348)
            6          755    (2F3)
            7          974    (3CE)
            8          731    (2DB)
            9          502    (1F6)
                            10         927    (39F)
          TOTAL BYTES UNUSED - 12536 (30F8)
          PHRASE TABLE LENGTH IN PAGES - 80 (50)
          IA
```

3—4

SECTION 3 PHRASE TABLE DEVELOPMENT

This time, add (append) the words ten, eleven, twelve, and the
syllables twen, thir, teen, fif, ty and =. Again you check how
large the table is.

```
11—10
12—11
13—12
14-TWEN
15—THIR
16—TEEN
17-FIF
18—TY
19—=
20—<
```

```
     BYTE SUMMARY
PHRASE #   BYTES
     1       785    (311)
     2       772    (304)
     3       783    (30F)
     4       741    (2E5)
     5       840    (348)
     6       755    (2F3)
     7       974    (3CE)
     8       731    (2DB)
     9       502    (1F6)
    10       927    (39F)
    11       755    (2F3)
    12       915    (393)
    13      1145    (479)
    14       759    (2F7)
    15       697    (2B9)
    16      1137    (471)
    17       809    (329)
    18       886    (376)
    19      1126    (466)
TOTAL BYTES   UNUSED    — 4307 (10D3)
  PHRASE TABLE LENGTH IN PAGES —80(50)
```

If you wonder how fifty-five might sound, check it.

!T17, 18,6

The "ty" syllable did not sound right. The syllable "ty" was
closer to "five" than it was to "fif", so record the phrase with
a little silence behind it.

```
!D18
!118
WAIT FOR SPEAK TO BLINK BEFORE TALKING
HIT RETURN WHEN FINISHED
18—(,2) TY
19-<
IT 17,18,6
```

SECTION 3 PHRASE TABLE DEVELOPMENT

It sounds better, so save your table by **typing** CTRL-E.

Now move on to the second table, and set silence in front of phrase to one. You then append the new phrases into the table.

```
:FØ
:E14
NEW PHRASE TABLE IA
WAIT FOR SPEAK TO BLINK BEFORE TALKING BIT
RETURN WHEN FINISHED
1-PLUS
2-MINUS
3-TIMES
4-DIVIDED B!
5-IS
6—RIGHT
7-WRONG
8-BUT GETTING
9-WARMER
10—COLDER
11—(
!
```

Play back the phrases, and since they sound good, save this table also. Now create table 15.

```
:FØ
:E15
NEW PHRASE TABLE !A
  WAIT FOR SPEAK TO BLINK BEFORE TALKING
  HIT RETURN WHEN FINISHED
1—
```

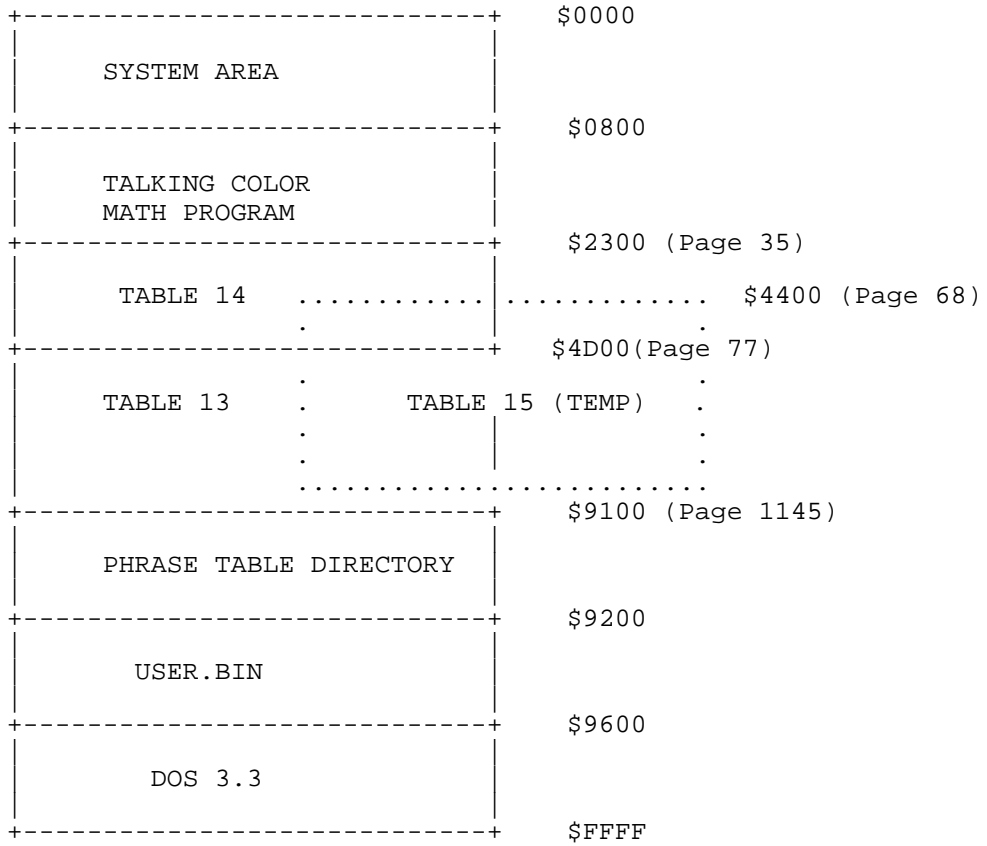Now, start creating your new table as shown below.

```
1—INTRO
2-LANGUAGES
3—ARITH
4-<
!T
```

For phrase 1 enter a short introduction (e.g. HI! THIS IS GEORGE SMITH'S). For phrase 2 enter a short description phrase (e.g. LANGUAGE DEMO) and for phrase 3 enter a short description phrase (e.g. TALKING MATH PROGRAM). When **4** appears, press CTRL-T to make prompt **!** appear. Then type T (for Talk) and press RETURN to play back what you have recorded. (Type CTRL-E to save.)

In order for these three phrase tables to operate with the MCI Talking Color Math program they must be positioned in Apple memory at specific locations so that they are compatible with the program. These locations are shown in the following figure.

SECTION 3 PHRASE TABLE DEVELOPMENT

APPLE MEMORY MAP

```
+-----------------------------+     $0000
|                             |
|       SYSTEM AREA           |
|                             |
+-----------------------------+     $0800
|                             |
|     TALKING COLOR           |
|     MATH PROGRAM            |
+-----------------------------+     $2300 (Page 35)
|                             |
|     TABLE 14    ...........|.............. $4400 (Page 68)
|                 .          |               .
+-----------------------------+     $4D00(Page 77)
|                 .          .               .
|     TABLE 13    .     TABLE 15 (TEMP)   .
|                 .          |               .
|                 .          |               .
|                 ........................
+-----------------------------+     $9100 (Page 1145)
|                             |
|     PHRASE TABLE DIRECTORY  |
|                             |
+-----------------------------+     $9200
|                             |
|       USER.BIN              |
|                             |
+-----------------------------+     $9600
|                             |
|       DOS 3.3               |
|                             |
+-----------------------------+     $FFFF
```

Notice that the three phrase tables overlap in Apple memory. This does not cause a memory conflict because Table 15 is used only once, then Tables 13 and 114 are brought in. **You must be sure that the three tables you have created are within the boundaries indicated in the figure above; if not, recreate them.** To specify the correct page address for each of the tables perform the following steps. Enter **A13** after the colon and enter the page address, then enter the page address for Tables 14 and 15.

        :A13
        ENTER PAGE ADDRESS — 77
        :A114
        ENTER PAGE ADDRESS - 35
        :A15
        ENTER PAGE ADDRESS — 68

SECTION 3 PHRASE TABLE DEVELOPMENT

Verify that phrase tables 13 through 15 will be routed to the memory locations shown in the figure above by entering the following.

