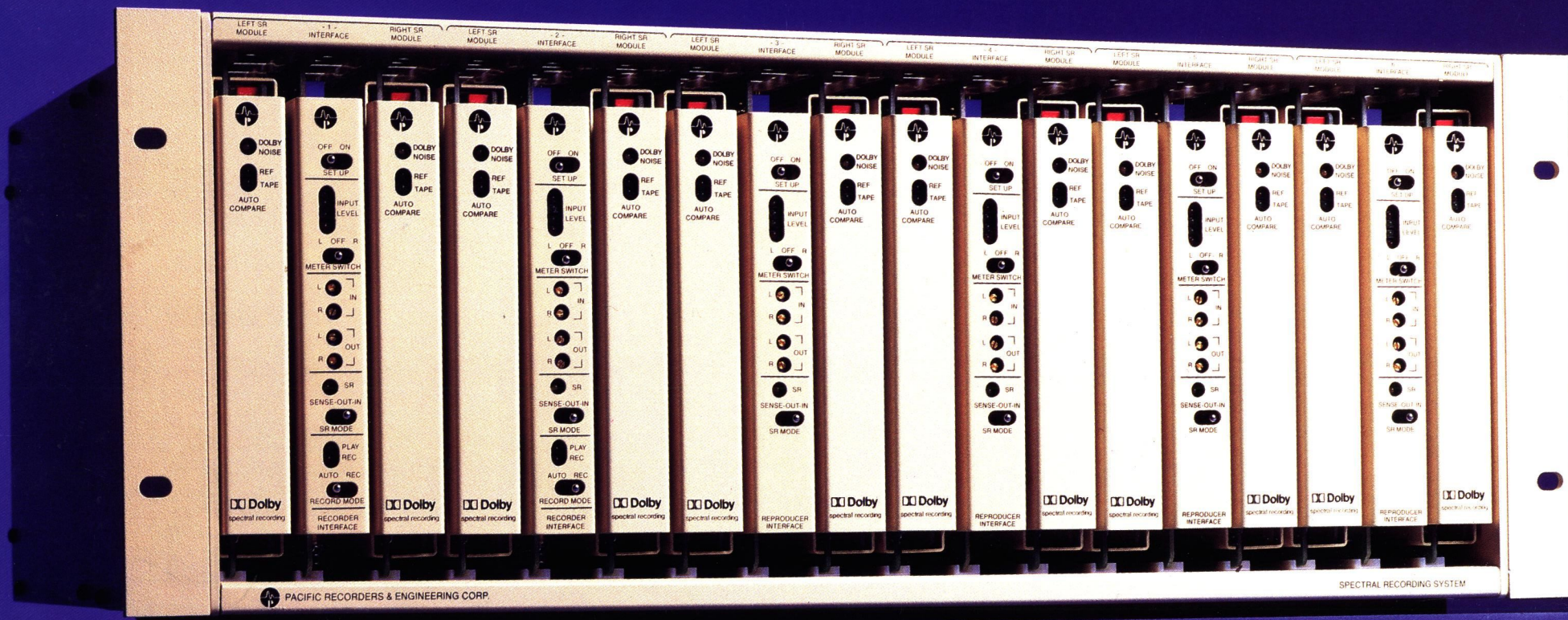


# DOLBY SPECTRAL RECORDING

## FOR BROADCAST TAPE & CARTRIDGE



## SYSTEMS INTEGRATORS FOR THE BROADCAST INDUSTRY.

Pacific Recorders & Engineering Corporation was founded in 1969 to serve Southern California's professional recording and broadcast industries with audio product design/manufacturing and facility development.

Today, operating from a 55,000 square foot facility in Carlsbad, California, PR&E has grown to become one of the world's leading manufacturers of broadcast consoles, cart machines and related peripherals and is recognized for its expertise as a broadcast and production systems integrator.

PR&E has designed and fabricated more than 1500 custom control, studio, newsroom and master control systems, and is setting the standards for exciting new products, for innovative solutions to complex facility design, and for maximum performance from both.

