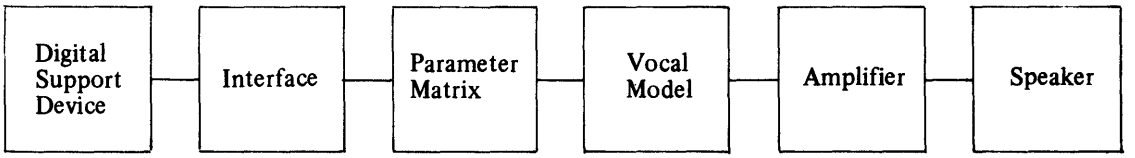
Interfacing VOTRAX,® Models VS-6.0 & ML-I

Introduction

The VOTRAX Voice Synthesizer is an all solid-state electronic device which can produce speech when properly driven by a digital device. VOTRAX produces speech by phonemic concatanation. The digital device, to which VOTRAX is interfaced, instructs VOTRAX to sound out phonemes in a sequence defining words and sentences. Each phoneme may also have rate and/or inflection levels assigned to it. The phonemes are linked together in a dynamic fashion so that each phoneme blends naturally with those preceding and following it. The inflection aids in producing a natural flowing speech from the electronic device.

The VOTRAX synthesizer consists of three main electronic sections. The vocal model, the parameter matrix and the interface.



The Vocal model is an electronic simulation of the human vocal system. Given the proper input, this model can produce any of the sounds that the human vocal tract can produce.

The parameter matrix defines special sets of inputs into the Vocal model. The sounds defined by these parameters are those characteristic of human speech phonemes. The parameter matrix is driven by binary data lines supplied by the interface. 8 or 12 data bits define one of 64 to 128 phonemes and its user-assigned rate and inflection levels. For your requirements, see your VOTRAX representative.

The interface provides the means of getting the digital information from the driving device (usually a computer) to the parameter matrix in the proper form. Every effort is made to eliminate the time-dependent nature of the data from becoming a concern of the driving device. Also every effort is made to use data in currently existing forms so that a minimum of hardware or software effort will be required on the part of the user. To these ends, the following interfaces are available with VOTRAX; Parallel Buffered, Parallel Fifo Buffered, Parallel Unbuffered, Parallel Fifo Buffered ROM, Serial EIA-RS-232, and serial DATASWITCH. In the future, other interfaces may be developed. Those titled above are each covered in the body of this paper.

Parallel Buffered

The Parallel Buffered interface requires that the supporting device supply the following input:

(1) 8 or 12 data lines
(2) 1 data strobe
(3) 1 or 2 control lines for INPUT and OUTPUT mode control

The interface returns a BUSY line to the supporting device reflecting the status. All signals are TTL compatible.

The parallel data lines (1) are held while the data strobe (2) is pulsed. Each strobe enters one phoneme and its modifiers into an 80 character shift register buffer. 80 characters should always be transferred in each input cycle. If there are less than 80 phonemes required for a message, the end should be padded with "NULL" data entries. Normally 2 mutually exclusive control lines (3) are required which instruct the interface to enter INPUT or OUTPUT mode. Input mode allows data to be entered into the buffer. Output mode disables all inputs and causes speech to be produced from any loaded data. Optionally, Input and Output mode can be controlled from the state of a single control line.

Upon entering OUTPUT MODE, the status line reflects a BUSY condition. When the loaded data has been spoken, the status line changes to Ready (NOT BUSY) informing the supporting device that new data may now be loaded.

Since the Parallel Buffered interface requires that 80 characters be sent at each input cycle, it appears to be a RECORD oriented device. This interface is well suited for use on a DMA (Direct Memory Access) channel of a computer. The interface can accept data rates greater than 1 megahertz.

Parallel Fifo Buffered

The Parallel Fifo Buffered interface requires that the supporting device supply the following inputs:

1. 8 or 12 data lines
2. 1 strobe line
3. 1 inhibit output (optional)

The interface returns two status lines:

4. Buffer empty (optional)
5. Buffer Full

All signals are TTL compatible.

The data lines (1) are held while the data strobe (2) is pulsed. Each strobe enters one phoneme and its modifiers into a 64 character FIFO buffer. Unless Inhibit (3) is held

low, the phonemes begin to create speech as soon as they are loaded. Speech output and data input occur simultaneously. Input should be performed on a character by character basis. Buffer full (5) should be checked just before each character is sent. For this reason, the interface is best suited in a programmed I/O, or character I/O environment. Buffer Empty (4) may be used to tell when VOICE OUTPUT has completed. Data may be input at up to 700 KHZ.