```
:01
:C13—15

CATALOGUE FOR PHRASE DISK MATH
ID#
----

13 LENGTH=65 SECTORS
   STARTING TRACK=O, SECTOR=1
   LOAD INFO.=77 [19712] (4D00)
   VOL.=3 FREQ.=3

14 LENGTH=42 SECTORS
   STARTING TRACK=3, SECTOR=14
   LOAD INFO.=35 [8960] (2300)
   VOL.3 FREQ.=3

15 LENGTH=37 SECTORS
   STARTING TRACK=6, SECTOR=8
   LOAD INFO.=68 171108 (111100)
   VOL. =3 FREQ. =3
```

   NUMBER OF UNUSED SECTORS= 419

Verify that the following do not overlap: Tables 13 and 14, Table 13 and the Phrase Table Directory, and Table 1 5 and the Phrase Table Directory. This can be done by multiplying the LENGTH IN SECTORS of each table by 256 and adding this to the decimal value in LOAD INFO. (value in brackets). Verify that the starting address for each table is correct (the first value in LOAD INFO. is the page). If an overlap exists, recreate the table (try to make the phrases shorter).

Your tables may now be used with the Color Math Demo program.

APPENDIX A
PHRASE DISKETTE COMMANDS

MAIN COMMAND LEVEL

This is the main level of the VPS program. The prompt for this level is a colon (:). Most of the commands at this level return control back to this level.

This is the top level of the VPS. The commands at this level affect the phrase tables you will create. While at this level, there are no current tables in memory. The commands which set parameters (B,F,M,H and V) establish these parameters for all subsequent phrase tables you produce. Any phrase tables which already exist on the diskette are not affected. That is to say, if you change a parameter (M), the VPS will <u>not</u> change the length of the phrase tables out on the diskette. Any new phrase tables made after you change the length (via M) will be affected. In general, the commands at this level affect phrase tables subsequent to the command's execution.

CONTROL FLOW

The flow of control is shown in the flow chart (Figure A-1). The commands in this Main Command Level which return control back to the Main Command Level are:

A,B,C,D,F,I,L,M,O,H,T,and V

After you execute any one of these commands, you will get the : prompt again. If you execute the Command E, you go down to the next lower level, the Edit Level, and you get the Edit Level prompt, **!** . At this command level (: prompt), the Q command or the CTRL—C will reboot DOS and leave the Main Command Level, returning the user to APPLESOFT.

APPENDIX A   PHRASE DISKETTE COMMANDS

START

CONFIGURATION
&
CONFIRMATION

IS IT
A PHRASE
TABLE DISK?

NO

DO
YOU WANT
INITIALIZATION?

NO

RE-BOOT DOS

YES

YES

INITIALIZE
PHRASE
DISKETTE

MAIN
COMMAND
LEVEL

A,B,C,D,F,I,L,M,
O,R,T,or V
COMMANDS

Q
or
CTRL-C

E
CMND

D,L,M,R,S,T,or V
COMMANDS

RE-BOOT DOS

CTRL-C

EDIT
LEVEL

CTRL-E, CTRL-S
COMMANDS

I or A
CMND

CTRL-C

VOCAL
CREATION
LEVEL

CTRL-T
COMMAND

A-2
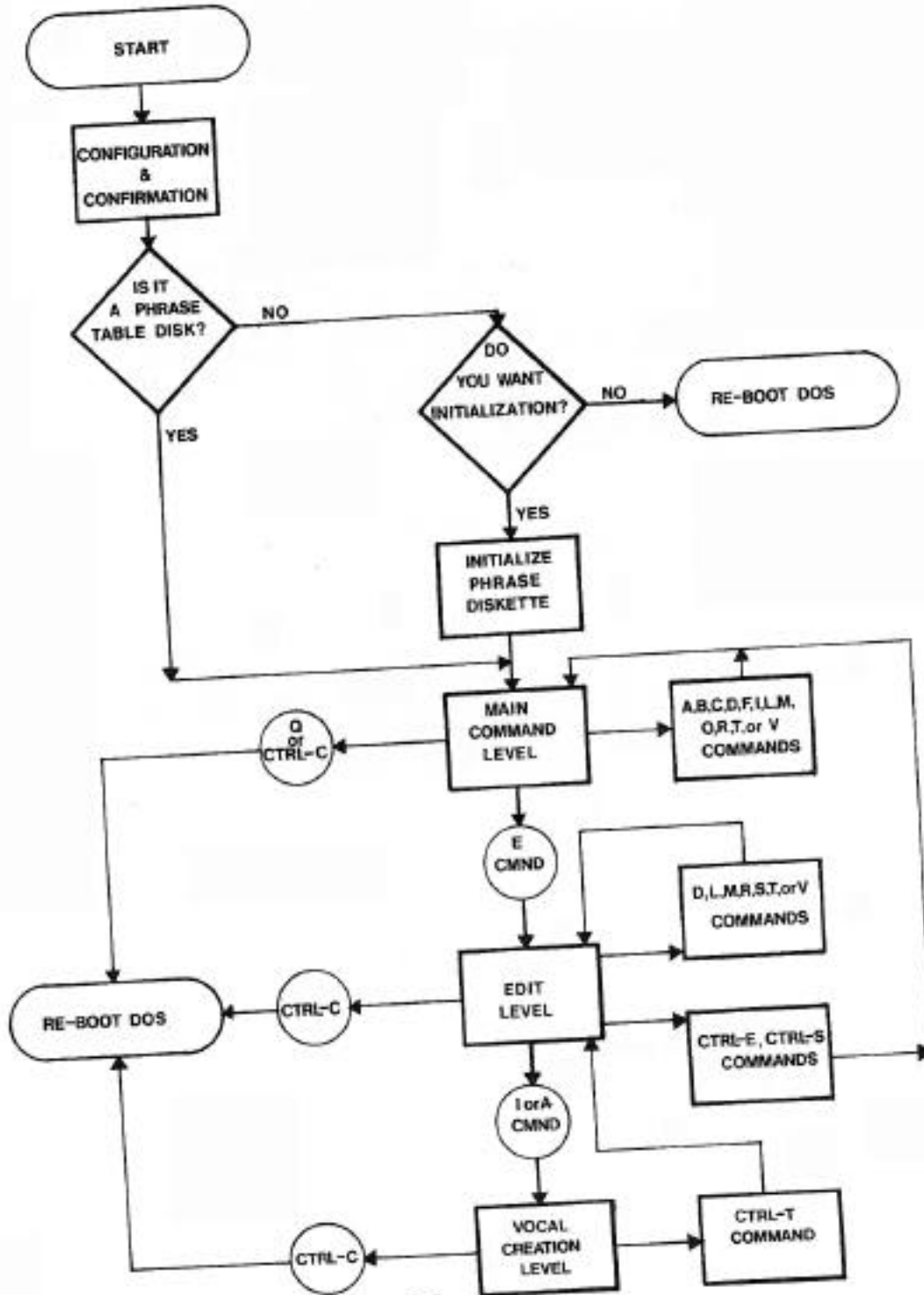
APPENDIX A   PHRASE DISKETTE COMMANDS

This section contains a detailed explanation of each command, their effects, and examples of the commands as they are used.

A COMMAND – Address Origin

```
    Syntax          :A range (CR)
    Example         :Al(CR) or :A3—6(CR)
```

This command will prompt for the page address origin of the phrase table(s) specified. The origin address is a page number, and represents the address where the phrase table will be loaded when used by the user program. The number entered may be hexidecimal. This origin address is written into the phrase diskette's directory entry for the particular table(s) involved. Before setting this parameter with this command, it assumes a default of page 65 (ADDR $44100).

A phrase table is always at least 2 pages (512 bytes) long. You may find the origin address by doing a C command. See the M command section for cautions and more information.

B COMMAND – Default Silence Behind Phrase

```
    Syntax          :B # (CR)
    Example         :B 16 (CR) or :B(CR)
```

This command sets the amount of silence to be appended behind each phrase. The number must be an integer between 0 and 256. It represents the number of 1/16 second units of silence to be appended. This defaults to a value of 0. See F Command. Affects subsequent phrase tables like other commands at this level.

C COMMAND – Catalog of Phrase Tables

```
    Syntax          :C range (CR)
    Examples        :C(CR) or :C1, 3—5(CR)
```

This command displays directory information for a phrase diskette. A sample output:

```
            CATALOGUE FOR PHRASE DISK MATH
            ID#
            ----
        1   LENGTH=60 SECTORS
            STARTING TRACK=O, SECTOR=1
            LOAD INFO.=88 22528 (5800)
            VOL.=3 FREQ.=3

        2   LENGTH=25 SECTORS
            STARTING TRACK=4, SECTOR=9
            LOAD INFO.=60 15360 (3C00)
            VOL.=3  FREQ.=3