## FEATURES

- Audio quality combining the best performance features of digital and analog technology
- Extraordinary dynamic range and headroom without digital dither noise or quantization distortion
- Uses existing media, analog open reel tape and NAB type cartridges
- Automatic logic controlled switching of encode & decode modes and input & output monitor selection when interfaced with a professional broadcast tape or cartridge recorder
- Nominal operating levels of 0 dBu to +8 dBu, adjustable
- Extensive RFI protection for input, output, logic and power supply circuitry
- Redundant power supply capability
- Cartridge SR recognition capability
- Compact package, easily integrated into existing systems
- Very economical when compared to recording studio Spectral Recording systems

## THE PROBLEM

### Incompatible Dynamic Range

All audio systems have a limited dynamic range, or operating margin, between the noise floor and overload distortion. This range, expressed in dB, varies from one type of system to another, and from one component to another within each system. For example, the available dynamic range of a properly designed audio mixing console may exceed 104 dB, compact disc players and digital tape recorders offer 90 dB and professional stereo analog tape recorders range from 71 dB (unweighted) to 76 dB (weighted). Obviously, analog recording systems are in need of some improvement *in terms of dynamic range*.

A simple measurement of dynamic range alone does not address the issue of how recordings will sound. For example, such numbers do not address noise which appears only in the presence of signal, or the behavior of the recording system when the signal reaches the overload point. (Analog tape saturates gradually while digital recordings clip fully at the overload point, even if the overload is extremely short.)

Over the years the dynamic range of analog recordings has been improved through the development of new tape formulations, improved heads and fine tuned electronics. Comparing the performance of today's recording systems to equipment and tape in the mid 1970's shows an improvement of over 16 dB in dynamic range. Even so, the recording professional must carefully choose optimum recording levels to maximize signal-to-noise ratio while avoiding tape saturation.

## THE SOLUTION

### Must we go digital?

The development of digital recording processes has gone far to address the limits of noise and headroom, but at the expense of introducing new sonic problems. Quantization distortion, dither noise, non-linear phase response, sharply limited bandwidth and a "harshness" of sound have challenged designers of digital audio

equipment. At the same time, high capital equipment cost and the extreme complexity of professional grade equipment have conspired to keep digital recording technology beyond justification for most broadcast facilities.

What are the alternatives? Noise reduction systems for analog tape equipment have been available, in various grades of performance and cost, for a number of years. The simple broadband compander (compressor and expander) offers noise suppression only when no signal is present. When a real program is recorded, the compander is often at rest when it is needed most. When working, critical listeners can hear artifacts such as modulation of the background noise and signal, as well as limited transient performance.

Dolby A-type processing uses four bands of complimentary low-level compression and expansion and can improve recorded noise performance by 10 dB across most of the audio band and by 15 dB at very high frequencies. To further improve the overall sound of the recording, it is not enough to simply increase low level companding; a new process must conform more closely to the actual signal spectrum than is possible with a fixed-band system.

The best dynamic range improvement system would use the optimum gain for each part of the audio spectrum. Spectral Recording does just that by increasing dynamic range through a dramatic reduction in the noise floor together with a considerable increase in the operating headroom. The tape recorder's working range is dramatically improved, which provides greater freedom for creative effort with less risk of under- or over-recording.

For the listener, the effect of Dolby SR is astounding. Many audiences in critical forums have reported that, compared with digital reproduction, analog recordings using Dolby SR are more musical and more pleasant to the ear.

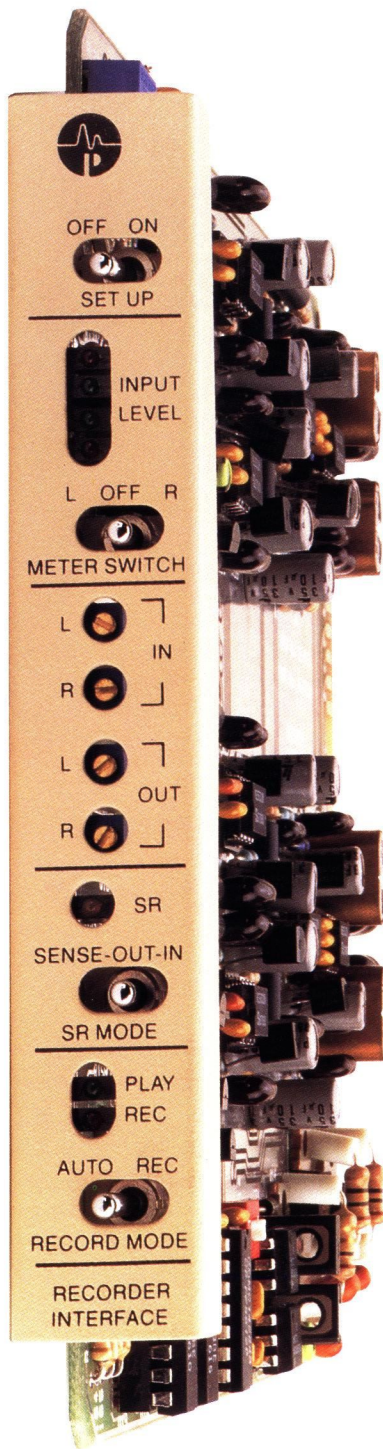
Dolby Spectral Recording for broadcast provides a new alternative to digital recording — one which many broadcasters find preferable for reasons other than cost. Built by Pacific Recorders & Engineering Corporation, dedicated to producing working solutions to broadcasting challenges.

