

(analyzer's upper limit), and was a full 20 dB from 2 to 10 kHz.

The frequency response of the Sony NR-500 alone was measured at a number of input levels. Encode and decode responses were tested separately. In general, the two sets of curves were complementary, although we made no special effort to match the levels. However, the fixed "cut" (recording) and "boost" (playback) of the anti-saturation network was clearly evident, with a gradual response change up to about 12 kHz and very rapid change from there to 20 kilohertz.

The record/playback response of the cassette deck, with and without the Dolby C, was measured at several indicated recording levels from 0 to -40 dB. We noted mistracking between the encode and decode processes, as evidenced by a change in frequency response when the Dolby C system was switched in or out. At most signal levels, and over the lower audible frequency range, the difference between the NR-500's on and off curves was less than 3 dB. But differences of 6 dB were noted between 5 and 15 kHz, and at recording levels of -20 dB or lower. However, these test-instrument

measurements are really moot since we were unable to make distinctions by ear alone.

While our two-head recorder and single NR-500 processor setup made it impossible to compare incoming and outgoing signals with the flip of a switch, any audible changes that might have been noted were certainly not obvious. We heard no modification of the recorder's response with various musical programs. The noise reduction, however, was very obvious, especially when dubbing from good-quality, quiet discs at very low indicated levels on the recorder's meters (-10 to -20 dB). Recordings made at these low levels without noise reduction were intolerably noisy during playback.

The Sony NR-500 requires an encode input level of at least 77 mV (from the amplifier TAPE output) for proper operation, and delivers about 0.25 V of encoded signal to the recording inputs. During playback, the NR-500 should receive at least 77 mV from the recorder line outputs, and it returns approximately 0.44 V to the amplifier TAPE inputs. All of these levels are well within the normal operating range of most stereo system components. The LED system calibration indicators have a rated level accuracy of ± 0.5 dB.

User Comment. When the original Dolby B noise-reduction system was introduced, more than 14 years ago, there were virtually no cassette (or open-reel) tape recorders equipped with it. During the several years it took for the tape recorder industry to build the Dolby system into their products, a number of companies marketed adapters so that the advantages of Dolby B could be enjoyed with existing tape machines.

Availability of the Sony NR-500 marks a parallel development. Every cassette deck today has Dolby B (or an equivalent), but just a few late models include Dolby C. The NR-500 makes Dolby C available at modest cost for anyone who now has a tape deck.

The Sony NR-500 works very well, as our tests show. However, switching manually between the record and playback modes is a bit awkward, though with some familiarization the mode switching becomes routine.

Obviously, it would not be worthwhile to spend \$200 for this add-on feature if you own, say, a \$240 deck without Dolby C since you could buy a new machine in this price range with it. But if you own a costly cassette deck and wish to overcome dull highs when recording fine source material or do not want to risk tape saturation by recording at a high level in order to squeeze out that better fidelity, then the Sony NR-500 is a most welcome component. With some two-dozen cassette decks selling without Dolby C for upwards of \$600 only a year ago, not to mention such earlier expensive models, there are likely to be a lot of candidates for upgrading with this new product.

—Julian Hirsch

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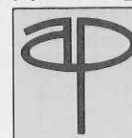
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CIRCLE NO. 21 ON FREE INFORMATION CARD

Popular Electronics Tests



Otrona "Attache" Portable Computer System

PORTABILITY and communication are rapidly becoming the watchwords of the Eighties, especially as they apply to microcomputer systems. The Otrona Attache exemplifies these characteristics.

The \$3995 Otrona Attache is built for both good looks and ruggedness. Housed in a high-impact plastic case, the system boasts a flip-down, plug-in Selectric-style typewriter keyboard, 5" diagonal CRT screen, and built-in 5 1/4" double-density, double-sided floppy-disk drives having a capacity of 760K bytes, 48 tracks/in., and 10 soft-sectored format.

The basic Attache consists of a CRT monitor, dual floppies, 64K memory, CP/M, WordStar, Valet, operator utility, Charton graphics package, and BASIC-80. In addition, RS-232 serial jacks for adding a modem and printer are included, as is a direct video jack for attaching an outboard video monitor.

Although the machine is designed essentially for portable use, the manufacturer has added a single connector that conforms to STD-Z80A bus definitions. This connector is for adding an optional \$295 STD expansion bus.

Besides the expansion bus, you can add a dc power adapter for 10-to-16-V and 20-to-32-V operation at \$295. For portable power there is a strap-on battery option for 1.5-hour operation for \$395; and a 10-hour option is to be available by midyear, though no price has yet been set. To carry everything

around you'll need the accessory pouch for \$49.

The complete Attache takes up less than 1/2 cu. ft and weighs under 19.5 lb. This appears to be the smallest full-feature computer system currently on the market. And although the unit looks classy on the outside, what's inside the case makes it even more impressive.

Based on a 4-MHz Z80A microprocessor, the Attache uses an Am9517A direct memory processor for handling disk- and communication-port operations. In addition, the Otrona engineers designed in, rather than added on, a clock/calendar, battery backup, graphics, and shielding for RFI and EMI.

The CRT display is unlike any other available microcomputer system. It has the ability to handle full raster-style graphics, underlining, super- and subscripts, and equations with Greek letters. In fact, the screen allows you to do anything that you can do on paper.