        NUMBER OF UNUSED SECTORS= 369
```

On the first line you have the phrase table identification number and the length of the phrase table in disk sectors. The next line gives you information on where the phrase table begins on the diskette. The loading address is the page number (in decimal) where the phrase table will be loaded when used by the user program. The square brackets contain the calculated load address. It will often correspond to the suggested HIMEM value. See section on VPS Interface for explanation of its use. The number in parenthesis is the hexidecimal address equivalent. The last line provides information about the rate and volume that are associated with the phrase table.

During the listing of the catalogue, the only way to stop the listing is by hitting the CTRL—S character. If this has been done, the listing may be terminated by typing CTRL-C. To resume the listing, however, another CTRL—S must be struck. See Command Syntax in Appendix B for information on CTRL—C and CTRL—S characters.

D **COMMAND** - Delete a Phrase Table

       Syntax   :D range (CR)
       Example   :D 14 (CR) or :D1—3,14,7—6(CR)

This command will simply delete the phrase table(s) specified by range from the phrase diskette. This frees the sectors allocated to the phrase tables deleted.

E COMMAND - Edit a Phrase Table

       Syntax   :E#(CR)
       Example   :El(CR) or :E$F(CR)
       Not allowed   :E1—3(CR)

This command affects the flow of control. After this command is executed, you enter the Edit Level and get the Edit Level prompt (**!**). The phrase table you selected is known and available to the Edit Level for editing. A message is given before the Edit Level prompt indicating whether the phrase table is an old phrase table or a new phrase table. Of course, you may edit any one of the 47 possible phrase tables in any order. See Edit Level Commands section for more detail on its commands.

F COMMAND - Default Silence in Front of Phrase
       Syntax   :F # (CR)
       Example   :F 16 (CR) or :F(CH) or :F$D(CH)

This command sets the amount of silence inserted before each phrase. The number is a positive integer between 0 and 256, and it represents the number of 1/16 second units of silence inserted before the phrase. This defaults to a value of 2.

APPENDIX A PHRASE DISKETTE COMMANDS

This reflects the speaker turn-on time. If you use a value less than 2, you might clip the beginning of some words. (For example, words beginning with h, V or s.) You can playback the phrase to hear if it sounds acceptable. See B Command. Effects subsequent phrase tables.

I COMMAND — Initialize a Phrase Table Diskette

    Syntax   :I(CR)
    Example   :I(CR) not :13(CR)

This command writes information onto a diskette which identifies the diskette to VPS as a phrase diskette. The program asks for a name for the phrase diskette. This name can be up to seven characters long. In every way, this command is the same as initializing a phrase diskette at the Configuration and Confirmation Level.

L **COMMAND** — List Phrases in Phrase Table

    Syntax   :L range (CR)
    Example   :L(CR) or :L1—14(CR) or :L1,3,5,7 (CR)

This command lists on the screen or output device all the phrases contained in the phrase tables specified by range. The listing may be stopped by typing a CTRL—S. Subsequently, you may terminate the listing by typing CTRL-C or you may resume the listing by typing another CTRL-S.

M **COMMAND** - Set Default Length of Phrase Tables

    Syntax   :M # (CR)
    Example   :M(CR) or :M1O(CR) or :M$14(CR)

This command sets the default value for the maximum length of phrase tables. The number is the maximum length of the table expressed in pages of memory. A page of memory is equal to 256 bytes. All phrase tables have a minimum length of two pages. The default length before being changed by this command is 80 pages of memory ($5000 bytes). Keep in mind that there is a consideration involving the maximum length and the origin address. If one adds the origin to the length and the resultant value is greater than the USER.BIN origin ($9100), then you will be destroying these routines when you load your table. To prevent this, appropriate messages will appear to warn of this condition.

O COMMAND - Output

    Syntax   :0 II (CR)
    Example   :0 3(CR)
    Illegal   :010(CR)

The 0 Command allows the user to direct output from the C, L and T commands to the device whose controller is in the slot

number given. Output continues to the screen, always. This command is the same as saying "PR#N" in APPLESOFT. To stop the output to the device, you would give the command 0 Ø(CR) or simply O(CR) which returns output to the default device only (the CRT). CAUTION: An attempt to output to a device not powered—up will cause the program to hang.

Q COMMAND – Quit

    Syntax   :Q(CR)
    Example   :Q(CR)

The Q Command is used to end a session with the VPS at the Main Command Level. DOS is rebooted from the disk. A CTRL-C character entered after the Main Command Level prompt (:) will have the same effect as the Q Command. See the Syntax appendix for more information on CTRL-C.

R COMMAND – Rate Command

    Syntax   :R # (CR)
    Example   :R1(CR) or :R(CR)

This command sets the rate at which the SUPERTALKER records and plays back the speech. Allowable values and the associated rates are as follows:

VALUE	RATE
1	512 bytes/second of speech
2	10211 bytes/second of speech
3	20118 bytes/second of speech
11	11096 bytes/second of speech

This command, like other commands at the Main Command Level which change default parameters, effects subsequent phrase tables only. Compare with R Command at Edit Level.

T COMMAND – Talk Phrases

    Syntax   :T range (CR)
    Examples   :T1,4,3(CR) or :T1—3,5—6(CR)

This command is exactly like the L Command at the Main Command Level, except that in addition to listing the phrases, table by table, SUPERTALKER will also speak the phrases as they are listed. CTRL—S and CTRL-C act in the same fashion as explained under the L Command.

V COMMAND – Volume Command

    Syntax   :V # (CR)
    Examples   :V2(CR) or :V(CR) <u>not</u> :V1—2(CR)

The V Command sets the default playback volume for all sub-

sequent phrase tables. It does not affect phrase tables which already exist. The allowable values and associated volumes are:

VALUE	VOLUME
1	lowest
2	next to lowest
3	next to highest
4	highest

EDIT LEVEL

This is the middle level in the VPS. The prompt at this level is the exclamation point ! . You may go up one level to the Main Command Level, or down one level to the Vocal Creation Level. On the Edit Level, the commands which return control to the Edit Level are D,L,M,R,S,T and V.

At the Main Command Level we could affect one or more phrase tables. At the Edit Level, we have narrowed the scope down to one phrase table and the phrases within it. By way of example, if you were in the Main Command Level and you gave the command "E6(CR)", you would enter the Edit Level and would be working on the phrase table you have specified, Table 6. Here on the Edit Level, we have some commands in common with the Main Command Level. These commands are the M,R and V commands which basically do the same functions as in the Main Command Level. The one important difference is that these commands operate only on the one phrase table you are editing, Table 6. The commands are local to their level, and lower level commands will not disturb anything on a higher level.

To reach the lowest level, the Vocal Creation Level, you use either of these commands: A, I. You may return to the Main Command Level by either the CTRL-S or the CTRL-E character. At the Edit Level, when you see the ! prompt, both CTRL—S and CTRL—E are considered commands and will be detailed below in the Command section.

In addition to the above control flows, you may also go directly from the Edit Level back to a rebooted DOS. This bypasses the Main Command Level, and any phrase table that you might have been working on in BALI would now be in bit-heaven. To reboot the DOS and while at the Edit Level (and send your phrase to bit—heaven), type the CTRL—C character in response to the **!** prompt.

  A **COMMAND** - Append Phrases Command
    Syntax   !A(CR)
    Example   !A(CR)

  This command sends the flow of control down to the lowest

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level, the Vocal Creation Level. The Append Command will place the phrases to be created after any phrases which now exist in the phrase table. For example, suppose your phrase table already had three phrases in it and you gave the Edit Level on A command. The next available phrase is #4 and this is your prompt. It should be noted that it is less expensive in computing time to append than it is to insert. For more information, see section on Vocal Creation.

D COMMAND — Delete Phrases Command

```
    Syntax        ID range (CR)
    Examples      !D1,3(CR) or !D1,2~4,7,8—12(CR) or !D(CR)
```

The D Command will delete any range of phrases within the current phrase table. ID(CR) will delete <u>all</u> phrases. This will free space in a phrase table.

I COMMAND — Insert Phrases Command

```
    Syntax        !I # (CR)
    Example       !I(CR) or !13(CR) or !I$A(CR)
```

This command, like the A Command, sends control down to the lowest level, the Vocal Creation Level. If the number is not specified, the insertion starts with phrase #1. If a number is specified, and it is less than the greatest phrase number, the insertion starts with the phrase number specified.

If the number is greater than the greatest phrase number, insertion is at the next phrase number after the greatest number. In this last case, we are actually appending.

Insertion is far more expensive than appending, in terms of computing time. This is because all higher phrases must be moved to make room for insertion3.

L COMMAND - List Phrases

