

A microprocessor in every component of this price-is-no-object stereo hi-fi system.



Bang & Olufsen Beosystem 8000

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In the past, a few readers have taken me to task for doing reviews of hi-fi equipment. "After all," said one reader good-naturedly, "what credentials do you have to do hi-fi reviews?"

He was right. Although my fifth year EE project at Cornell was in acoustics and I worked briefly for Alcor, an innovative speaker manufacturer in the late 50s, this hardly qualifies me as an expert reviewer of hi-fi equipment.

On the other hand, I believe I am a rather discerning listener and user. I regularly attend symphony concerts at Lincoln Center and Symphony Hall in Newark, and outdoor concerts at Waterloo Village, Delaware Water Gap, and other locations. In addition, when travelling, I always make an attempt to attend local performances of interest. For example, last week in Washington I heard the U.S. Marine Band perform at the Jefferson Memorial.

Hence, in evaluating a hi-fi component or system I look for three things: 1) realistic sound reproduction, i.e., how does the sound compare with the original? 2) User friendliness, i.e., ease of installation and use. 3) Innovative technology. Obviously, my main interest is to see the various ways in which microcomputers

and microprocessors are being used to advantage in other consumer products.

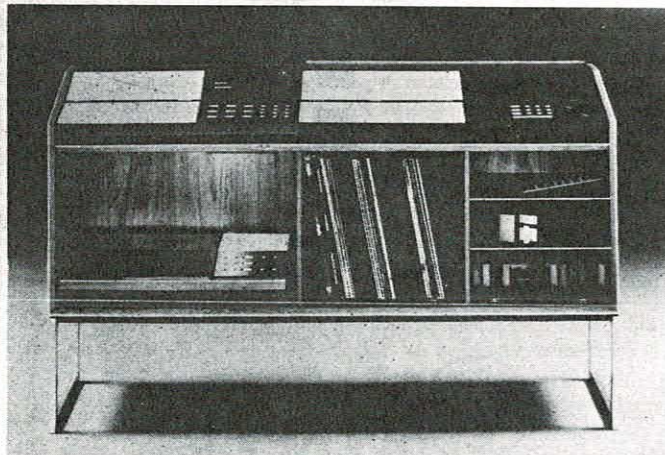
Obviously, we can't afford a great amount of space for this sort of thing in *Creative Computing*. After all, if you want hi-fi reviews, you should be reading *Stereo Review*. However, from time to time we will try to review innovative products of excellence on these pages. Hence, it was with more than passing interest that I read the letter from Fran Dym of Bang & Olufsen's public relations agency. Fran had seen my reviews of the dbx 20/20 Equalizer, KLH computer controlled speakers, Advent Sound Space control, etc., and wondered if I would be interested in reviewing the Bang & Olufsen Beocord 9000 cassette recorder. I was excited at the possibility but found it hard to imagine reviewing a component that cost nearly as much as the rest of my system combined. I called Fran and told her that, to which she replied, "Why don't we send you the entire system?"

Good Grief! This was an offer I couldn't possibly refuse.

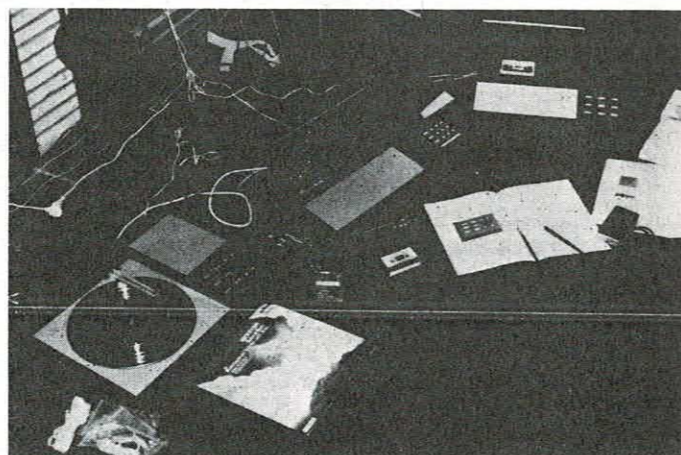
I had seen and heard the Bang & Olufsen Computer Controlled Beosystem 8000 at the last Consumer Electronics Show and was most impressed by its performance. Here, however, was the opportunity to try it in a more realistic listening environment as well as get the reaction of other people to the system.

