The Perfect Mate For the IBM PC
This is no silent partner' the PC-Mate Speech Master synthesizer board from Tecmar gives quality speech to your IBM.
By James Derry, address correspondence to James Deny, 1538 Rawies Drive, Akron, OH 44313.

Would you like your IBM Personal Computer to talk to you? There is a speech synthesizer board that can do just that-the PC-Mate Speech Master from Tecmar, Inc. (23600 Mercantile Road, Cleveland, OH 44122). The board costs $395 and is one of the products in the PC-Mate line of expansion chassis, memory and board addons for the IBM Personal Computer from Tecmar. This board will go into any expansion slot in the IBM PC or the PC-Mate. It performs text-to-speech conversion using both phoneme access, with the Federal Screw Works Votrax chip, and fixed vocabulary in ROM, with National Semiconductor's Speech Processor Chip (SPC). The software driver (SPEECH) for the board is supplied on disk and is functionally an overlay to PC-DOS. It does its job with minimal programming effort on the part of the user.

Hardware
National Semiconductor's SPC, the Digitalker, comes with vocabulary in pairs of ROMs and delivers high-quality nonmechanical speech. The two-ROM set that comes with the Speech Master contains 143 words; two more ROMs would yield another 100 to 150 words. Since there are eight sockets for ROMs, there is a possible vocabulary of about 560 words. Additional vocabulary ROMs are available in pairs in add-on kits.

Votrax, on the other hand, works with phonemes and has no problems with enunciating words without a lexicon. This chip produces speech which has a flat, mechanical quality without inflection or variance—but the Speech Master board does permit some output compensations. There are three trim pots on the board for tone and volume control. They are located at the top so they can be reached and tweaked with the board installed and running. You can use them to match the Votrax and Digitalker output, adjust the board speaker volume and adjust phoneme pitch.

DIP switches are used to set the board's base address, 0B00 (hexadecimal). Actually, the Speech Master uses four ports-0B00 through 0B03. The first two of these ports are used for controlling access to the fixed vocabulary, the third for phoneme access and the fourth for interrupts, status and module selection.

Interrupts shouldn't be used until you understand their use in the IBM PC. A single jumper (only one, no more) may be used to gain access to one interrupt request line out of the six that are available.

Speech Master has an on-board mixer, amplifier and speaker, which is enough for most tasks. An RCA phone plug is available on-board to enable use of an external speaker if that's needed. Power available on the board is adequate to drive an 8-ohm speaker, but anything more than that will experience distortion unless it has its own power and amplifier.

Software
Driver software must be reloaded when the computer is powered up and after each program reset. Do this by running the program named English. Once this software is loaded, output from the Speech Master can be obtained via print statements. For example, a Basic print instruction LPRINT CHR$(255) + HOW ARE YOU TODAY? would transmit the message to the talker instead of the printer due to the presence of the special character, CHR$(255), transmitted in the lead position. This example would select the Votrax device and the output would be phonemic.

One of the nice features of the software furnished by IBM with the PC is the control-P command, which causes printer output to be displayed on the CRT screen. In similar fashion, Tecmar software for this board has been written to use a control-T command to output to both the screen and the talker. A number of special operator command choices are available that permit complete flexibility in the choice of output modes.

Using Vocabulary
The vocabulary furnished in the two ROMs on the board is shown in Table 1. If you want to use any of these words, select the Digitalker with a CHR$(254) and then specify them in the following manner: LPRINT CHR$(254 + CHR$(26) + CHR$(77) +CHR$(129) This message is, "Eighty degrees."
Table 1. Vocabulary contained in the National Semiconductor SPC Digitalker ROMs furnished with the Tecmar PC-Mate Speech Master.

Note 1: 'SS' makes any singular word plural. 'S' must be the statement that follows the word that is to be plural. It adds an 'S' to that statement. For example, 'DOG' becomes 'DOGS'.

Note 2: Address 143 is the last legal address in this particular word list. Exceeding address 143 will produce pieces of unintelligible invalid speech data.

