

## H8 System Support I

This card contains six functions to support H8 operation:

- 1) I/O and Memory Wait State Generator
- 2) CPU Speed Indicator + general purpose I/O LED (supported with new front panel board)
- 3) Parallel printer interface
- 4) HA-8-2 Music synthesizer / dual general purpose DACs
- 5) Multiplexed 8-channel ADC
- 6) AM9511 Arithmetic Processor Unit

By leveraging common components like power supplies and bus interfaces, all of these functions can be placed on a single H8 card. It is possible for the builder to omit components for specific functions if they are not needed in a particular setting.

### I/O and Memory Wait State Generator

Adding I/O wait states has made it possible to run even the slowest of H8 I/O boards (like the H8-4 serial card) at full 16MHz CPU speed with no modifications to the board, chip replacements, or software fixes. For typical application mixes (like a lengthy assembly or compile), the addition of I/O wait states does not introduce significant performance penalties – an assembly run at 16MHz is almost exactly 8 times faster than the same assembly run at 2MHz. The generator can also produce memory wait states, but those have to be used with caution to avoid imposing a severe performance penalty. The wait state generator is easily adjusted to provide however many wait states a particular hardware mix requires to run reliably at 16MHz. Rather than using a shift register to count out wait states, the circuit uses a timed one-shot to hold the Z80 RDYIN\* line low for a fixed amount of time. This has the advantage of producing a fixed time delay regardless of CPU clock speed.

### CPU Speed Indicator + General Purpose I/O LED

The board produces discrete outputs for each CPU speed (2/4/8/Max) which can be used to directly drive individual LEDs or a single multi-color LED. The new front panel board includes individual LEDs for the speed indicator. It is easy to retrofit the original front panel board using the “5<sup>th</sup> LED” position to hold an RGB LED. The System Support I card connector has all of the signals and power necessary for the speed indicator without hacking any wires direct to the CPU board. There is an additional I/O LED that can be used to monitor H17 Side select or H8 Bank select. It could be used to monitor I/O signals from the H17 or other devices as well.

### Parallel Printer Interface

The 82C55 PIO board supports a parallel printer, but many users may not want to attach an entire full-sized card if the only needed function is the parallel printer. The System Support I

uses an 82C55 PPI to duplicate the parallel printer interface included on the Heath/Zenith Z89-11 board. Connector pinouts were modified so that a standard IBM PC motherboard to DB-25 parallel cable can be used – no handcrafted connector wiring required! This circuit also includes the Z89-11 high-current drivers to keep the load on the 82C55 within its datasheet limits. While the 82C55 can, in some circumstances, directly drive a parallel printer without additional circuitry, the load on any individual 82C55 pin must not exceed 2.5ma. Typical terminating resistors found in most parallel printers will require the 82C55 to sink more than 2.5ma – sometimes considerably more. Using the separate drivers, like the Z89-11, isolates the relatively fragile 82C55 from the parallel printer load.

#### HA-8-2 Music Synthesizer / Dual General Purpose DAC

The NOGDS HA-8-2 Music Synthesizer circuit has been included on the System Support I. Very small automotive capacitors made it possible to shrink the HA-8-2 circuit to just a corner of the System Support Board. To avoid interference with RAM-at-zero H8 configurations, the HA-8-2 is now I/O mapped. The original NOGDS music software requires just two lines of code change to flip to I/O mapping, and it remains true to pitch. The audio output may be taken from a standard 1/8" stereo mini-jack for direct connection to amplified speakers or an external amplifier/receiver. If you're looking for general purpose DACs, the unfiltered output of the pair AD7524JN 8-bit DACs is available at a convenient header. The DAC circuit includes extensive power supply filtering and ground isolation for low noise.

#### Multiplexed 8-channel ADC

System Support I includes an ADC0804 8-bit ADC with an 8-channel multiplexer front-end. You can, for example, connect up to four X-Y joysticks for game or other software control. During prototyping, the System Support I was used to control a 6-axis robotic arm using three X-Y joysticks and the I2C output of the 82C55 board to drive the PWM servo motors.

#### AM9511 Arithmetic Processor Unit

The AMD AM9511 / Intel 8231 floating point APU chip is supported by the System Support I. This chip provides significant performance gains for transcendental functions. It's a specialty function that doesn't warrant a dedicated card, but since the System Support I already has all of the power supply, wait state, interrupt, and bus interface circuitry, including the APU on this board required very little incremental space. Rather than being driven by a variable speed CPU clock, the APU circuit uses a fixed 2 or 4MHz crystal oscillator for stable operation at any CPU speed.