In due time three massive cartons arrived—no stereo compact this. The receiver and cassette deck are about one-third again larger than other "standard size" stereo components. The turntable is about the same size. The components are connected to one another by means of DIN plugs on shielded cables supplied with the system. For those using just one component with other standard components, cables with RCA-type phonojacks are provided.

Initially, the instruction manuals appeared as formidable as the many controls on the components. The manual for the overall system runs 54 pages while the manuals for individual components run between 8 and 26 pages. Each component also includes a complete wiring diagram and a bright red booklet, "Safety Instructions," which deals with such things as ventilation, heat, antenna grounding, and the like.



Beosystem 8000 as pictured in Bang & Olufsen press release photo.



Beosystem 8000 as initially set up in my living room for this evaluation.

Beosystem 8000, continued...

Beomaster 8000 Receiver

The heart of the Beosystem 8000 is the Beomaster 8000 receiver. The Beomaster has plenty of power—100 watts per channel with 8-ohm speakers or 150 watts with 4-ohm speakers. Although volume levels of 20 watts are more than enough to drive the average listener from his living room, the additional power is important because of distortion. Music, particularly classical music, contains a broad spectrum of frequencies and a wide dynamic range. To reproduce the full scope of this sonic information accurately, especially at high volume levels, requires an amplifier with generous and stable power. When this power is lacking, clipping distortion occurs.

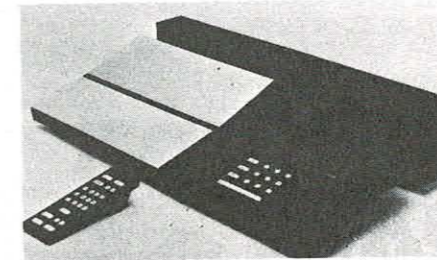
Even when this distortion is not particularly audible, it limits the dynamic response of the music, weakening the recreation of the original performance. For the normal home listening environment, or even a small auditorium, the Beomaster 8000 provides plenty of power to virtually eliminate clipping distortion.

However, it is in the tuner section where Bang & Olufsen's expertise really shines. The tuner features what is known as "digital frequency synthesizer construction." That long description means that FM tuning is accomplished with the aid of an internally generated reference frequency created by the vibration of a quartz crystal.

This frequency synthesis is then united with an innovative system of error-free automatic fine tuning. When the control is activated, the tuner will automatically lock on to the actual transmitted frequency of the FM station. This means that regardless of the drift of frequency or unstable reception conditions, the tuner will continue to follow the actual transmitted frequency with high accuracy.

The Beomaster 8000 receiver has two control sections: primary and secondary. The primary controls are located on the right front panel and, in most cases, are all that one would need for operating the system. The secondary controls are located beneath a brushed aluminum cover on the left rear of the system which raises upon pressing the word "programming." Also under this panel is a hinged access panel which conceals the input and output connectors for the receiver. For connecting to other B & O components, special 7-pin DIN sockets and cord sets are used. These carry the input signals as well as allowing communication between the microcomputer of the Beomaster with that of the turntable and cassette deck.

The expected two sockets are provided for an FM antenna: one for an antenna with 240-300 ohm impedance (included) and a coax input for an antenna with 60-



75 ohms impedance. Unfortunately, neither connector conforms to U.S. standards and if you elect to use the 75-ohm coax input, as I did, you are in for some trouble. Although the socket looks like a male F connector (U.S. receivers would provide a female F connector) in reality it is slightly smaller than an F connector and no amount of cussing will make it fit.

