ATARI 1450XLD

RESIDENT VOICE HANDLER

EXTERNAL REFERENCE SPECIFICATION
(PRELIMINARY VERSION)

MAY 24, 1984

1.0 SCOPE

This document contains the information necessary to use the numeric mode of the Resident Voice Handler in the Atari 1450XLD computer.

The reader should be aware that the Resident Voice Handler is not yet complete, and so the information in this document is subject to change. Also, the Resident Voice Handler will support at least one mode other than the numeric mode; only the numeric mode is documented here.

2. HARDWARE

The speech synthesis hardware in the Atari 1450XLD computer consists of an SSI-263 speech synthesis chip supplied by Silicon Systems Incorporated. (This chip is also known as the SC-02.) The chip contains five 8-bit registers which allow the user to select from 64 different phonemes, 4 different phoneme durations, 32 levels of pitch, 8 different speeds of inflection, 16 overall rate settings, 16 levels of amplitude, 8 rates of articulation, and 255 settings of the vocal tract filter response.

The five registers of the SSI-263 chip are mapped into the address space of the 6502 as follows:

$D100	DURATION/PHONEME (D/P)
$D101	INFLECTION (I)
$D102	RATE/INFLECTION (R/I)
$D103	CONTROL/TRANSITION/AMPLITUDE (CTA)
$D104	FILTER FREQUENCY (F)

The D/P, I, R/I, and F registers are write-only locations; the CTA register is a read/write location. The functions of these five registers will not be discussed in this document; for information on the functions of these registers, refer to the SSI-263 chip datasheet.

The interrupt (A/R) pin of the SSI-263 is connected to the 1450's parallel device interrupt line. This means that the SSI-263 can generate IRQ interrupts. Interrupts from the SSI-263 are enabled by setting Bit 5 of PORTB ($D301), and disabled by clearing Bit 5 of PORTB. The A/R line can also be read directly by reading Bit 7 of IPDVI ($D1CF).

3. HANDLER THEORY OF OPERATION

The Resident Voice Handler appears to application programs as a CIO-level device handler. The device name is "V:". The handler automatically enters itself into the device handler table (HATABS) during both coldstart and warmstart, and implements the normal CIO functions: OPEN, CLOSE, GET, PUT, STATUS, and SPECIAL.

Communication between the handler and the SSI-263 chip is fully interrupt-driven. The handler maintains a FIFO (First-In, First-Out) of phonemes to be sent to the SSI-263 chip. Data which the handler receives via PUT commands is placed into the FIFO. When the SSI-263 chip generates an interrupt, an interrupt service routine in the handler retrieves five bytes from the FIFO and stores them into the five SSI-263 registers. If the FIFO is empty when an interrupt occurs, the interrupt routine will supply a PAUSE phoneme.

Two memory locations on page $2xx are provided to assist in synchronizing speech with other system activities. Variable VPCTR at [$252,1] is incremented by the interrupt routine every time it retrieves a phoneme from the FIFO. (VPCTR is not incremented when the interrupt routine finds the FIFO empty.) Variable VMCTR at [$253,1] is incremented by the interrupt routine every time it retrieves a "marked" phoneme from the FIFO. Data received via PUT commands determines which phonemes are to be "marked".

4. THE OPEN COMMAND

The OPEN command turns on the SSI-263 chip, specifies the form in which data will be sent to the handler, selects the timing response of the SSI-263 chip, and gives the address and length of the FIFO. The contents of the IOCB is as follows:

ICBAL/ICBAH contains a pointer to the character string "V:",CR or "V1:",CR (CR = carriage return).

ICAX1 contains the following: (a) Bits 7-6 specify the timing response of the SSI-263 chip: 00 = Phoneme timing, transitioned inflection; 01 = Phoneme timing, immediate inflection; 10 = Frame timing, immediate inflection; 11 = Invalid. (b) Bit 6 = 1 if the calling program is supplying a FIFO. In this case, ICAX3/ICAX4 contains the address of the FIFO, and ICAX5 contains the length of the FIFO in bytes. Each phoneme requires five bytes on the FIFO; consequently, the length of the FIFO must be a multiple of five. If bit 6 = 0, the handler will supply a 40-byte FIFO. (c) Bits 5-0 = 01000.

ICAX2 specifies the form in which data will be received by the handler: 0 = Numeric Form; 'N' = Numeric form ('N' and 0 are the same); [other forms TBA].

5. THE CLOSE COMMAND

The CLOSE command immediately turns off the SSI-263 chip. Any phonemes in the FIFO are lost.

6. THE GET COMMAND

The GET command returns ERROR 146 (function not implemented).

7. THE PUT COMMAND

The PUT command sends data to the handler, which will convert it into phoneme codes (if necessary) and then place it onto the FIFO. If the FIFO is full, the handler will loop until space in the FIFO becomes available. The form in which the handler expects to receive data depends on the data form specified in the OPEN statement.

7.1 NUMERIC FORM

When numeric form is selected, the handler expects to receive numerical data which will be sent directly to the SSI-263 chip. The calling program must send five bytes of data for each phoneme that is to be produced. The five bytes are sent in the following order:

BYTE 1 = DURATION/PHONEME
BYTE 2 = INFLECTION
BYTE 3 = RATE/INFLECTION

BYTE 4 = CONTROL/TRANSITION/AMPLITUDE (BITS 6-0 ONLY)
BYTE 5 = FILTER FREQUENCY

If Bit 7 of Byte 4 is set, the phoneme is considered to be "marked"; if Bit 7 of Byte 4 is clear, the phoneme is not marked. The handler will increment VMCTR whenever a marked phoneme is written into the SSI-263 chip. In any case, Byte 4 is logically ANDed with $7F before it is written into the C/T/A register.

7.2 [OTHER FORMS TBA]

8. THE STATUS COMMAND

When the handler receives a STATUS command, it stores 4 bytes of status information into DVSTAT at [$2EA,4]. The 4 bytes are as follows:

DVSTAT = Phoneme Counter (copied from VPCTR).

DVSTAT+1 = Marker Counter (copied from VMCTR).

DVSTAT+2 = Flags:
Bits 7-6 = Data Form:
00 = Numeric
01 = TBA
10 = TBA
11 = TBA
Bits 5-2 = TBA
Bit 1 = FIFO Filled Flag.
Bit 0 = FIFO Exhausted Flag

The FIFO Filled Flag, if set, indicates that since the last OPEN or STATUS command there was at least one time that the FIFO was full when the handler wanted to store data into the FIFO (which means that the handler had to loop waiting for space in the FIFO). The FIFO exhaused flag, if set, indicates that since the last OPEN or STATUS command there was at least one time that the FIFO was empty when the SSI-263 chip requested a new phoneme (which means that the interrupt service routine had to supply a PAUSE phoneme).

DVSTAT+3 = Number of phonemes in the FIFO.

9. SPECIAL COMMANDS

Several SPECIAL commands are implemented by the Resident Voice Handler.

9.1 THE SYNCHRONIZE COMMAND = $31

The SYNCHRONIZE command has a command byte value of $31. When the handler receives a SYNCHRONIZE command, it places a PAUSE phoneme on the FIFO and then loops until the FIFO is empty. The SYNCHRONIZE command can be used to ensure that a phrase has been completed before CLOSEing the voice handler or going on to the next activity.

9.2 [OTHER SPECIAL COMMANDS TBA]