## BROADCAST APPLICATIONS

Dolby currently manufactures several models of SR systems addressing the needs of the recording studio, video and motion picture industries. By mutual agreement, Pacific Recorders & Engineering Corporation has designed and developed an interface system specially for broadcast reel-to-reel and cartridge tape machines. The goal was to create a more compact and affordable professional system than could be assembled using hardware designed for commercial recording studios.

For example, the vertical rack space required to accommodate six stereo record and/or reproduce channels with standard Dolby 365 or 361 frames is 21 inches. Our Broadcast SR System is housed in a seven inch rack mount frame containing the regulated power supply and connectors for input, output and logic control. The frame will accommodate up to six sets of modules, each set representing a single recorder or reproducer. A set is comprised of an Interface Module and a stereo pair of SR Processing Modules.

The power supply uses a toroidal transformer equipped with an electrostatic shield to prevent coupling of common-mode line noise and RFI. The input, output and logic connectors are the same Molex series as used in our consoles; the audio wiring sequence follows the normal console conventions.



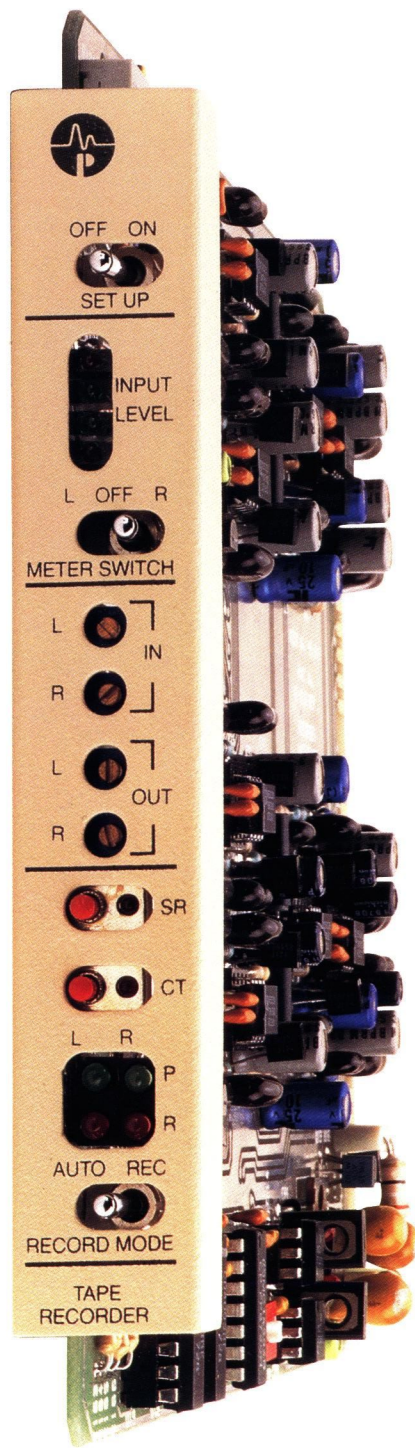
## CARTRIDGE MACHINE INTERFACE

There are two types of Cartridge Machine Interface Modules — one for use with a reproducer only, the other for a recorder/reproducer. The reproduce only module is equipped with balanced stereo inputs (to receive the outputs of the cartridge machine), stereo input and output level calibration controls, remote SR sense logic, an input level LED meter with meter switch, and a set-up switch. The recorder/reproducer interface module includes the same facilities plus record mode and record/play selector switches. Each type of interface module controls its set of SR processing modules as a stereo pair.