```
    Syntax        !L range (CR)
    Examples      !L1,2,3—6(CR) or !L1—3,$A—12,$F(CR)
```

This command lists the phrases of the range specified within the phrase table being edited. The CTRL—S will not stop this listing at the Edit Level, unlike its effect on the listing at the Main Command Level. See Syntax appendix. Ranges are commutative for this command. For example:

```
    !L3—1(CR) yields the same output listing as !L1—3(CR)
```

M COMMAND - Set Maximum Table Length Command

```
    Syntax        !M # (CR)
    Examples      !M1O(CR) or !M(CR) or !M$30(CR)
```

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This command sets the maximum length that a phrase table may have. The number is an integer which represents the length in pages. This is useful for setting the limits on the phrase tables that are to reside in memory with your program. NOTE: All tables are <u>at</u> <u>least</u> 2 pages long. Please be aware of the boundary considerations mentioned at the end of the M Command in the Main Command Section.

R COMMAND - Set Digitizing Bate Command
    Syntax   !R # (CR)
    Examples   !R1(CR) or !R(CR) <u>not</u> !R2,1(CR)

This sets the SUPERTALKER's data rate for the phrase table you are editing. When the phrase table is saved, the current value for rate is stored in the phrase table directory entry for that phrase table.

S COMMAND — Statistics on the Phrase Table
    Syntax   !S range (CR)
    Examples   !S(CR) All phrases or !S1—3.5(CR)

The S Command provides the user with exact information about how the space in the phrase table is being used and how much room remains. A sample listing is given below:

<div align="center">

BYTE SUMMARY

PHRASE #	BYTES	
1	1689	(699)
2	1558	(616)
3	1674	(684)
14	1378	(562)

TOTAL BYTES UNUSED - 13791 (35DF)
PHRASE TABLE LENGTH IN PAGES — 80(50)

</div>

It is the user's responsibility to keep track of the space remaining in the phrase table. This command makes the bookkeeping simple.

T COMMAND - Talk Phrases Command

    Syntax   !T range (CR)
    Examples   !T(CR) Talk all phrases or !T1,3,2,1—3(CR)

This command will talk in sequence the phrases given in the range following the command. The phrases will sound in combination as they would during program access. This command, therefore, allows the user to get immediate feedback so that fine tuning of silence or re—recording can be done if necessary.

V COMMAND - Set Volume Command
   Syntax   IV # (CR)
   Examples   !V1(CR) Sets volume to lowest level
                 !V(CR) Default volume level

The V Command sets the playback volume for this phrase table to an integer value between 1 (lowest) and 4 (highest) inclusively. The current value of volume is stored in the directory for reference when the phrase table is saved.

The next two commands transfer control back to the Main Command Level. Basically, you may leave the Edit Level and save the phrase table you just edited, or discard it. Note that if you edit an existing phrase table and return without updating, then the original phrase table that existed before the edit session will still exist on the diskette.

CTRL—S COMMAND — Return to Main Command Level Without Update

   Syntax   !CTRL-S <u>No</u> <u>carriage</u> <u>return</u> (a > character displayed)

This returns control to the Main Command Level from the Edit Level. Note that the CTRL-S character in the Main Command Level has a different meaning. See Syntax Appendix. Any editing done on a phrase table is lost when this return is used.

CTRL—E COMMAND - Return to Main Command Level With Update

   Syntax   !CTRL—E <u>No</u> <u>carriage</u> <u>return</u> (a > character displayed)

If there have been any changes made to the phrase table, then the modified phrase table is stored into the phrase diskette. If there are not enough sectors available on the phrase diskette for the phrase table, an error message will appear. You must delete a few phrases so that your table will fit. The C Command will tell you how many sectors are available and the S Command will indicate how many sectors your table requires. Use these commands to avoid problems.

Occasionally you will come across a situation where there is enough room for your phrase table, but it is not in consecutive sectors. The VPS will invoke a repacking operation whereby the phrase tables on the diskette will be shifted to make room for the new phrase table.

VOCAL CREATION LEVEL

This is the bottom level in the VPS program. It is at this level that you speak into the microphone. At this level only, your voice is digitized by SUPERTALKER and stored into RAM. At last, you can finally enter some phrases into your phrase table.

On this level, the prompt is a number and a hyphen (#—). The number is the phrase number. At this point, you should type in the words you want to be associated with this phrase. It can be anything you want. Although it is a good idea to type the word you speak, there is no reason why you could not type something totally different than the speech recorded.

Now you have typed your character string (up to 40 characters long) and are ready to record. Per instructions on the screen, type RETURN when you are ready to speak, but do not speak until you see your prompt. As soon as you finish your speaking, hit RETURN again. Your prompt will be the word "SPEAK" in flashing, inverse video on the screen. Before you speak, check your microphone to see that it is switched on. If you forgot to turn it on, you are informed of your possible error. Your blunder is recorded, but you are told that you recorded silence.

Between the time "SPEAK" prompts you and you hit RETURN to terminate your phrase, be aware that SUPERTALKER is recording and using up RAM at the specified rate (up to 4k/second!). It is a good idea not to wait too long before you speak. If you have a word which takes one second to speak and you pause two seconds after the Prompt, then speak the word, and then pause another second before hitting RETURN, you have just recorded II seconds of speech. Therefore, if there was only **3** seconds worth of memory left in your phrase table, the phrase will be chopped. How long do you think it would take to playback that phrase you just recorded? The answer is not necessarily 4 seconds. Instead, the playback time is the word plus the parameters now in effect for (in front) and (behind phrase) silence. (This is set by the F and B Commands.) In this case, we have F time + word time + B time **.** The program adds leading and trailing silence to comply with the parameters. What about the example where you forgot to turn on the microphone? How long does it take to playback? The answer is the sum of the B and the F parameters.

It is important to be aware of the time and memory used while building your phrase table. Use the S Command to check how much room is left in your phrase table.

As an option, you may have different silence lengths before and after your phrase than is given by F and B. This is done by entering the silence limits in parenthesis before the identifying text. For example:

```
1 - (5,3)  You can lead a horse
2 — (2)    to water, but if'
3 — (,4)   you can make him float on his back
4- (Ø,Ø)  you've really got something.
```

These are some of the possible ways that the silence limits will be accepted in place of the silence defaults.

CONTROL FLOW

From the Vocal Creation Level you may send control either back to the Edit Level (CTRL—T) or you may reboot DOS and enter APPLESOFT, destroying any phrase table you were editing.

APPENDIX B

COMMAND SYNTAX

Appendix B covers the syntax of the commands for the VPS program. Syntax is the structure of these commands.

The Character set is the first thing we will define. All characters lower in value than ASCII space ($20) are illegal and characters lower in value than ASCII space ($20) are illegal and cause the bell to ring. The exceptions are the carriage return (abbreviated "(CR)" throughout this manual), and these control characters: CTRL-E, CTRL-S, CTRL-C, CTRL-T and CTRL-X.

> CTRL—X will issue a backlash, clear everything after it on a line, and cause the line entered to be ignored.

> CTRL-C will cause the re—booting of DOS. During the list— type commands (C,L & T) of the Main Command Level, the striking of CTRL-C after a CTRL-S will terminate the listing.

> CTRL—E is an illegal character except at the Edit Level, where it will exit the Edit Level with an update of the current phrase table to disk.

> CTRL—S is an illegal character except at the Edit Level, where it will exit the Edit Level without an update.

> CTRL—T is an illegal character except at the Vocal Creation Level, where it will return you to the Edit Level.

Some of the special control characters issue a symbol when they are pressed. These special characters and symbols are:

>   (CR) wipes out everything on a line after the (CR).

CTRL—X issues /,   "   "   "   "   "   "   "   /
CTRL—E issues ,   "   "   "   "   "   "   "   .
CTRL—S issues ,   "   "   "   "   "   "   "   .
CTRL—T issues ,   "   "   "   "   "   "   "   .

We are allowed only one command per line. A command is a simple alphabetic character or a special control character. After we have typed the command, we could type one of three things. Some commands don't expect anything else, and they are terminated by a carriage return (CR). This has the structure:

>   command (CR)

Other commands will expect an ordinal number. This number is assumed to be decimal unless preceded by a dollar sign ($) in which case it is evaluated as a hexidecimal number. A

hexidecimal number is from 0 to 9 and A to F. Hexidecimal numbers do not have to start with a numeric digit. In commands where the number is necessary, you may mix decimal numbers with hexidecimal numbers. The structure is:

    command #(CR)

If this number is optional, we enclose it in square brackets:

    command [#](CR)

Some commands expect a range of numbers. This structure looks like:

    command range>(CR)

Range is defined as null, or a range element, or a range element and a range list.

<range>:= {null|<range element>|<range element>,<range list>}

Notice how the comma delimits the range element and the range list.

Range list is defined as a range element, or a range element and a range list.

<range list>:={<range element>|<range element>,<range list>}

Finally, the range element is defined as one number, or a number through a number.

    <range element):= {#|#—#}

The number sign represents an ordinal number in either decimal or hexidecimal.

Examples of legal ranges are:
        (CR)   1-3,4,5-2,4(CR)
        2(CR) $1F,3,$2—$f(CR)
        3—2(CR)   3,4,$C,3(CR)

When we are inserting or appending, we may also specify a silence range. It is defined as:

    <silence range>:= {(#[,#])|([#],#)}

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Examples of legal silence range are:

```
(3)              (,#F)
(,4)             ($1Ø,3)
(3,14)
```

The numbers correspond to units of silence. For the meaning of these values, see the B command and the F command in Appendix A under Main Command Level.

In some of the commands (C, D, and S) we observe a commutative effect in the range. If we ask for a catalog with a range of 5—1, i.e., C 5—1 (CR), we will get a catalog from 1 to 5. This makes the list come out in order. All other commands are now commutative.

Here is a list of the syntax of the commands:

MAIN COMMANDS	EDIT COMMANDS	VOCAL CREATION
A (range> (CR)	A(CR)	text (CR)•
B [#] (CR)	D<range>(CR)	[<silence range>j text(CR)
C<range>(CR)	I[#](CR)	
D<range>(CR)	I[#](CR)	CTRL—T
D<range>(CR)	L(range> (CR)	
E#(CR)	M[#](CR)	
F[#](CR)	R[#](CR)	
[(CR)	S(range>(CR)	
L<range>(CR)	T(range>(CR)	
M[#](CR)	V[#](CR)	
O[#](CR)	CTRL—E	
Q(CR)		
R [#] (CR)		
T<range>(CR)		
V [#] (CR)		

APPENDIX C
USING SUPERTALKER IN PROGRAMS

INTRODUCTION

This section will describe the steps to be taken in order to use SUPERTALKER and phrase diskettes prepared by the VPS in your application program. Memory allocation, program relocation, linking with the USER.TXT module, run-time procedures, and strings are discussed. This is structured to allow you to follow along on your own system.

VPS INTERFACE

It is assumed that you have prepared a phrase diskette and have an understanding of VPS and its functions.

First, USER.BIN should reside on the same diskette as your user program. To accomplish this, BLOAD USER.BIN from the diskette containing VPS modules and then BSAVE USER.BIN, A$9200,L$380 onto your user program diskette. Plan your memory use; you will need to decide where your programs and phrase tables are to be located in memory.

Next, link a module supplied on the VPS Program diskette to your program. When the linkage has been made, determine the upper and lower memory bounds for your program. After this, save your program in its present state. Later, you need only to run that program and load your phrase diskette and SUPERTALKER will speak to you.

Inside your program, you simply set parameters when necessary and GOSUB the subroutine to do any of these functions: I n i t i a l i z e SUPERTALKER, Initialize Another Phrase Diskette, Load a New Phrase Table, Save a Phrase Table, Switch Among Phrase Tables in Memory, Talk a Phrase, Talk a Series of Phrases, and Listen to a Phrase.

LINKING WITH VPS MODULE

First, load your user program into memory. Next, marry the user program to SUPERTALKER by linking to the VPS.TXT module. This module contains the BASIC statements which make up the subroutine calls to be described. With your BASIC program in memory, execute this DOS command:

    EXEC USER.TXT,[S#],[D#]

                        NOTE

        If EXEC is done on a different slot or drive
        number, be sure to use the correct slot and
        drive number when saving your program.

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This will load lines 25000 through 25999 into the BASIC program. These lines have been reserved for this code. These subroutines also make use of these variables:

P,T,PP(0)—PP(9) ,PØ— P9,TT,P1$,P2$,CC,C,CØ—C2.

CAUTION

Make sure that the assigned reserved lines and variables do not exist anywhere in the program. Now would be a good time to check your program for variable conflicts.

MEMORY ALLOCATION

The next step is the allocation of the APPLE's memory. When you use the SUPERTALKER, memory allocation must be given a fair bit of consideration. Since you will have at least one phrase table in memory plus your BASIC program, DOS and USER.BIN, and possibly even two pages of high resolution graphics, you will need to use every byte of memory efficiently. For any application program, the user is responsible to plan memory use so that there will be no conflicts.

One way to do this is to first decide how many phrase tables you want in memory at any one time. In most cases, this will be one phrase table at a time. In that case, you can use the value given by the catalog listing for HIMEM (the entry in square brackets). See the text later in this section for an example. However, you may have more than one phrase table in memory at one time. In this case, you must address the tables so that they don't conflict with each other or the program. When you know which table or tables you want to use, figure the maximum memory requirements of the table(s) to be in memory at one time.

Now that you know the requirements for your phrase tables, you can turn your attention to the program and graphics requirements. The programs which don't use graphics have that area of memory available for phrase table or program use. Most of the memory left over is available for your application program.

Plan now how you will allocate your memory. This is important as it will affect where you want to load your phrase tables in memory. (See A Command, Appendix A, for a detailed discussion on setting this address for a phrase table.) The routine which loads a phrase table from the phrase diskette will look at the load address information for the phrase table selected in order to determine where in memory to load the phrase table.

An example on memory allocation: Assume that you have an APPLESOFT program that is using two phrase tables, two pages of high resolution graphics, and DOS. Also assume that you have an APPLESOFT ROM card. A possible memory allocation might be (all addresses hex.):

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```
$Ø     —$7FF      System use, reserved
$8ØØ   —$1FFF     Phrase Table 1 of length $18ØØ (6k)
$2ØØØ  —$3FFF     Hi—Res page 1 (8k)
$4ØØØ  —$5FFF     Hi—Res page 2 (8k)
$6ØØØ  —$7FFF     BASIC Program (8k)
$8ØØØ  —$93FF     Phrase Table 2 of length $14ØØ (5k)
$91ØØ  —$95FF     USER.BIN and PHRASE TABLE DIRECTORY
$96ØØ  —$BFFF     DOS
```

To get this configuration, follow these steps, assuming the BASIC
program already existed on the diskette.

    I. Boot DOS.

    2. Load your application program. Note that at this time
        your program would be loaded starting at $8ØØ, but it
        has been assigned to $6ØØØ—$7FFF. You need a procedure
        to relocate it to $6ØØØ Below is a procedure that
        works for APPLESOFT. A later example gives the
        procedure to relocate an INTEGER BASIC program.

Here is the procedure for APPLESOFT:

```
]NEW
]POKE 1Ø3, (low byte of "START ADDRESS+1")
]POKE 1Ø4, (high byte of "START ADDRESS+1")
]POKE START ADDR,0
]LOAD program
```

In the example, the POKEs take on these values:

```
]POKE 1Ø3,1
]POKE 1Ø4,96
]POKE 214576,Ø :REM($6ØØØ)
```

Each time before loading this program the POKEs must be in place
(i.e., address 1Ø3 = low byte **+**1 :address 1Ø4 = high byte:
starting address = Ø).A RESET, CONTROL C or CONTROL B do not reset
these addresses. However, a boot of the disk does change
them.

To eliminate having to type in the POKEs every time your system
is initialized, a text file containing the following lines could
be written. Then, just EXEC the text file to run your program.

```
>FP
 NEW
 POKE 1Ø3,1
 POKE 1Ø4,96
 POKE 24576,Ø
 NEW
 RUN PROGRAM
```

APPENDIX C   USING SUPERTALKER IN PROGRAMS

Your first statement in the APPLESOFT program should be a HIMEM statement. In our example, we set HIMEM:32768 which is ($8ØØØ).

If your application program is written in INTEGER BASIC, you will use a different procedure to relocate your program. Assume that you want the same allocation you had for the previous example. The first statement will have to be a HIMEM: statement. But HIMEM: is executed only in the immediate mode in INTEGER BASIC. There is a trick you can use to get around that problem. After you determine what your HIMEM: should be (-32767 which equals $7FFF in our example), just type a GOTO instead of HIMEM.

