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Synertek's SYM-1: Still Versatile

The 'nym's new, but the SYM's still the same good old VIM.

About 1½ years ago, Synertek Systems Corp. (PO Box 552, Santa Clara CA 95052) introduced their Versatile Interface Module (VIM). It's now called the SYM-1, but the versatile is still included. It uses a 6502 microprocessor that makes the SYM-1 a cousin of the KIM-1. The SYM-1 includes an excellent 4K system monitor (in ROM), and the on-board 28-key keypad (along with a 6-digit hex format display) will get you started right away into machine-language programming (see Fig. 1).

SYM-1 Features

Before going into more detail on the features of the system

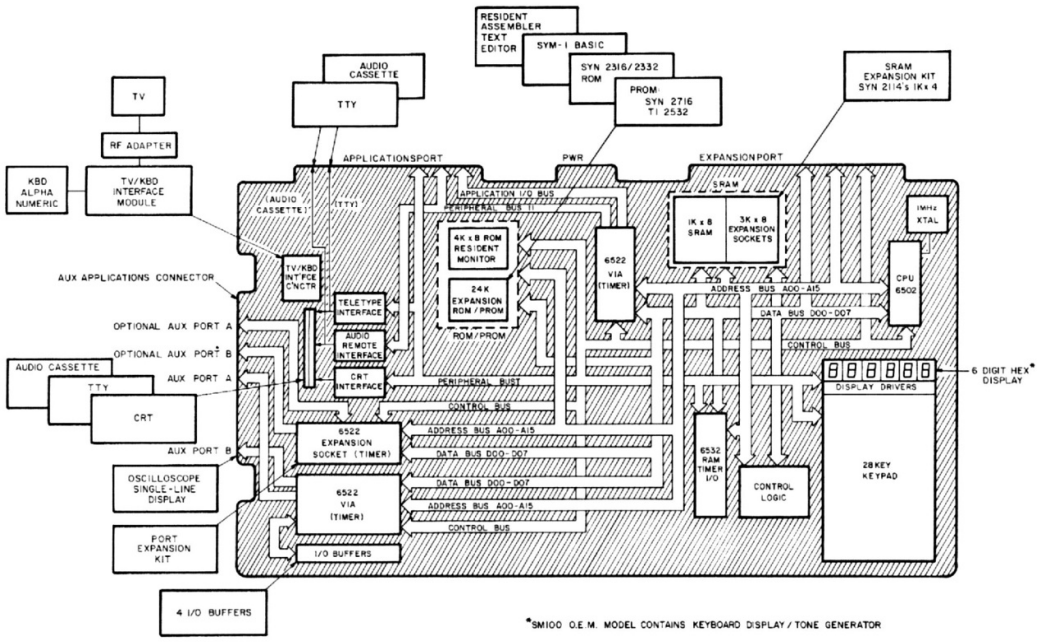

Fig. 1. Block diagram of the SYM-1 board (reprinted courtesy of Synertek Systems Corp.).

monitor, let me skim over some of the SYM-1's features. The board comes with 1K of 2114-type RAM and is expandable (on-board) to a healthy 4K worth of RAM. In addition to this, decoding is provided to add another 4K of RAM (off-board).

As mentioned before, the system monitor resides in ROM, but three sockets are provided to add up to 24K bytes of additional ROM/PROM. Addressing jumpers are provided so that each socket can accommodate any of four different types of read only memory devices.

On-board interfaces include a cassette interface complete with remote control (on/off of cassette recorder motor) that is usable in two modes: KIM-1 compatible and high speed (nearly 1500 baud). A Model 33 Teletype can be added through the 20 mA teleprinter interface, or if you'd rather use an RS-232 CRT terminal, an interface is provided for this also.

All of the software needed to support the cassette, Teletype and CRT terminal interfaces is included in the system monitor. In addition to this, the SYM-1 automatically adjusts for baud rates from 300-4800 baud (inclusive) when the CRT terminal interface is used. For users without terminals, the SYM-1 provides an oscilloscope driver that will allow you to use an ordinary oscilloscope to display one line of 32 characters; the software for this scope driver is included in the SYM-1 reference manual.

For input/output and timing applications, the board comes with two 6522 VIAs (versatile interface adapter) and one 6532 device. These three devices are worthy of a chapter by themselves; they are one of the big reasons the SYM-1 is so versatile. The 6532 has an on-chip programmable interval timer; its I/O ports are used to interface the keypad/display or any other user-supplied terminal to the microprocessor.

The 6522 devices include two on-chip timers—an interval timer (that can double as a "pulse counter") and a timer that can operate either in a free-running mode or in the "interval" mode. The 6522s also include two 8-bit bidirectional I/O ports (with "handshake" capability) that can be configured in any I/O combination through the 6522's Data Direction registers. In fact, some of the features of the SYM-1 (such as the scope driver, cassette interface and the write protection of user RAM) use part of these VIAs.