Parallel Unbuffered

The Parallel Unbuffered interface requires that the device supply the following input:

1. 8 or 12 data lines

The interface supplies the following signal to the supporting device:

2. Phoneme clock

All signals are TTL compatible.

The presence of any data on the data lines immediately evokes the sound of the phoneme addressed and the modifiers. The sound remains until the data changes. Since each phoneme has its own timing parameter, the interface returns a signal to the supporting device to instruct the device to supply the next phoneme address. This signal is called Phoneme clock and it is only disabled by a null (all one's) address. This interface should be used when it is difficult to support the strobe input on the FIFO buffered interface. The operating sequence for this interface is as follows:

1. Set to idle state (Null on input lines)
2. Set input lines to PA $\emptyset$ phoneme (to synchronize with phoneme clock)
3. At each phoneme clock set input lines to next phoneme and inflection
4. After last phoneme and phoneme clock return to step 1.

The time between phoneme clocks is determined by the current phoneme and the speech rate control on the front of the unit.

Parallel Fifo Buffered ROM

The Parallel FIFO Buffered ROM requires that the following signals be supplied by the supporting device:

1. 8 or 12 data lines
2. 1 data strobe
3. 1 inhibit output (optional)

The interface supplies the following signals to the supporting device:

1. Buffer empty
2. Buffer full

The supporting device holds data on the data lines (1) while it strobes the data strobe line (2). This enters data into a 64 character FIFO Buffer. The data may be of three types; Phoneme command, ROM Address, or a control code to change modes. Phoneme commands address phonemes and modifiers just as in the Parallel FIFO interface. ROM (Read Only Memory) addresses cause phoneme and modifier commands to be extracted from a customer defined ROM on the interface board. A single address will cause a word or message to be spoken. The message may be of any length. The ROM system is expandable to increase message length.

Control codes cause an explicit mode switch, so that ROM addresses and phoneme data may be interspersed in the buffer. In this fashion the phonemes may be used to fill in variable information and the ROM addresses extract the entire fixed portion of the output.

Another mode of operation for this interface is as a verbal warning or command system by connecting VOTRAX directly to machine sensors. A switch closure on the machine is encoded and input to VOTRAX as a ROM address. This causes a sequence of instructions to be spoken by VOTRAX.

The operational sequence for this interface is identical to that of the Parallel FIFO Buffered interface.

Serial EIA-RS-232

The Serial EIA-RS-232 interface requires the following signals from a computer:

1. 1 serial data input line
2. 1 serial data output line (optional)
3. 1 request to send (optional)
4. 1 clear to send (optional)
5. 1 data terminal ready

The interface may also be used with a Western Electric 403 (half-duplex) or 407 (full-duplex) data set as a full Touch-Tone* input, audio response output system. The signals required from the modems are:

6. Touch-Tone data lines
7. 1 carrier detect (strobe)
8. 1 data set ready

All signals are EIA-RS-232C compatible.

All serial data (1 & 2) is sent and received as ASCII data. The data received from the computer (1) is checked to see if it is a valid character. If so, the low order bits are stored as half a phoneme. If not, it is ignored. When a phrase has been received, it is spoken. The interface is FIFO buffered so that it can speak while being loaded. Request to send (3) and clear to send (4) are used as buffer status indicators and are optional.

When used as an input device with a modem, the interface accepts data from the modem and encodes it into an ASCII character. The character is then converted to serial data and sent to the computer (2).

Optionally, if the computer interface is half-duplex, a break signal will be generated if a character is received from the modem while the computer is outputting data. The buffer may also be cleared at user option.

*Registered Tradename

Operationally, the computer raises Data Terminal Ready. When a call is received Data Set Ready turns on. The computer may now send data and speak or recieve Touch-Tone data from the user. Serial data follows the Asynchronous protocol and can be sent at any of the following baud rates: 110, 150, 300, 600, 1200, 2400, 4800 or 9600. When the computer wishes to terminate the call it drops Data Terminal Ready. If the user hangs up his phone, Data Set Ready will drop. In most cases the standard communications saftware packages supplied by hardware vendors are capable of supporting VOTRAX on the computer.