        Ø GOTO —32767 :GOTO 1

On the same line you must have a GOTO 1 (the next statement). When statement 0 is executed, the program will be moved down to the HIMEM boundary. It is important also to establish a lower bound for variable generation if it differs from $800 as in the example. To accomplish this, add the following code:

        1 POKE 2Ø4, (Low byte of Lower Bound Address):

        POKE 2Ø5, (High byte of Lower Bound Address)

For our example, the Low byte Ø and the High byte = 96.

Now we get to the trick. After your INTEGER BASIC program is linked with the USER.TXT module, and otherwise ready to run, enter the monitor using this statement:

                    CALL -151

Now, examine locations $CA and $CB. These locations contain a pointer to an address. Examine the address ($CA=low byte, $CB=highbyte) pointed to by locations $CA and $CB. At this address plus three, we should find the value $5F. This is the "GOTO" token. Replace the contents of that location with the token for "HIMEM:", which is the value $10.

        For example, if in the monitor: *CA.CB produced
                                ØØCA — CF 8Ø

        Then enter the following: 8ØD2:10

Next, enter a CTRL—C and you will be back in your program. If you list line 0, notice that the line has become a HIMEM statement followed by a GOTO. (And you thought you weren't a magician.) Now you may save the program, and whenever it is run it will be relocated to the right place.

Please note: If, during execution, you get a message about running out of memory, relocate your phrase tables; if that is not possible, reduce their size. Consider re—recording and removing some of the silence. Sometimes if words are repeated, it may be possible to talk word combinations to reduce the table

                        C-4

size. See the color math example in Talking Color Math section with reference to speaking numbers.

Normally you will be placing your phrase table(s) into memory just below DOS and below the area you always reserve for USER.BIN ($91ØØ—$96ØØ), that is, from $93FF and below. You have HIMEM already calculated for any given table. This is true for both APPLESOFT and INTEGER BASIC. This information is in the square brackets in the catalog listing. See the C Command (in Appendix A) for an example listing. This value in the square brackets is the HIMEM you may use for this particular phrase table, if it sits up against $91ØØ in memory. If you are going to overlay another phrase table into the same memory area, then you need to pick the lower of the two HIMEM values. In this way, your program and phrase tables are protected.

If you have found this all very confusing, check the Color Math example (in Talking Color Math section) where we describe what address origins were set for our phrase tables and how we set HIMEM for our program.

SUBROUTINE CALLS

In this part is detailed the names and functions of the different subroutines contained in the VPS.TXT module. We also indicate when it is appropriate to use these subroutines, and what parameters are passed to the subroutines.

<u>INITIALIZATION</u> (Line number 251ØØ)

    Example: P=6:T=1: C=3:GOSUB 251ØØ

    This is the first subroutine call you make to set up SUPERTALKER. This initialization subroutine should be called <u>just</u> once in your user program.

    Before you call this subroutine, you must set up three variables, P, T and C. You may select one of four options for initialization which are explained below. The variables and the options are as follows:

        P — This variable is set equal to the slot number of the controller for the disk drive which contains your phrase diskette. Legal values are 1 through 7 inclusive.

        T — This variable is set equal to the drive number of the disk drive connected to the controller specified by the "P"" variable above. Legal values are 1 and 2.

        C — This variable is used to select the initialization option. These options are detailed below:

APPENDIX C USING SUPERTALKER IN PROGRAMS

C=Ø   Select this option if you have one <u>disk</u> <u>drive</u>, and
       you want a prompt when it is time to change the
       diskette in the drive. With this option, you want
       your program disk in the drive when you call init—
       ialization. The subroutine will load the USER.BIN
       module into memory, and then prompt the user to
       remove the program diskette. It will then load
       the directory from the phrase diskette.

C=1   Select this option if you have <u>one</u> <u>disk</u> <u>drive</u>, and
       you do not want a prompt. This option requires
       that the user have a phrase diskette in the drive
       and ready to go. This option also requires the
       user to BLOAD USER.BIN <u>before</u> initialization. The
       directory is loaded from phrase diskette into
       memory.

C=2   Select this option if you have more than one disk
       drive in your system, and you want a prompt when
       it is time to load the phrase diskette. The INIT—
       ialization subroutine will load USER.BIN from the
       same drive containing the user program. You will
       get a prompt to insert the phrase diskette into
       the drive. The directory is then loaded from the
       phrase diskette into memory.

C=3   Select this option if you have more than one disk
       drive, and you do not want a prompt. You will be
       responsible for having the phrase diskette in the
       proper drive and ready to go. The subroutine will
       load USER.BIN from the user's program diskette and
       then load the directory from the phrase diskette.

In all cases of initialization, all three parameters must be set.
P and T will always specify the drive where the phrase diskette
is located. These must be correctly set even in a one disk
system. Initialization will always load the USER.BIN module into
memory except in the case of C=1. When this option is selected,
the user is responsible for having USER.BIN loaded <u>before</u> the
call to the initialization subroutine. The other initialization
options will all load the USER.BIN module automatically. In the
other options (C=Ø, C~2, C=3), the program will try to
load USER.BIN from the current disk drive, i.e., the drive last
used by DOS. We recommend you have USER.BIN on the diskette
where your program lives.

If you use the C1 option, you must load USER.BIN before you call
the initialization subroutine. Here are the statements to do
that (we choose line #5ØØØ arbitrarily):

```
5ØØØ D$="":REM D$ EQUALS CONTROL-D
5Ø1Ø PRINT D$: "BLOAD USER.BIN"
```

APPENDIX C USING SUPERTALKER IN PROGRAMS

The initialization subroutine will find the slot which has the SUPERTALKER, prepare entry points, load USER.BIN into memory (except if C=1), then load the phrase table directory into memory. This routine should be called only once. If you wish to change the phrase diskette during program execution, call the Initialize Another Diskette subroutine.

INITIALIZE ANOTHER DISKETTE (Line Number 252ØØ)
    Example: P=6:T=2:C=Ø:GOSUB 252ØØ

    This subroutine will load a new phrase diskette directly into memory, establishing new entry points, and will prepare SUPERTALKER for using a different phrase diskette.

    The parameters used are:

        P — same use as in Initialization
        T — same use as in Initialization
        C — same use as in Initialization

    This subroutine is called whenever you wish to get a phrase table of f a phrase diskette other than the phrase diskette you first initialized. After this routine has been executed, the first phrase diskette will no longer be accessible (unless you initialize another phrase diskette on that former drive). All subsequent phrase tables are loaded from the most recently initialized phrase diskette. This routine may be called any number of times.

LOAD PHRASE TABLE (Line Number 253ØØ)

    Example: T=3:GOSUB 253ØØ

    This subroutine will load a phrase table in from the phrase diskette and make it the current phrase table. T is set to the table number we wish to load. The legal values range from 1 through 47. A message is printed if the phrase table does not exist.

SAVE PHRASE TABLE (Line Number 254ØØ)

    Example: GOSUB 254ØØ

    This subroutine will save the current phrase table only. This is useful if your program has recorded new data into a phrase table or has changed a phrase table somehow, and you wish to save it. You may not enlarge the phrase table beyond the limits already set for this particular phrase table. There are no parameters for this subroutine.

<u>SWITCH</u> <u>PHRASE</u> TABLE (Line Number 255ØØ)

   Example: T:10:GOSUB 255ØØ

   This subroutine is used to switch the current phrase table in memory. The phrase table indicated by the parameter becomes the current phrase table. If the table you wish to switch is not in memory, an error message is printed.

   T is set to the number of the phrase table in memory that is to become the current phrase table.

TALK <u>PHRASE</u> (Line Number 256ØØ)

   Example: P=2:GOSUB 256ØØ

   This is the subroutine you call to make the SUPERTALKER speak. This subroutine uses the current phrase table. If the phrase does not exist, a message is printed. Legal values for P are 1 to 6=4.

   P is set equal to the phrase number in the current phrase table that is to be spoken by SUPERTALKER.

<u>LISTEN</u> <u>PHRASE</u> (Line Number 257ØØ)

   Example: P=3:GOSUB 257ØØ

   This subroutine is used to record speech into the current table. The recording starts at the phrase number you specify. All existing phrases from the number you select onward are altered. All phrases before the number you select are not changed and may still be used.

   P is set equal to the phrase number in the current phrase table where you begin to record SUPERTALKER input data.

