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**NEW! DIGITAL CINEMA PROCESSORS
FOR ANALOG SOUNDTRACKS
ON DISPLAY AT SHOWEST
(DON'T MISS THEM)**

BY

JOHN F. ALLEN

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FIRST IN DIGITAL STEREO

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NEW! DIGITAL CINEMA PROCESSORS FOR ANALOG SOUNDTRACKS ON DISPLAY AT SHOWEST

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Several new cinema sound processors offering digital processing for analog soundtracks will be shown at this year's SHOWEST 96. This marks a new departure in processing for all soundtracks and cinema sound systems. BOXOFFICE contributing writer John F. Allen explains why this is so important.

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Digital soundtracks offer a huge advantage for motion pictures. Audiences attending (the all too few) digital theatres equipped with true digital-ready playback systems can hear a presentation equal to the master recording for the film. Now the digital and analog soundtrack processing which is done in the theatre has gone one step further. The introduction of all digital cinema processors offers a new level of low distortion and low noise by keeping most, if not all, of their functions in the digital domain.

For several years, audio engineers have discussed and debated the advantages and disadvantages of digital sound recording and digital processing. The advantages are generally conceded to be cleaner sound and less noise. The disadvantages have been cost (though this is no longer the case) and the possibility of really horrible sound or no sound at all if and when digital gets into trouble. Some critics in the music recording world have simply stated that digital sound is inferior to analog for any number of reasons. I have never felt so. Quite the contrary, I have believed that what these critics

were really complaining about was caused by listening to a superior product over often deficient loudspeakers with flaws made more apparent by a cleaner source. But perhaps the biggest problem in music recording is that digital sound, without the artifacts of analog recording, is so unforgiving that close up multiple microphone techniques sound especially poor and unnatural when recorded so accurately.

When one thinks of a digital processor for motion pictures, the first thought might be of a processor dedicated to digital soundtracks and used in conjunction with an analog cinema processor. This is because up to now, with the exception of the various digital units mentioned above, the electronic portions of cinema sound systems have been entirely analog. If we are to examine the pros and cons of all digital processors, we must also scrutinize those of analog based processors. While analog cinema processors have been inexpensive (one could say even cheap as building a six channel system with discrete components would cost considerably more), the compact and comprehensive analog processors are often unstable. Not unstable in the sense that they repeatedly fail; they don't. Rather, they are known to drift and require periodic output readjustment for the sound system to stay in balance. Older processors can drift one dB between channels in a day. Newer ones are better, but still can't be completely depended upon to stay where they are set over time. Well intentioned or not, tampering can also be a problem. An all digital processor would eliminate all this as well as sound cleaner.

A digital processor for optical or magnetic analog soundtracks converts the analog signals retrieved from the film to digital, decodes the channels as required into left, center, right, surround and subwoofer as well as provides the necessary sound system equalization before reconvert everything back to analog. Fader control is typically done digitally, though the voltage controlled amplifiers (VCA's) remain analog. Digital control of the VCA's (which actually regulate the signal levels) eliminates the collection of mechanical output controls which seem to be the biggest cause of long term output level drifting.

Dolby Laboratories, Sony Cinema Products Corporation and Ultra Stereo Laboratories have recently announced the introduction of "digital" analog cinema processors. Dolby's processor is called the CP-500; Sony is offering their DCP-1000; and Ultra Stereo's processor is dubbed the DSP-60. The cost of the processors is surprising low considering their true value. If one factors in the lower maintenance costs over their life, digital processors actually end up costing less than their analog counterparts.

DEJA-VU

I must confess to a sense of deja-vu upon encountering these processors for the first time. Several years ago, I was asked to assist a manufacturer who was considering a motion

picture digital sound format. Over the course of many months, the shape of the digital processor was discussed. As they had never offered one before, I decided to design an ideal all digital processor which could handle up to four projectors plus all 35 and 70 MM analog sound formats, including Showscan, as well as several digital formats. I called this processor the DP-501. When I see the CP-500, DCP-1000 or DSP-60, it's hard to escape a sense of quiet satisfaction with their similarity to my earlier concept. The front panels contain a medium sized Liquid Crystal Display (LCD) surrounded by pushbuttons which can serve multiple functions, each shown by various menus on the screen.

The CP-500 can be outfitted with the appropriate modules to play both Dolby Stereo 70 MM formats 42 and 43 (mono and stereo surround respectively). An accessory unit has been announced which will provide for other 70 MM 6-track formats, up to four projectors and other capabilities. In addition, the CP-500 also contains its own built in real-time-analyzer (RTA) software and a microphone input; something I hadn't thought of. A unique feature of the CP-500 is the option of including Dolby's DA-20 digital processor within the processor, eliminating the need for a separate unit to play Dolby Digital films.

Ultra Stereo's DSP-60 is also said to be self-calibrating. It is presently rigged for 35 MM sound formats including two digital formats provided by external processors. Each format has a user adjustable level offset of + or - 3 dB.