B & O furnishes a female connector for the FM input which connects directly to coax cable. It was not at all obvious how the cable shield was supposed to be attached nor was this mentioned in the instructions. Presumably if you get a B & O system, these are things the dealer will handle.

The speaker connectors are tricky little buggers which must be permanently attached to the end of your speaker cables.

The primary controls consist of 13 buttons and 2 wheels. All are set flush into the surface of the receiver. The free-turning wheel on the left controls volume. It can be adjusted over a range 60 increments of 1.5 dB each. An LED digital display shows the current volume setting. The display is on the right of the receiver above the control section behind dark plexiglass.

A companion control to volume, but in the secondary control area, is balance. After you have adjusted volume and balance to a preferred level, you can then press the "store" button and these levels will be stored in the memory of the microcomputer. Thereafter, each time your system is turned on it will return to the same volume and balance settings.

The twelve touch buttons in the center of the primary control panel are for selection of inputs. One selects phono, two select tape, and the other nine select nine preset FM frequencies from the tuner section.

The large tuning wheel on the right side of the control panel is used to tune FM stations. The frequency being received is shown in a large LED display above the tuning wheel. A station may be preset by simply tuning to the right station, pressing "FM Store" in the programming section and pressing one of the buttons, P1-P9.

The last button in the primary control section is used for turning the receiver off. To turn it on, you simply press the input selection that you desire.

The receiver also has the expected bass

and treble controls, loudness compensation switch, stereo/mono switch, high pass filters, tape monitor switch, and tuning mute switch. Putting some of these into service lights an appropriate indicator in the display section.

One switch, found on few other systems, allows the FM signal strength meter to show the strength of a multi-path signal. In other words, this could indicate that your FM transmission is being affected by reflected signals from high buildings, a hillside, or other barriers. To minimize the distortion caused by such reflections, you can adjust your FM antenna using this meter as a guide.

Another rarely found indicator in the display section lights up if the volume is increased to such levels that clipping distortion will occur at peaks in the music. This does not indicate that any damage is being done (except, perhaps to your ears) but that clipping distortion is occurring.

A phone jack (standard) is provided on the front of the unit for stereo headphones. In addition, a pair of RCA phone jacks are available on the left side for connecting other audio components such as an equalizer, expander, or the like. I did not try this with my KLH computer-controlled speakers although the combination should work.

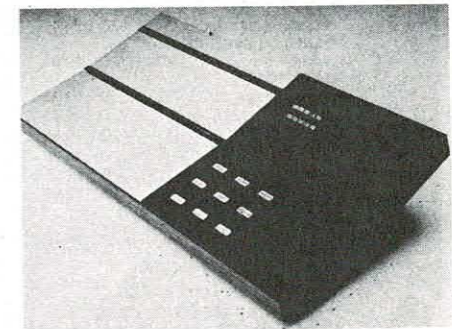
Although a tuner, cassette deck, and turntable are the most common input devices for a hi-fi system, I was disappointed that the designers did not provide for any additional input devices, such as a laser disc player, computer synthesizer, or component TV system. I feel that a receiver that is obviously designed with years of service in mind ought to anticipate that more electronic audio devices are coming down the road.

I was also surprised to find no additional auxiliary power outlets on the receiver. Unfortunately, this system requires a separate wall outlet or equivalent for each component.

Beocord 9000 Cassette Recorder

The Beocord 9000 is by far and away the most sophisticated hi-fi component which I have ever touched. The performance is nearly unbelievable, but let me take you on a guided tour of the deck and its controls before getting to that.

Upon turning on the deck, the first



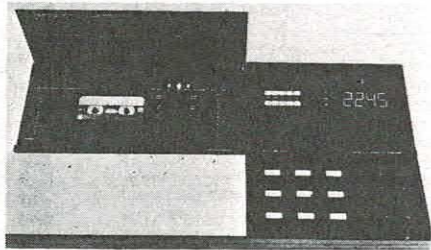
Beosystem 8000, continued...

thing you notice is a large digital LED display (normally invisible behind black smoked plexiglass). Unlike those impossible mechanical counters found on most other tape decks, the digital display always shows the elapsed minutes and seconds of tape travel regardless of operating mode (playback, record, fast forward or rewind). I found it especially convenient to work with a system in real time rather than trying to guess how much tape was left or use a not-very-accurate watch like I have done so many times in the past. This feature alone may justify the cost of the deck.