<u>TALK</u> <u>PHRASES</u> <u>IN</u> <u>SERIES</u> (Line Number 258ØØ)

   Example: C=4:CC(Ø)=3:CC(1)=2:CC(2)=5:CC(3)=1:GOSUB 258ØØ

   This subroutine is used when you wish to have phrases spoken in combination. You may have up to ten phrases in your series. C is set to the count of phrases in the array CC. In the example, you have a count of four phrases to speak. The value of C must be 1 through ~O, inclusively. The array CC is set up with the phrase numbers of the phrases to speak in the correct sequential order. The subroutine will then speak the phrases in the array CC from CC(Ø) to CC(C—1). Of course, C and CC must be set up before you call this subroutine. In the example, the phrases spoken are 3,2,5,1. For further use of this feature, see the Color Math example.

APPENDIX C   USING SUPERTALKER IN PROGRAMS

STRINGS

Each phrase table that is created by the VPS has an area for string storage. When you are appending or inserting into a phrase table, you are allowed to type a character string at each phrase number prompt. The character string that you type is stored with the phrase table on the phrase diskette. There is a maximum of 256 bytes available for storing all the strings for one phrase table.

In many of your application programs, you will find it very useful to have strings available which correspond to a phrase. Mountain Computer's Accent program is a good example. With this program a student is allowed to practice his accent for a number of phrases. It would be possible to have many phrase diskettes to use with the Accent program. You could place French phrases on one diskette, Spanish on another, German on a third, and so on. Each diskette would have many phrases or words in another language to practice. Since we would like to print the phrase that SUPERTALKER will speak, and we have a lot of phrases, it would make no sense to store all possible strings in the program. Instead, we store the strings for a particular phrase table with that table on the phrase diskette. When we load the phrase table into memory, the strings are loaded also. All we have to know is how to access those strings.

The strings are stored in a table in memory. After you initialize SUPERTALKER (GOSUB 25100) or switch a phrase table (GOSUB 25500) the BASIC variable P5 contains a pointer to the end of the string table (see below). The start of the table is (P5—256). The first byte contains a count of the number of strings in the string table. If you did a PEEK (P5—256), you would get a value which was the number of phrases in that phrase table.

        A = PEEK (P5—256)
        REM A EQUALS NUMBER OF PHRASES IN THIS TABLE

The next byte (P5—255) is the start of the first string. The first byte in a string contains a count of the number of characters within that string. After the count, the ASCII values of the characters are stored. There are no delimiters for the strings, as the count will specify where one string ends and the next begins. Therefore, the address of the start of the second string is given by:

        ADDR2 = (P5—255)+PEEK(P5—255)+1

By way of example, let's construct strings in APPLESOFT from the entries in a given table.

P5—256	3	16	N	0	S	T	A	L
P5—218	G	I	A		I	S		N
P5—240	0	T	7	W	H	A	T
P5—232	I	T	1Ø	U	S	E	D
P5—224	T	0		B	E	?	?	?
P5—216	?	?	?	?	?	?	?	?

A program that will create strings from the table is as follows:

```
16 I   PEEK <P5 — 256>:K = P5 — 255
20 DIM A$(I)
36 FOR J   S TO I — 1
4Ø FORL=Ke-1 TO K+ PEEK<K).e-1
56 A$(J) A$(J> + CHR$ ( PEEK (L)>
66 NEXT L
76 K = L — 1
8Ø NEXT J
```

The resulting strings are:

A$(Ø) = "NOSTALGIA IS NOT"

A$(1) "WHAT IT"

A$(2) "USED TO BE"

These strings are now available to the program. Thus, it is possible to construct programs in which data contained in the phrase tables will determine the flow of the program and input to it.

APPENDIX C   USING SUPERTALKER IN PROGRAMS

SIMPLE INTERFACE

It is possible to use the SUPERTALKER without the support of the VPS. In the USER.TXT module are subroutines which support SUPERTALKER on a simple level. There is an initialization sub-routine, and subroutines for both talking and listening with SUPERTALKER

When using SUPERTALKER at this basic level, the user is responsible for the phrase table's location and length. You must also pass legal values with the parameters, or indefined things will happen. The reserved variable names are: PP(5), P, P1—P5.

We should set up some values in the PP array. We define the variables in the PP array as follows:

     PP(1) — Slot 1k of SUPERTALKER. This is always
          set by auto slot finder.

     PP(2) - Starting page of Phrase Table data. This is
          a decimal number.

     PP(3) — Ending page of Phrase Table data. This is a
          decimal number.

     PP(14) — Volume, with 1 being the softest and 4 being
          the loudest.

     PP(5) — Digitizing Rate, with 1 being 512 bytes/second
          and 4 being 4k bytes/second.

We set the values of PP(2), PP(3), PP(4) and PP(5) to the proper values and then call the table initialization routine.

     GOSUB 25Ø1Ø:REM THIS INITIALIZES SUPERTALKER

Any time you want to change any of the values in PP(2) through PP(5), you must do a GOSUB 25ØØØ to initialize SUPERTALKER with the new values.

The SUPERTALKER is now ready. Let's next see how to place phrases into the table. We will assume that PP(2), PP(3),PP(4) and PP(5) have all been set to the values we want. Next, we set P=1 for our first phrase. P is the phrase number, and when we are listening, P must start with 1 and count up in numerical order. The maximum value for P should be 64. Then, in order to listen:

     P = 1
     GOSUB 25ØØØ:REM CALL LISTEN ROUTINE

As soon as the Listen subroutine is called, it starts to record. A carriage return will stop the recording. You should provide a minimum prompt. This could be done in the following way:

```
1Ø    PRINT "HIT RETURN TO START RECORDING"
2Ø    PRINT "AND HIT RETURN AGAIN TO STOP RECORD"
3Ø    INPUT A$:REM THIS WAITS FOR THE FIRST RETURN
                        TO START RECORDING.
4Ø    P1  GOSUB 25Ø3Ø: REM THIS IS THE LISTENING ROUTINE
5Ø    REM  THE LISTENING ROUTINE WILL RETURN WHEN IT RUNS
6Ø    REM  OUT OF MEMORY, OR WHEN THE RETURN KEY IS
7Ø    REM  STRUCK
```

After you have placed a few phrases into the phrase table, play them back to see how they sound. When you want to talk a phrase, simply set P equal to the phrase number and call the Talk sub-routine.

```
    P = 3:GOSUB 25Ø2Ø:REM This speaks Phrase #3.
    P = 14:GOSUB 25020:REM This speaks Phrase #14.
```

Any phrase table that you create may be saved with the BSAVE command. Likewise, a saved phrase table may be restored to memory with a BLOAD command. When you are ready to save the phrase table, use these statements.

```
    NAME$="TABLE.1":REM  THIS IS THE FILE NAME OF YOUR
                        PHRASE TABLE
    D$="":REM             D$ EQUALS CONTROL—D
PRINT D$;"BSAVE ";NAME$;",A";256#PP(2);",L";256#(PP(3)-PP(2)+1)
```

When you want to load the phrase table into memory, use these statements:

```
    PRINT D$;"BLOAD ";NAME$
```

The phrase table will be loaded into the same location in memory that it was saved from.

APPENDIX D
SUPERTALKER FUNCTIONAL DESCRIPTION

The following is a brief functional description of the electronic circuits on the SUPERTALKER SD200 circuit card. Figure E—1 is a schematic for the SD200 circuit.

The MOTOROLA LM3418 (U4) is the heart of the system. It is a Delta Slope Modulator/Demodulator. An analog waveform will produce a stream of is during the positive transition of the incoming audio signal. It will produce a stream of zeros during negative transition of the audio signal (WI pin—9). This serial bit stream is sent to the Serial/Parallel and Parallel/Serial Converter (U8 pins J4 & 5). Data bit 7 gates a four bit nibble onto the bus via driver U12 (completing one record cycle).

In "playback mode" the unit performs the same operation in reverse. Accepts a 14—bit nibble from the data buss (via U11), converts it to serial (U8), and delta slope converts the serial stream back to audio (WI).

The clock (U14) drives the serial stream. The Phi 0 clock enters the 4040 Ripple Divider (U15) pulses several divided points on the chain into a dual, 4 to 1 multiplexer. And thus, via the mixer, the sample rate (FO & Fl) can be controlled.

Control over wheather WI and U8 are in the record or playback mode and selection of the output amplifier (via Q14) is controlled by the LISTEN/TALK line. Output volume is selected by the VOL 0 & VOL 1 signals. This circuit is a simple digital control 'L Pad', switching in another leg of 'L', will increase the audio attenuation.