If this I/O capability is not enough for you, a socket is provided so you can add one more 6522 to the SYM-1 to give you 16 additional I/O lines (with handshaking lines), plus the timers and other on-chip functions. Four buffers are also provided on-board (on four I/O pins of VIA #3) that the user can configure in any way he chooses.

And there's one nice thing about the SYM-1 that I've saved for now: It's already assembled and fully tested; all you add is a single +5 V supply.

The SYM-1 package.

System Monitor

I left the discussion of the system monitor for now because if you bought a microcomputer to learn about it and its microprocessor (as I did), then you'll want an operating system that's versatile and thorough enough to allow you debugging facilities and to give you the ability to examine registers, move data around and so on. It would take too much space to describe each of the system commands, so here is just a list: Memory Examine/Modify, Memory Search, Register Examine/Modify, Go (to start the program at immediate address or address given), Verify (display eight bytes in memory or any number of bytes), Deposit To Memory, Calculate (for hexadecimal arithmetic), Move Memory Block (to another location), Jump, Store Double Byte, Fill Memory Locations X-Y With Z, Write Protect (user RAM), Load Tape (KIM-1 or high-speed), Load Paper Tape, Save Paper Tape, Save Tape (KIM-1 or high-speed) and Execute.

In addition to these commands, "+" advances eight bytes (as when in Memory Examine), "−" retreats eight bytes, "→" advances one byte (or register) and "←" retreats one byte. There are eight user-defined keys to enable you to add to the monitor's command repertoire, and there is a system reset key to allow you to sweep your mistakes under the rug. And, of course, there is the DEBUG key/function.

Pressing DEBUG allows you to single-step through each instruction in your program. Thus, after each instruction is executed, you can examine all of the registers and any memory locations and then go on to the next instruction in your program by pressing GO and Carriage Return (CR).

You can let the monitor step through your program, but at a rate that's closer to jogging rather than mile-a-minute sprinting. By changing the "Trace" velocity, you can set up the monitor to display the Program Counter address and the contents of the accumulator, pause and then resume execution, again one instruction at a time. And there is even a set of error messages to tell you when something is wrong (I still like the Bronx cheer method better).

The error codes are interactive; that is, the error message flashed onto SYM-1's display depends on the context in which the error occurred. This simplifies to a message of "Er XX," where XX is a two-digit representation of the byte that couldn't be digested. Finally, for you programmers, the eight user-defined keys should start you on your way to controlling the world.

Unfortunately, I've had to restrict (and sometimes omit) the descriptions of the SYM-1's features and capabilities. For more detail consult the comprehensive manuals that come with the board.

Applications

With its I/O and timing capabilities, the SYM-1 is an obvious choice for intelligent-controller-type applications. But the board is an application in itself, teaching you machine-language programming and the merits of the 6502 microprocessor, including the versatile combination of its instruction set and addressing capabilities. You can apply what you learn to all microprocessor-based computers, as all microprocessors share common features that will enable even a novice to get his or her foot in the door.

For those interested in programming in a high-level language, there is Synertek's BASIC, which is packaged in two ROMs that plug right into sockets provided on the SYM-1. This extended BASIC even has string functions that should enable you to write a nice text editor or two.

But it is the SYM-1's ability to interface with the real world that will please the utility-minded user most. If he is a photographer, the SYM-1 can automate his darkroom from enlarger timing to agitation of the chem-

icals; if he is interested in an audiovisual display, he can control lighting systems to the tune of his favorite music, creating effects that will make ordinary color-organs pale in comparison.

To an experimenter/hobbyist, the SYM-1 could combine several test instruments into one, such as a frequency counter, digital voltmeter and a programmable pulse generator; for the electronic music enthusiast, the SYM-1 could become the heart of a polyphonic synthesizer, generating envelopes for your VCAs (voltage controlled amplifier) and even making sure you're in tune.

You can write programs that will test ICs (with the addition of some wire and a zero insertion force socket or two), program your EPROMs (and check for errors), move "light" pieces on a game board, secure your home; in short, anything that can be controlled electrically (directly or indirectly) can most probably be controlled and monitored by SYM-1. That includes the coffeepot.

My own uses for SYM-1 have included some of the above (such as the EPROM programmer) plus such things as a geometric art generator that uses an ordinary oscilloscope, and a music program that will play up to 256 notes (any audible frequency) and uses the on-board timers (in the VIAs) for the notes' pitch and duration. When I got the Synertek BASIC, I wrote some "recreational" programs including a conversational program, and even a program that will balance a checkbook.

So, if you like to program in BASIC, or are interested in using a microcomputer as the intelligent heart of any system (from kitchens to multi-channel data-acquisition systems), or if you're just interested in learning about microprocessors and microcomputers, look into the SYM-1.■