Serial Data Switch

The Serial Data-Switch Interface is intended to connect between an interactive computer terminal and its dataset or acoustic coupler. This interface is designed to add voice to any existing terminal. Only two signals are of importance to this interface. They are:

1. Received data (from dataset)
2. Carrier Detect (from dataset)

and the corresponding:

3. Received Data (to terminal)

All other signals are directly linked, through VOTRAX, between the dataset and the terminal. The above signals must be EIA-RS-232 compatible.

VOTRAX resides on the incoming serial data line (1) where it decides, based upon the data, if the data is to be printed or spoken. If the data is to be printed, it is propogated to the terminal. If the data is to be spoken, it is not sent to the terminal, and it is accepted into the VOTRAX buffer in a similar manner to the Serial EIA-RS-232 interface.

To cause data to be spoken, the print or write statement should prefix and postfix the speech data with the proper control characters. These control characters may be chosen by the customer and can be printing or non-printing characters. To cause a mode change the proper control character must be sent twice without any intervening characters.

This interface is quite useful in C.A.I. (Computer Aided Instruction) systems, Computer Graphics to avoid cluttering the display with text, Automated drafting systems, and other applications where the user is not standing at a terminal, but must receive instructions.

Summary

VOTRAX and the previously discussed interfaces reflect, in part, the broad technological base of Vocal Interface. By identifying and meeting the interface, storage and computational needs of our customers over the last several years, the Division has achieved a commanding position in communications expertise.

Whether man to machine, machine to machine, or machine to man, our business is communications, our product-performance. Utilizing state-of-the-art microprocessing and integrated circuit technology, our staff of experienced professionals offers unrivaled assistance in the design and application of communications hardware and software. From audio response subsystems to turnkey systems for information transfer, storage and processing, see your Vocal Interface representative.

COMPUTER INTERFACE REQUIREMENTS

Because of its wide range of interface options, VOTRAX can easily be connected to almost any computer. By utilizing one of the Serial RS232 interfaces available, VOTRAX may be attached to the computer by means of an Asynchronous Serial Line Interface. In this configuration, VOTRAX appears identical to the Bell 103 or 202 type modem and operates like a buffered asynchronous terminal. Nearly all computers have such interfaces available via optional communications adapters or telecommunications control units.

VOTRAX is also easily attached via general-purpose parallel interfaces. This type of interface is available on most popular minicomputers and on some large mainframes. The following is a partial list of computers and hardware features for interfacing VOTRAX:

Manufacturer	Model or Series	Interface Type	Feature/Option
Computer Automation	Naked Mini, Mega Byter	Serial	14630* Intelligent Cable
			14535 Asynch. Modem Controller
		Parallel	14631* Intelligent Cable

* Prerequisite is 14629 Serial I/O Distributor

Manufacturer	Model or Series	Interface Type	Feature/Option
Data General	Nova Eclipse	Serial Parallel	4029 Voltage (EIA-type) Interface 4066 Digital I/O Interface
Data point	1100, 2200, 5500	Serial Parallel	9400 Asynch. Adapter 9420 Parallel Logic-Level Interface
Digital Equipment	PDP-11	Serial Parallel	DL11 Asynch. Serial Line Interface DR11 General Purpose Interface
General Automation	SPC16 18/30	Serial Parallel Serial	1561 Asynch.-Communications Controller 1430 General Purpose I/O 1552 202-Data Set Control HDX
Hewlet Packard	2100 21MX 3000CX	Serial Parallel Serial	12587A Asynch. Data Set Interface 12566B General Purpose Interface 30032B Asynch. Terminal Controller
Interdata	70, 80, 85 7/16, 7/32, 8/32	Serial	M46-102 Programmable Asynch. Single Line Adapter
Raytheon	RDS-500	Serial	52706
Texas Instrument	960B 980B	Serial Serial Parallel	961642 Full Duplex EIA Interface 966637 Full Duplex EIA Interface 965955 Parallel Interface
Varian	620, V70	Serial	5401 Data Set Controller
Wang Laboratories	2200, WCS	Serial	2227 Asynch. Telecommunications Controller

Vocal Interface Division
Federal Screw Works

OFFICES:

East Coast

Vocal Interface
270 Concord Street
Framingham, Mass. 01701
Phone: (617) 879-3274

Midwest

Vocal Interface
500 Stephenson Highway
Troy, Michigan 48084
Phone: (313) 588-2050

West Coast

Vocal Interface
4340 Campus Drive
Suite 212
Newport Beach, CA 92660
Phone: (714) 557-9181

Europe

Vocal Interface
Reis-STR. 16
6200 Weisbaden
Federal Republic Germany