Devices U7 and Ul0 control most of the Supertalker operations. The WR STAT signal controls the mode of operation. The WR Data line enables digital data from the Apple to be input for audio conversion (enables U11). READ DATA will output the converted nibble (via U12). CLR STAT will clear the nibble flag for data bit 7 (U5).

The overall frequency response is the speech portion of the audio range(300Hz to 3KHz). From the mic input the stage descriptions are: AMP STAGE 1 (GAIN 15), AMP STAGE 2 (GAIN 20), HIGH PASS FILTER (300 Hz), LOW PASS STAGE 1 (3KHz), LOW PASS STAGE 2 (3KHz). The stages from the analog out are: LOW PASS STAGE 3 (300 Hz), LOW PASS STAGE 4 (300Hz), and final Amp out (U3).
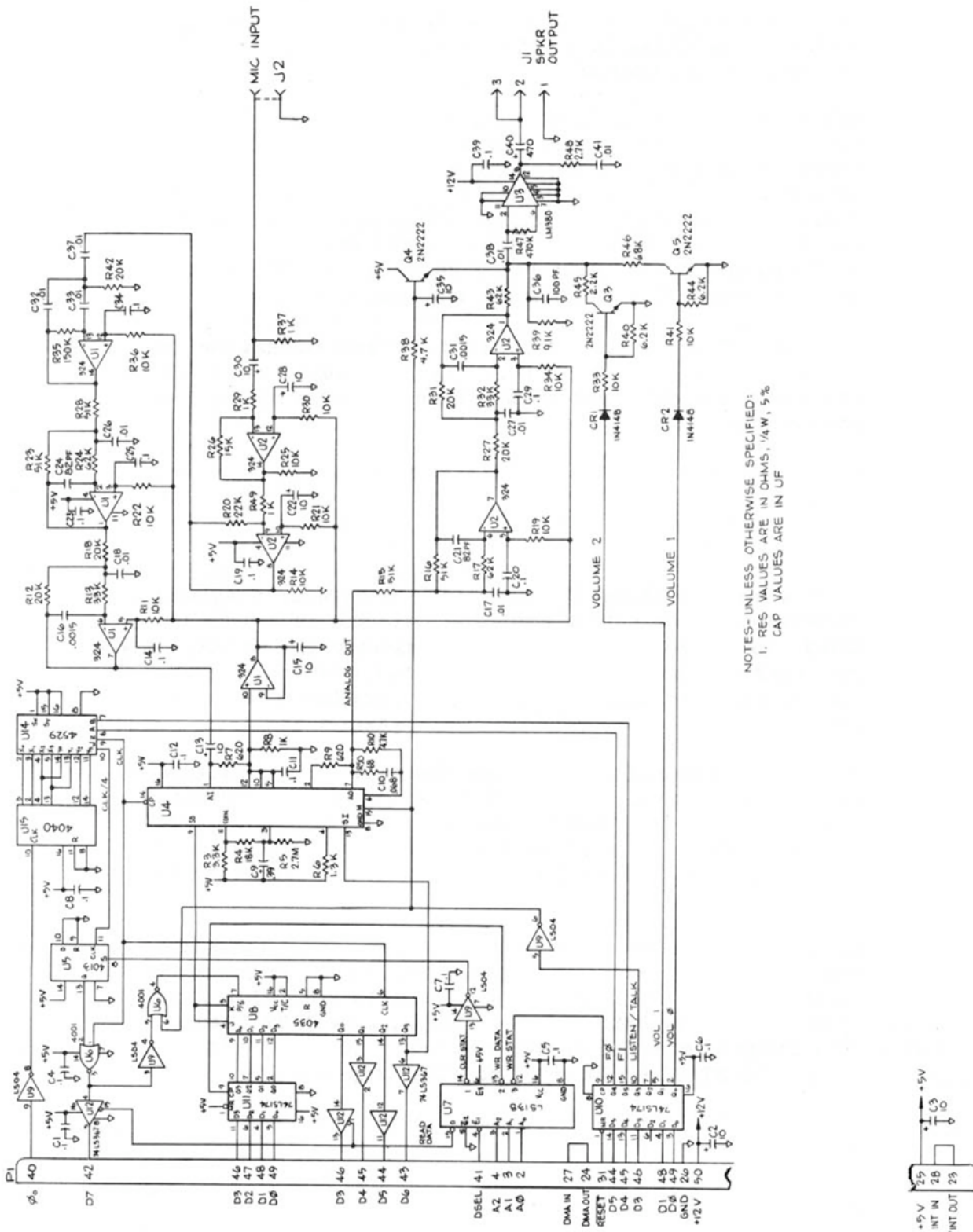
Figure D-1   Supertalker Schematic

APPENDIX E
GLOSSARY OF TERMS

BASIC — A simplified high level computer language intended for use with the SUPERTALKER. Acronym for "Beginner's All—Purpose Symbolic Instruction Code." Both Integer BASIC and Applesoft BASIC programs have been included on the MCI 12-OO246 diskette.

binary - A numbering system using a base number, or radix, of 2. There are two digits (1 and 0) in the binary system.

bit — Abbreviation for binary digit. The smallest amount of information which a computer can hold. Bits are grouped to form larger values (see Byte).

boot - Short for bootstrap. To get a system running from a cold start.

byte - A basic unit of measure of a computer's memory. An Apple byte contains eight bits.

character - Any graphic symbol. Letters, both upper and lower case, numbers, punctuation marks, various symbols are all characters.

circuit — An electronic device between two or more points capable of providing one or a number of functions.

circuit card - Computer hardware equipment containing circuits (e.g. the SUPERTALKER SD200 card is a circuit card).

configuration - The relative arrangement of parts (or components) in a circuit.

cursor - "Blinking square". An electronically generated indicator which moves back and forth, up and down, over the surface of the monitor to delineate the next location.

CR — Acronym for Carriage Return (or RETURN key).

CRT - Acronym for Cathode-Ray Tube, meaning any monitor or television screen, or a device containing such a screen.

data — Information of any type.

digitize - To convert an analog measurement of a physical variable into a number expressed in digits in a scale or notation, (e.g. SUPERTALKER audio input is converted to digital bytes).

diskette — Also called floppy disk, 5 1/4" flexible disk or mini—disk. A round nonrigid piece of magnetic tape, contained in a plastic envelope. It is coated on the inside with a soft material that permits easy rotation of the disk inside the envelope at 360 rpm. A slot in the envelope provides access for the read—write head to the disk surface.

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DOS - Acronym for Disk Operating System.

drive - A sloppy reference to the floppy disk drive.

floppy disk - see diskette.

hang — Short for hangup. A condition in which the 6502 central processor of the Apple is trying to perform an illegal or forbidden operation or in which it is continually repeating the same routine.

hardware — Physical equipment that you see — video screen, keyboard, disk drive, etc. - mechanical, magnetic, electrical, or electronic devices. (Contrasted with software).

initialization — The process in which information is supplied to a computer prior to the running of a program.

input-output - See I/O.

integer — A whole number, not fractional or mixed (e.g., 1,2,9, 100 etc. — not 1.1 or 1/1).

interface — An exchange of information between one thing and another (e.g. the Apple and the floppy disk drive), or the mechanisms which make such an exchange possible.

I/O — Acronym for input-output. The transmission of information from an external source to the computer, or from the computer to an external source.

menu - A list of options or functions which are displayed on a CRT.

memory — The Apple RAM (Random Access Memory) used to hold machine—language information in electrical form. Collecting and holding pertinent information until it is needed by the computer.

monitor — The video screen of the Apple. (See CRT.)

motherboard - The main board in the Apple that has the I/O slots at the rear.

output — See input—output.

peripheral - Something attached to the Apple which is not part of the Apple itself. The SUPERTALKER System and the floppy disk drives are peripherals.

program - A sequence of instructions that tells the Apple how to receive, store, process, and deliver information.

RAM — Acronym for Random—Access Memory.

ROM - Acronym for Read-Only Memory.

run - To follow the sequence of instructions which comprise a program, and to complete the process outlined by the instructions.

slot - One of the rear connectors provided in the Apple motherboard for the purpose of insertion of circuit cards. The slot numbers are located above the connectors and range from 0 to 7.

software - Programs and routines, codes and other written information for use with the Apple (as distinguished from the Apple and its peripherals which are referred to as "hardware").

string — A connected sequence of entities, such as characters, in a command string.

subroutine — A segment of a program which can be executed by a single call. Subroutines are used to perform the same sequence of instructions at many different places in one program.

syntax - The make—up of expressions in a language. The rules that govern the structure of expressions in a language.

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