- **SET UP:** Engages the Dolby Noise calibration logic of the SR processing modules.
- **INPUT LEVEL:** Four LED input level calibration “meter”.
- **METER SWITCH:** Selects the meter source from the left and right channel SR processing modules.
- **TRIMPOTS:** Stereo pair of input and output level controls for aligning the system to the console and cartridge machine.
- **SR (LED):** Illuminates whenever the SR processing circuitry is engaged.
- **SR MODE:** Selects the SR operating mode of the associated SR processing modules. The IN and OUT positions manually engage and disengage the SR circuitry. The SENSE position allows the SR engagement to be remote controlled by a photo sensor installed in the cartridge deck. The logic for the remote sense mode may be internally set for default modes of “SR” or “no SR.” The interface module includes an LED current source and input buffer circuitry for a machine mounted photo detector.

The following controls and indicators are included on the record/reproduce version of the interface module:

- **PLAY/REC:** Two LEDs (play=green, record=red) to indicate the signal routing status and processing mode of the associated SR modules.
- **RECORD MODE:** Sets the operating mode of the interface and its associated SR modules. The AUTO position is used to automatically switch the SR system between the record/encode and playback/decode operating modes. The automatic switching is remote controlled by the cartridge recorder and has optoisolated logic inputs for the machine's RECORD SET and PLAY tally light voltages; the logic accommodates input tally voltages in the range of +5 to +24 Volts DC. The REC position is selected when separate sets of SR systems are used to provide simultaneous record encoding and playback decoding.



## TAPE RECORDER INTERFACE

The Tape Recorder Interface Module is designed for professional reel-to-reel tape machines which are equipped with NR (noise reduction) control connectors. The module is equipped with balanced stereo inputs to receive the outputs of the mixing console and tape machine, and balanced stereo outputs to feed the inputs of the tape machine and console. The interface module controls each SR processing module in a stereo pair (only one SR processing module is required for monaural applications). The SR engage/bypass and Check Tape functions are remote controllable with the interface module providing current limited +12 VDC tally voltages to indicate each function.

- **SET UP:** Engages the Dolby Noise logic of the SR processing modules.
- **INPUT LEVEL:** Four LED input level calibration "meter."
- **METER SWITCH:** Selects the meter source from the left and right channel SR processing modules.
- **TRIMPOTS:** Stereo pair of input and output level controls for aligning the system to the console and tape machine.
- **SR:** Button switch, with LED indicator, used to engage or bypass the SR process. The SR process may also be remotely selected by a momentary button.
- **CT (Check Tape):** Button switch, with LED indicator, is used while recording to check the decoded playback of the tape. This function is also remote controllable.
- **PLAY/REC:** Four LEDs (play+green, record+red) indicate signal routing status for each SR processing module.
- **RECORD MODE:** Sets the operating mode of the interface and its associated SR modules. The AUTO position automatically switches the SR system between encode and decode for each of the tape recorder's stereo channels. The interface module's automatic switching is remote controlled by the tape recorder

through the tape machine's NR (noise reduction) commands. The REC position is selected when separate sets of SR systems are used to provide simultaneous record encoding and playback decoding.

## SR PROCESSING MODULE

The SR Processing Module, manufactured by Dolby Laboratories, is a specialized version of the Cat. 280 module. The Cat. 280, a retrofit for the Cat. 22 Type-A noise reduction module, is equipped with a programming switch and circuitry to accommodate a variety of existing Dolby chassis frames. The SR Module used in the broadcast cartridge frame does not need the programming switch and uses the input and output amplifier circuitry contained in the interface module.

Each processing module is equipped with a unique set-up signal, called Dolby Noise, along with an automatic comparison system for rapid frequency response and level confirmation of the tape equipment. Dolby Noise is pink noise interrupted with 20 millisecond nicks every two seconds for identification. Engaging the SET UP switch on the recorder interface module will cause Dolby Noise to be fed to the recorder at 15 dB below the standard reference level. Upon playback of the signal while in the SET UP mode, the Dolby Noise is automatically alternated with the internal reference pink noise every 4 seconds and fed to the system output for monitoring. The two signals may be recognized by the presence or absence of nicks or by observing the REF and TAPE indicators on the individual SR modules.

The use of Dolby Noise and the auto-compare system provides a quick method of checking tape machine performance. Any significant frequency response error in recorded pink noise can easily be heard and a decision made about whether adjustments are necessary. The gain of the LED level meter on the interface module is also increased in the SET UP mode to facilitate observing Dolby Noise reference level.