In a sense, all the controls of the deck revolve around the timer. When you place a cassette in the Beocord and press Play or Record, the deck will automatically assign the time 00:00 to the starting point of the tape (by using the fast forward or reverse controls, you can shift the starting point if you wish). From then on all times on the cassette are shown relative to this starting point.

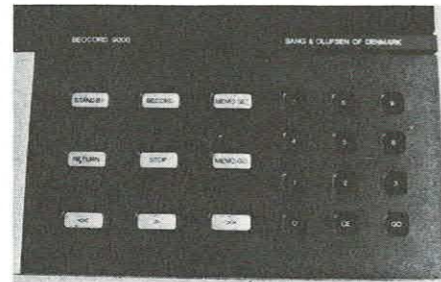
To calibrate any cassette, say a previously recorded one, to a real time index, you simply press the "Go" button on the control panel. The following operations then take place. The tape will rewind to the beginning, it will be advanced for approximately 12 seconds at playback speed while it is analyzed by the Beocord microprocessor. Then, at fast forward speed it will be advanced once again, shifted to playback speed and calibrated for an additional six seconds.

Once the calibration process is complete, the tape will automatically return to the location at which it was loaded when the cassette was inserted. Playback will then begin.



If you want playback to begin at a location well into the tape, say 10:25, you simply press 1025 on the front panel and then press Go. The tape will advance to that point and start playing.

I mentioned earlier that pressing "Go" will cause the Beocord to "analyze" the tape. What does this mean? The microprocessor runs through a short measurement process which takes into consideration all the physical characteristics of your cassette. A small data bank on this cassette is then created in the computer memory and a real time calibration takes place. Calibration is unique to each



External control panel.

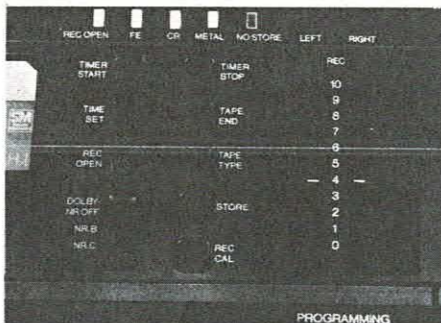
cassette and takes into account varying tape types (iron oxide, chrome, metal, etc.) and the thickness of the magnetic coating. Thus each time you insert a cassette the process begins again.

Another pair of control functions, for which I admit I found no practical use, is "Memory Set" and "Memory Go." In playback, pressing Memory Set on the control panel will place the present tape position in the Beocord memory. To return to that position at any time you simply press "Memory Go" and the Beocord will fast forward or rewind to that location and begin playback.

Much more useful was the "Return" button. Unlike Rewind which brings you to the beginning of the tape, Return causes the tape to rewind to the beginning of the last recorded segment. Thus, if you are recording from the record and get an annoying bit of static on one band, you need not return to the beginning of the side and start over. Rather, you can simply return to the beginning of the last selection. (This doesn't always work, since the Beocord is looking for four seconds or more of silence before it will stop.)

Where the deck really shines is in recording. To start a recording, you place your cassette in the deck and press "REC OPEN" in the programming section. This activates the recording circuitry and illuminates the corresponding indicator.

You then press "REC CAL." This initiates the tape calibration process. This takes approximately nine seconds during which time the Beocord will optimize its recording circuitry in relation to the bias, equalization, and sensitivity characteristics to the tape you are using. Also, an analysis of your tape distortion is made, and the electronic peak program meters



Internal control panel.

are automatically calibrated to reflect the recording ability of your specific tape.