The Sony DCP-1000 is comes ready for all current 35 MM analog sound formats and is equipped with four expansion slots for the addition of additional sound formats. It is programmed to interface with Sony's SDDS digital processor so that each Sony processor knows what the other is doing. In addition to SDDS, the DCP-1000 can also be used with other external digital processors.

For eight channel sound systems with 5 full range speakers behind the screen, the DCP-1000 can be programmed to play the left and right channels through the left-center and right-center speakers respectively. This would only be done in formats using three screen speakers. If a theatre used a solid masking which covered up the outboard speakers when placed in the "flat" position, this feature could be helpful. However, I would personally hope that all modern theatres would use acoustically transparent masking so that the widest stereo image could be presented at all times.

The setup procedures for these processors differ substantially. As stated, the Dolby CP-500 includes its own built in pink noise generator, microphone input, real-time-analyzer and calibration software. A password may be used to prevent unauthorized adjustments.

Sony, on the other hand, is continuing to opt for their external laptop computer based setup software introduced with the SDDS digital processors. No password is required with this approach as no adjustments can be done without the laptop, but a password function is available just the same. Ultra Stereo's DSP-60 setup controls are also password protected. Using its own built-in pink noise generator, the unit may be setup with either an optional lap-top computer interface or with the front panel's displays.

All three processors include provisions to retain the setup parameters. In the event of a module replacement, settings can quickly be restored from this memory.

DSP's

My earlier design concept was drawn in discrete form. If actually constructed this way, each function would be accomplished by a dedicated digital circuit specifically designed to do one thing. While perfectly acceptable, one would not actually build such a unit, due to the multitude of functions as well as the bother and expense of building different components for each one.

Fortunately such an approach is unnecessary due to the development of inexpensive Digital Signal Processing (DSP) chips. These handy things are multipurpose and can be programmed to perform many different tasks. You simply put them where you need them, and tell them what to do. This makes the design and construction of an economical all digital processor considerably easier. DSP's have been routinely used in sound production, as well as home and cinema digital processors for sometime. Sony's DCP-1000, Dolby's CP-500 and Ultra Stereo's DSP-60 are the first cinema processors employing DSP's for analog as well as digital soundtrack processing.

Interestingly, some of the CP-500 functions such as the optical preamplifiers and noise reduction stages remain analog but are digitally controlled. The optical preamplifier's slit loss correction and gain are controlled by a digital circuit. The Dolby level calibration adjustments can be done automatically by simply lacing up a loop of Dolby level test film and pushing a button. Thirty seconds later the noise reduction stage is self-calibrated. The A-type and SR-type noise reduction decoding stage remains analog since Dolby finds it more accurate as well as economical to do so. Both the Sony DCP-1000 and Ultra Stereo DSP-60 perform all signal processing in the digital domain.

The CP-500 looks similar enough to the CP-65. The colors are the same. There are a group of format buttons and a large fader knob on the front panel. Anyone familiar with previous Dolby processors will feel right at home with this one. Inside and on the back, however, most everything is new, including the connections. Gone are the convenient

barrier strips. These new processors are designed to conform to Europe's new strict limits on Radio Frequency Interference (RFI) emissions and sensitivity. All wiring connections are now done with computer style "DB" connectors. The CP-500 uses a slightly different arrangement for their output connections. In addition, the CP-500 provides an optional crossover module for bi-amplified sound systems.

Sony's front panel looks similar in some respects to their SDDS unit and includes eight programmable preset or format selectors as well as a cursor control for navigating the front panel display. Wiring connections to the DCP-1000 are also done with computer style "DB" connectors.

The DSP-60 represents an all new look for Ultra Stereo. Finished in a brass color, the control layout is very straight forward. The front panel display also shows the relative signal level metering for each channel.

DIGITAL EQUALIZATION

Optical Radiation Corporation's CDS system was the first to offer digital equalization for motion picture sound systems. While a twenty-seven band 1/3 octave *analog* equalizer can be designed to insert a minimum of signal degradation, some loss in quality is generally found due the sheer amount of circuitry involved. Digital equalizers, however, perform all the equalization in the digital domain so there is virtually no impact on the quality of the sound. In addition, digital equalization adjusts only the bands desired. The signal is not passed through any unused tuning circuits. The result is noticeably cleaner sound. Each of the three digital processors described here include full digital equalization.

Also included is an analog bypass circuit which provides continuous sound in the event of a digital problem. Indeed, the CP-500 bypass circuit incorporates a totally separate power supply requiring a separate AC plug.

What all this means is that these new digital processors represent a rather pleasant surprise. Not only do they promise superior sound, less maintenance and greater stability, they also represent the kind of processors that this sound system designer (at least) would have designed for himself, and more. Though only three have been discussed here, there are other manufacturers offering digital processors as well, notably Peavey. I would urge you to see them all.

John F. Allen is the founder and president of High Performance Stereo in Newton Massachusetts. He is also the inventor of the HPS-4000™ digital-ready cinema sound system and in 1984 was the first to bring digital sound to motion picture theatres.