

# Single-board speech synthesizer extends microcomputer-I/O capability

One significant way to extend the I/O capability of a microcomputer system is to add voice communications. A single-board speech module does this easily and quickly with a self-contained data set that can be programmed to generate many phrases and sentences. In addition, the TM990/306 speech module can be interfaced to any host CPU, be it minicomputer or mainframe. Five special features make this possible:

- Programmable systems interface
- Serial communications with  $\mu$ C modules
- Simplified hardware interface
- Four modes of operation that include provisions for interfacing to both mini and mainframe computers
- Interrupt-driven capability.

The basic speech set consists of 180 words (Table 1) contained in TMS2716 EPROMs. Specialized speech sets are also available and can be handled by the EPROMS. In addition, the sound quality is suitable for operation in many industrial environments like assembly lines and stockrooms.

All event timing, interrupts and I/O functions associated with the  $\mu$ C bus are performed by the TMS9901 programmable systems-interface IC (Fig. 1). A real-time clock or event timer, part of the PSI, contains a 14-bit counter that decrements at 1/64 of the input clock frequency.

When the counter is running, it decrements and issues an interrupt. When it reaches zero, it is reloaded from an internal register; decrementing starts again. Consequently, the timer can either keep track of real time or measure elapsed time from a specific event and, by issuing an interrupt, can tell the speech module to say something like "Time to check the meter."

Suppose an application requires 1-second pulses to time certain events while operating from a real-time clock. To do this, the 9901 clock can be set to interrupt every  $333.33 \text{ ms}$ , by programming the 14-bit internal to  $3D09_{16}$  or  $15,625_{10}$  periods. Under these conditions, a system clock frequency of 3 MHz yields a resolution of  $21.333 \mu\text{s}$ .

The decrement period of  $21.333 \mu\text{s}$  multiplied by

Table 1. TM990/306 speech set

<b>A</b>	<b>G</b>	<b>P</b>	<b>U</b>
Abort	Gauge	Pass	Under
Adjust	Gate	Passed	Unit
Alert	Get	Percent	Up
All	Go	Pico	<b>V</b>
Amps	Green	Plus	Valve
And		Point	Volts
Automatic	<b>H</b>	Position	<b>W</b>
	Henry	Pound	Wait
<b>B</b>	Hertz	Power	Ward
Back	High	Press	Watts
Button	Hold	Pressure	Welder
	Hours	Priority	West
<b>C</b>	Hundred	Probe	<b>Y</b>
Calibrate		Processing	Yellow
Call	<b>I</b>	Pull	<b>Z</b>
Cancel	Inch	Put	Zero
Carpenter	Initialize		
Check	Inspector	<b>R</b>	
Clock	Intruder	Range	
Close	Is	Ready	
Control		Red	
Crane	<b>J</b>	Repair	
Crease	Jog	Repeat	
Cycle		Replace	
	<b>L</b>	Right	
<b>D</b>	Left		
Danger	Light	<b>S</b>	
Days	Line	Safe	
Degrees	Low	Seconds	
Delay 4		Set	
Delay 3	<b>M</b>	Seven	
Delay 2	Machine	Shut	
Delay 1	Maker	Six	
Device	Manual	Slow	
Direction	Measure	Smoke	
Display	Mega	South	
Door	Meter	Speed	
Down	Micro	Start	
	Mill	Stop	
<b>E</b>	Milli	Switch	
East	Minus		
Eight	Minutes	<b>T</b>	
Electrician	Motor	Temperature	
Eleven	Move	Ten	
Enter		Test	
Equal	<b>N</b>	The	
Exit	Nine	Thousand	
	North	Three	
<b>F</b>	Number	Time	
Fail		Timer	
Farad	<b>O</b>	Tool	
Fast	Of	Turn	
Feet	Off	Twelve	
Fire	Ohms	Two	
Five	On		
Flow	One		
Foreman	Open		
Four	Operator		
Frequency	Out		
From	Over		

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