If you wish, you can store the calibration date of up to four tape types in the Beocord memory. This means that if you use the same brand and type of tape, you do not have to use the "REC CAL" process each time you insert a new cassette.

In the record mode, the timer will tell you not only how much time has elapsed since the beginning of the tape, but also how much time remains on the cassette you are using. No matter whether you are using the elapsed time or time remaining display, a "Tape End" warning will flash approximately five minutes before the end of your tape. It will continue to slowly flash until the end of the tape.

For those who like to know what's going on inside the recorder, the Beocord allows you to display some of the calibration data on the display panel. For example, you can look at the bias on the right and left channel, equalizing, sensitivity, and distortion level. I had fun finding out that TDK tape had a lower distortion level than Audio Magnetic which, in turn, was lower than DAK tape, which, in turn, was lower than Realistic (Radio Shack) Low Noise Tape. In fact, I had one old unbranded cassette that had calibration data so far removed from the standards that the Beocord refused to accept the data in memory.

The Beocord has an 8-level peak program meter (signal strength). This provides real time measurement of the input signal strength for both left and right channels. As with most recorders, you adjust the signal so that it is mostly in the green and the loudest peaks light up the first red indicator. However, the Dolby C and HX Professional circuitry allow recording a much wider dynamic range than most other recorders are capable. The HX circuit automatically delivers a constant, signal controlled bias current to the record head regardless of the varying signal strength or frequency content. This constant bias current means that every tape type gains in signal handling and capacity without increased distortion. This was originally developed by Bang & Olufsen and is now being licensed to other manufacturers by Dolby Laboratories. Basically, the signal is evaluated after all processing (noise reduction and equalization) so the adjustment is made on the basis of what is actually going on to the tape. The constant bias means that both high level high frequency signals as well as very low level signals will all go on to the tape at the same level of tape saturation. This minimizes saturation and even self-erasure. This explanation may sound like gobble-de-gook, but the sound on the tape is unbelievable. I recorded several 45 rpm digital records and could scarcely tell the difference on playback between

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the original sound source and the tape, even on the relatively low quality Realistic tape. A listener with better hearing than I commented that the Realistic tape did not have the highs of the original recording but there was no audible difference with TDK and Maxell tapes.

These days, most high quality recorders have two or three heads. Earlier Bang & Olufsen recorders did. However, in the interest of maintaining optimum head alignment, the 8000 and 9000 series recorders went back to a single head. The owners manual spends three pages in describing the rationale for this decision. The ultimate test, of course, is in listening and in this regard I judge that it is considerably better than my current Brand X recorder with three heads. If I want written proof, I can simply go to the computer alignment paper tape which came with the recorder showing that it has +1 db response from 20 Hertz to about 15K Hertz.

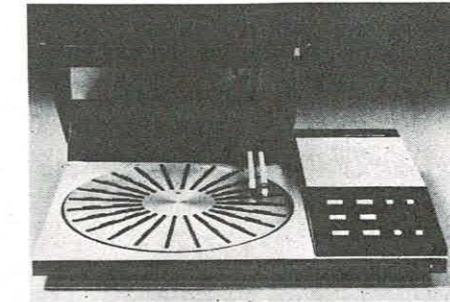
Rounding out the nifty features with the timer is the ability to set the time of day and a "Timer Start" and "Timer Stop" for making off the air recordings. These instructions are automatically communicated back to the Beomaster Receiver and the cassette deck is turned on and off automatically. If you wish to record, the receiver must already be on, however, if you wish to play back the deck will turn on the entire system. Thus, you could use it as a clock radio and wake up to a favorite tape.

I found that it took me some time to get used to the controls on the Beocord as they were quite different from a standard recorder. Initially, I was annoyed at not being able to monitor my recordings directly as I could with my existing deck. In some sense, I found the controls overly complicated for doing the "simplest" functions. On the other hand, once I got used to the "intelligence" of the deck coupled with the real time clock, I found it very much to my liking.