Using Phonemes

Phonemes available with the Votrax chip are given in Table 2; Table 3 has the same list rearranged according to the type of sound involved. Software adjustment for the flatness of the phoneme speech output is done with pauses based upon encountering (and recognizing) commas, periods, colons and semicolons. Pitch changes are also used to inflect sentence completion at a period and inquiry at a question mark. Speech output is also better if you spell words phonetically, such as compewter in place of computer. The program listing might look bad, but the sound will improve. Experiment a little.

In order to output the message Eighty degrees using phonemes, select the Votrax chip with the code CHR$(255) and give it the text: LPRINT CRR$(255) + "EIGHTY DEGREES"

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Vocabulary and phoneme outputs may be mixed if you want the best of both worlds.

More Advanced Programming

There are more complicated matters for those who like to deal with such things. Fortunately, you don't need to know assembly language because sufficient instructions are available in Basic.

You will find that the Digitalker output can be terminated before it is complete by presenting the next request to the input port before the prior instruction is finished. The Votrax chip, on the other hand, doesn't turn off a phoneme until it is commanded to do so.

Communication with the Speech Master is handled through the four ports that carry the addresses 0B00 through 0B03 (2816 through 2819 decimal). The documentation that comes with the board contains two small Basic demonstration routines illustrating methods of handling the devices (see Listing 1).

The Out function transmits data that follows the comma to the given address; e.g., line 30 transmits an 8 to address 2819 (which turns on bit 3 and turns off all other bits) to enable the Votrax chip. The program then calls for the 64 phonemes available to be spoken in turn, each executing the loop in lines 100 and 110 while waiting for the previous phoneme to finish.

A similar demonstration program is available to exercise the SPC digitalker chip and the ROM vocabulary. The SPC is enabled by turning on bit 2, address

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<th>Phonomes and their durations for the Federal Secure Votrax Votrax device used with the Former PC-Moto Speech Master.</th>
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<td><strong>Phoneme Categories According to Production Features</strong></td>
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Table 3: Votrax phonemes grouped by production features: voiced, voiceless, and nasal.
Applications
Uses for the Speech Master have been found in business and industrial automation areas where the audio output permits the operator to keep his attention riveted on his job. Any anomaly found by the microcomputer in processing its tasks for the operator's work station will be made clear by the audio output of the talker. The operator is free to make corrections without needing to redirect his attention to a CRT screen or printer.
Other useful applications can be found as teaching aids, voice response in automatic telephone answering systems and even limited work with foreign languages (phonemes aren't just for English, you know).
Increasing use of computers by the blind due to availability of audible output (and Braille in lieu of printing) is another high value application that may be a social bonanza.
These are only a few of the possible ways to use speech synthesizers. Try the PC-Mate Speech Master with your IBM PC and find your own application.

Listing 1. Basic phoneme demonstration program.
10 REM PHONEME DEMONSTRATION
20 A=2816: REM BASE PORT ADDRESS
30 OUT A+3,8: REM ENABLE PHONEME CHIP
40 FOR N=0 TO 63: REM SAY ALL PHONEMES
50 OUT A+2,N: REM ADDRESS 2818
60 GOSUB 100: REM TEST FOR COMPLETION
70 NEXT N
80 END
100 S=INP(A+3): REM ASK FOR COMPLETION STATUS
110 IF S * 128 THEN RETURN ELSE GOTO 100: REM DONE? *>

Listing 2. Basic vocabulary demonstration program.
10 REM VOCABULARY DEMONSTRATION
20 A+2816: REM BASE PORT ADDRESS
30 OUT A+3,4: REM ENABLE DIGITALKER
40 FOR N=0 TO 143: REM SAY ALL VOCABULARY WORDS
50 OUT A, N: REM ADDRESS IS 2816
60 GOSUB 100: REM TEST FOR WORD COMPLETION
70 NEXT N
80 END
100 S=INP(A+3): REM ASK FOR COMPLETION STATUS
110 IF S * 128 THEN RETURN ELSE GOTO 100: REM DONE? * >

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