# DIGITAL QUALITY À LA CART.

## The Sound of Line In



*Program material, spots or promotions are on the air in an instant.*

*You get performance equal to or better than 16 bit PCM linear digital audio recording.*



### DOLBY® SPECTRAL RECORDING

Spectral Recording, or SR, is a new professional mastering system yielding analog recordings with unprecedented purity of sound. Spectral Recording provides analog recording with the two key advances found in digital tape recording. The first benefit is a substantial extension of available headroom and dynamic range, the second is the practical elimination of the influence of noise and non-linearity on the reproduced sound.

The SR system delivers this superior performance because it adapts to the signal spectrum and because it consistently applies minimum processing to the signal. When combined with a professional half-track reel-to-reel or Maxtrax® format cartridge tape machine, SR provides performance equal to or better than 16-bit linear PCM digital audio recording. The performance

with NAB format cartridge equipment is also outstanding.

The Dolby Spectral Recording process addresses the classical limitations of analog magnetic recording. In terms of dynamic range and distortion, SR gives you digital quality audio performance, while it retains the sonic advantages of analog recording including linear phase response and wider bandwidth.

Spectral Recording encodes the analog signal prior to recording and decodes it upon playback. The SR process works by optimizing the modulation capabilities of the magnetic recording medium and by applying corrective characteristics to eliminate or greatly minimize tape saturation at the extreme ends of the audio spectrum.

The process is best described by the following excerpt from Dr. Dolby's paper, presented at the November 1986 AES Convention in Los Angeles:

“ The goal of the spectral recording process is to modify the various components of the incoming signal in such a way as to load an imperfect recording or transmission medium in the most rational way. Generally, high level signals at both ends of the spectrum are attenuated, whereby a better match with the overload characteristics of the medium is provided. At the same time, low level components are amplified substantially, in a highly frequency selective way. These effects are reversed in reproduction, restoring the original signal. The result is a significant reduction of distortion and noise, both in the absence and presence of signals.

“A design philosophy used in the development of the new system is that the best treatment of the signal is the least treatment. The operating goal of the encoder is to provide fixed, predetermined gains for all frequency components of the signal, with corresponding attenuations in the decoder. If a large signal component appears at a particular frequency or frequencies, then the gains should be reduced at those frequencies only, in accordance with predetermined compression laws for restoration of the signal during decoding. In other words, the compressor (encoding) should try to keep all signal components fully boosted at all times; when boosting must be cut back at a particular frequency, the effect should not be extended to low level signal components at other frequencies.”

## SPECIFICATIONS

### INPUTS:

#### From Console:

Source Impedance	600 ohms or less
Input Impedance	40K $\Omega$ , balanced
Input Level Range	0 dBu to +8 dBu

#### From Tape Deck:

Source Impedance	600 ohms or less
Input Impedance	40K $\Omega$ , balanced
Input Level Range	0 dBu to +8 dBu

### OUTPUTS:

#### To Tape Deck:

Source Impedance	80 ohms, differential
Load Impedance	600 ohms or greater, balanced
Output Level Range	0 dBu to +8 dBu

#### To Console:

Source Impedance	8 ohms, differential
Load Impedance	600 ohms or greater, balanced
Output Level Range	0 dBu to +8 dBu

### LOGIC:

#### Cartridge Deck Interface:

Record Sense	+5 to +24 VDC
Play Sense	+5 to +24 VDC
LED Current Source	+12 VDC with 560 $\Omega$ series resistor
Photo Sensor Input	CMOS input, 100K $\Omega$ pull-up to +15 VDC

#### Tape Recorder Interface:

Record Sense	Sustained contact closure, floating
SR Engage/bypass	Momentary contact closure, 1.5 mA
SR Tally Drive	+12 VDC, current limited at 100 mA
CT (check tape)	Momentary contact closure, 1.5 mA
CT Tally Drive	+12 VDC, current limited at 100 mA

### CONNECTORS:

Mating connectors and pins supplied. Audio Inputs and Outputs 6-pin female Molex.  
Logic 9-pin female Molex.

### DIMENSIONS:

7 inches high, EIA rack mount chassis 15 $\frac{3}{4}$  inches deep overall, not including mating connectors

### POWER REQUIREMENTS:

120 VAC, 50-60 Hz, 60 Watts (fully configured)

Features and specifications subject to change without notice.

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Pacific Recorders & Engineering Corporation  
2070 Las Palmas Drive  
Carlsbad, CA 92009  
(619) 438-3911 Telex: 181777  
MCI Mail: 650 285 0799 MCI UW