Beogram 8000 Turntable

Two innovations combine to make the Beogram 8000 one of the best, if not the best, turntable on the market today.

The first innovation is called "Tangential Drive." A coil with a high number of windings is mounted outside of the circular aluminum plate which supports the turntable platter. When an electric current is passed through this coil, it produces a magnetic field. The stronger the current, the stronger the magnetic field. The aluminum plate next to this coil permits the magnetic field to pass through. However, the magnetic field within the aluminum plate does not decline correspondingly and an eddy current (also called a Foucault current) is induced.



Now if a similar coil with fewer windings is placed on the other side of the aluminum plate and a current is passed through, a weaker magnetic field is created. If the currents are kept in balance, a constant magnetic field will be maintained. Because the eddy current remains constant, the aluminum plate experiences a force that causes it to move. In this way, the turntable platter is caused to rotate with exceptional stability and reliability. In effect, driving the turntable is an electronic flywheel; there is no motor in the conventional sense. And because there is no conventional motor, there is no vibration, motor noise, motor hum, mechanical connections and resonances.

This system is coupled with a micro-computer programmed to continually compare two pieces of information: an unvarying frequency generated by a quartz crystal and the frequency created by the revolutions of the platter. The computer compares both signals and if there are deviations or phase differences it instantly sends instructions to the drive system and the speed is corrected. Because the revolutions of the platter itself serve as a reference for the correct speed, adjustment remains unaffected by changing line voltage and the turntable does not have to be adjusted with the exotic strobe lights or markings on a conventional system.

The second innovation is a lateral tone arm coupled with a cantilever cartridge. The extremely low mass, lateral tone arm is precisely perpendicular to the grooves in the record just as the original cutting head. Thus, tracking distortion is completely eliminated. However, in addition, the diamond stylus tip is mounted directly on the cantilever of the cartridge and not fitted with a bushing of any sort. This means the mass of the stylus assembly is held to a minimum which, in a practical sense, means low record wear. The cantilever of the cartridge is made of single crystal sapphire. Sapphire is an exceptionally rigid substance, some 500% stiffer than commonly used aluminum. Also, the speed of sound in the single crystal sapphire is twice that of aluminum which further reduces the possibility of phase distortion being introduced by the cantilever. Furthermore, the resonant frequency of single crystal sapphire is above the audible range so the entire assembly

needs only minimal damping to achieve a flat frequency response.

Altogether, this leads to exceptionally flat response. Indeed, the computer data furnished with the cartridge indicates absolutely flat response from 20 Hertz to 18,000 Hertz on both channels.

Summing Up

In describing the Beosystem 8000, it is difficult to avoid the superlatives. Concert hall realism? Absolutely. Hum, hiss, and rumble? Virtually none. Off the air sensitivity and selectivity? Excellent. Visual appearance? Contemporary, refined and unobtrusive. Ease of use? Child's play on the receiver and turntable although it takes some getting used to for the cassette deck. Price? If you have to ask... (No, that's not fair, the receiver costs \$2600, cassette deck \$1800, and turntable \$895.)



For that money, the minor glitches shouldn't be there. In particular, I would like to see provision for at least two more input sources in the receiver. I would also like to see U.S. standard connectors throughout (after all, the controls and displays are in English). And frankly, I would have expected a little more from the computer controlling the whole system. As it is, the computers handle the internal functions having to do with sound reproduction superbly. However, why shouldn't the control computer in the cassette deck be able to turn on the receiver to a particular station at a certain hour. Much more complicated control capabilities are built in to even the lowest cost video tape recorders (recording eight programs over fourteen days, etc). Even a \$49.95 BSR timer unit controls up to 12 devices, each with their own on/off cycle. I would expect that level of control from an \$1800 tape deck.

Nevertheless, for music reproduction the Bang & Olufsen Beosystem 8000 is superb. If you are yearning for a system with technical sophistication, outstanding design and the highest quality, and price is no object, this may well be the system for you. □