Software Functionality. The Attache is designed to operate with a standard configuration of 64K bytes of RAM. Handling of the memory, I/O ports, and disk system is the responsibility of the aforementioned Am9517A direct memory processor, which greatly increases system throughput.

To provide compatibility with other Z80-based systems, the Attache employs Digital Research's CP/M operating system, optimized to take advantage of the machine's features and provide a simple user interface.

Working in concert with CP/M are a number of application and utility packages. These include Micropro's WordStar 3.0; Valet, a specialized communications package utility; Microsoft's BASIC-80; and Charton, a graphic plotting package for the generation of line, bar, or pie graphs on the screen, or for output to an external printer such as the optional Epson MX-80 dot-matrix printer.

Even though most of the supplied packages are standard, Valet and Charton are unique to the Attache. The Valet communication package greatly extends the use of the machine by permitting it to interact with another computer, such as in a time-sharing system.

In operation, Valet allows you to develop a report using WordStar or Charton (or both, for that matter), and either send data to another system or download necessary information without disrupting the operation of the primary program.

Valet uses the interrupt structure of the machine to save the status of the primary program on a user stack, thus releasing the hardware stack for use by Valet. Pointers are maintained to provide entry to the primary program. By using interrupts and multiple stacks, it's possible to flip back and forth between a program and Valet's processes, giving the impression of multitasking and concurrency of operation.

Evaluation. The Attache evaluated was a basic unit without any add-on options. We did, however, have the use of a 12-in. monitor, which was connected via an RCA-type video jack. The flip-down keyboard connects to the system via an RJ11 phone plug and can be used totally detached or, if desired, hinge-connected to the system case. We found that both configurations worked well.

The keyboard's top row has special function keys that are activated by using a combination of escape (ESC) and control sequences. In WordStar for example, you can perform block moves, print, or set WordStar HELP levels all at the touch of a single key.

In addition, you can set-up key sequences to be used in communication with Valet or other modem control packages. The keyboard also offers audible feedback and responds exactly like an IBM Selectric.

In operation, we found that we could type text at 60 wpm without losing characters or causing typos due to slow keyboard response.

Although the keyboard is important, the display may be of more importance since it serves as the window into the system's operation. The 5-in. green-phosphor screen works well, even when creating full text pages and displaying WordStar menus. The display quality is equal to that of CRTs with bandwidths of 15 MHz.

Since the display is mapped directly into user memory and a paging technique is used to "paint" a picture on the display, video response is very rapid. The Am9517A handles the display and memory, which gives a four-fold increase in display speed over any—and we stress any—other system, including nonportables.

The display supports true full-dot graphics with a resolution of 240 by 320 dots (76,800 points). Since the resolution is so great and the screen response is at DMA (direct memory access) speeds, you can quickly draw figures either free-hand or have displays created using calculations from BASIC or Charton.

The Attache can perform three-dimension transforms, show two-dimension representations with absolute perspective of image, and page figures in and out. In addition, we found that you can set up a graphics image and scroll characters around or through it.

For a speed test, we used our 10 GOSUB 10 BASIC program, which when executed, causes everything to be pushed on to the stack until you run out of memory. The response is an out-of-memory error. The time required to obtain this condition was insignificant since an error response was incurred immediately upon running the program on the computer.

User Comments. For the disk subsystem, we liked the quick response—CP/M took only seconds to sign on. Although we were unable to verify it, the

Otrona designers have apparently created a CP/M BIOS (Basic Input/Output System) that doesn't need to be loaded into memory and then executed, or they have managed to more than quadruple the disk data rate.

We found that data could be written to and read from disk without a lengthy wait. We were able to enter other commands, during a SAVE or LOAD, and have them executed almost as quickly as they were entered.

Because the hardware is designed to operate in environments that may not be optimum, the Attache uses a switching power supply with full brown-out protection and a 2-second margin for power loss. This is sufficient for issuing a QUICK-SAVE command or even plugging the line cord back in if it is accidentally kicked out.

We checked with the local power company (California Edison) and found that most outages last less than 2 seconds. These interruptions are usually due to automatic switching equipment bringing major power sources on- or off-line and creating momentary interruptions on the power grid. Therefore, the 2-second margin used in the Attache should be sufficient to handle most power problems.

The Attache isn't restricted to using the software supplied since it can use any CP/M-compatible product available. Furthermore, the UCSD p-system, which is a unique collection of software systems, ranging from Pascal to Fortran, is available for the Attache, as are the necessary p-code interpreters.

As exciting as the machine is from a hardware and software point of view, be aware that it's designed for portable operation. If you need a development system, don't buy the Attache. But if you're looking for a multi-purpose system that travels well, definitely consider it. Don't be deterred by the \$3995 price tag. The Attache is a high-quality machine, with ruggedness and reliability its main features. The computing power just happens to be there too.

What we didn't like about the Attache was the lack of an integrated modem. We felt that since the machine is portable and designed to operate with a remote system, Otrona should offer an add-on modem as an option. The Valet software ideally supports most modem functions and could be used to set up interactive remote communications.

Our minor gripes aside, the Attache is ideally suited for serious portable operation as well as desktop use. It's powerful, versatile, has good storage capability, and the keyboard is very comfortable for the user.

According to company officials, you can expect to see more add-ons for the Attache, including an A/D, D/A board (by mid-year), a Winchester disk (speculated to be Sony's 3 1/2", 5M-byte model), and possibly a 16-bit processor.

—Carl Warren

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