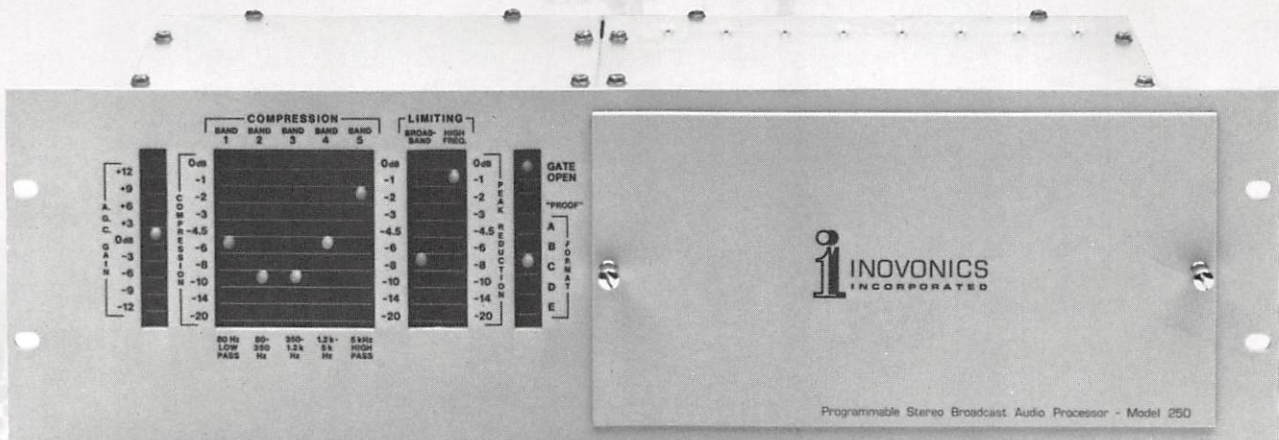


Digitally Programmable Audio Processing



Inovonics' 250 is a versatile and comprehensive stereo audio processor for AM, FM or TV broadcasting.

Digital programmability of the 250 enables the user to adapt processing parameters to alternative program sources or to suit changing station formats and listener profiles over the course of the broadcast day.

Programmability may take the form of either simple remote selection of

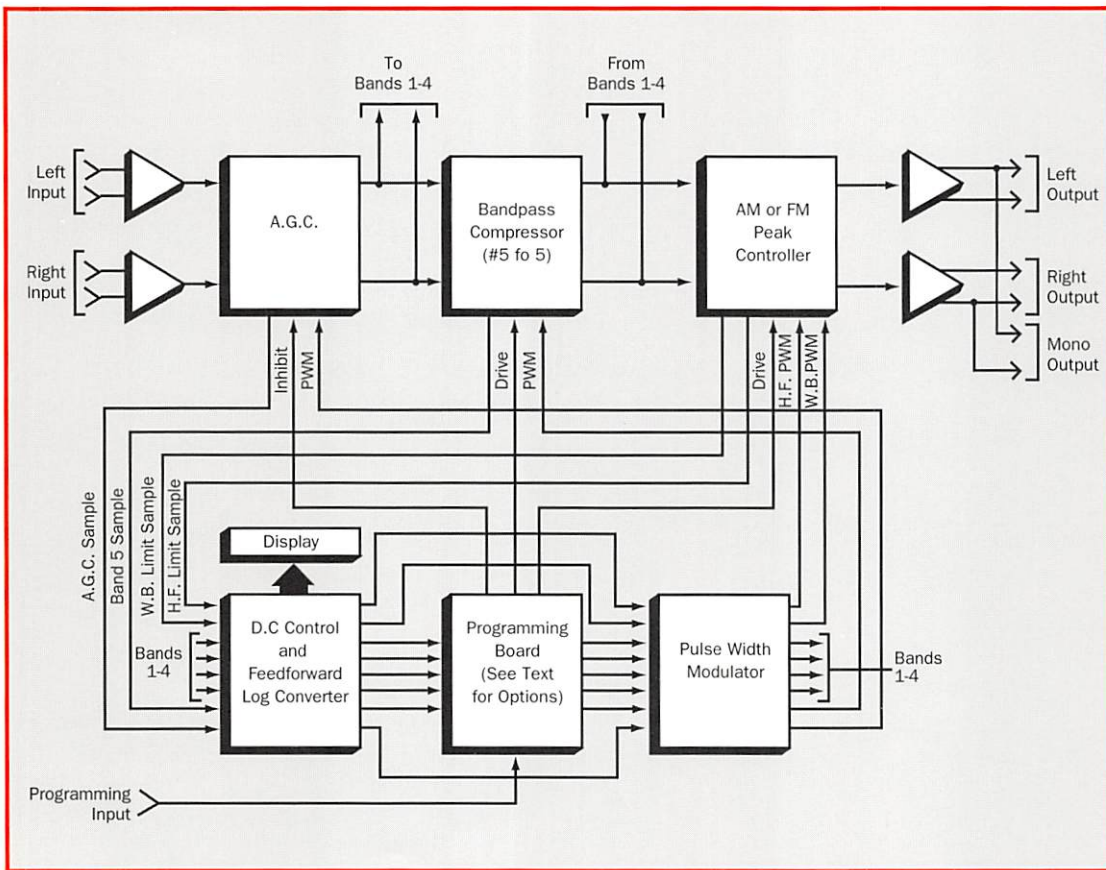
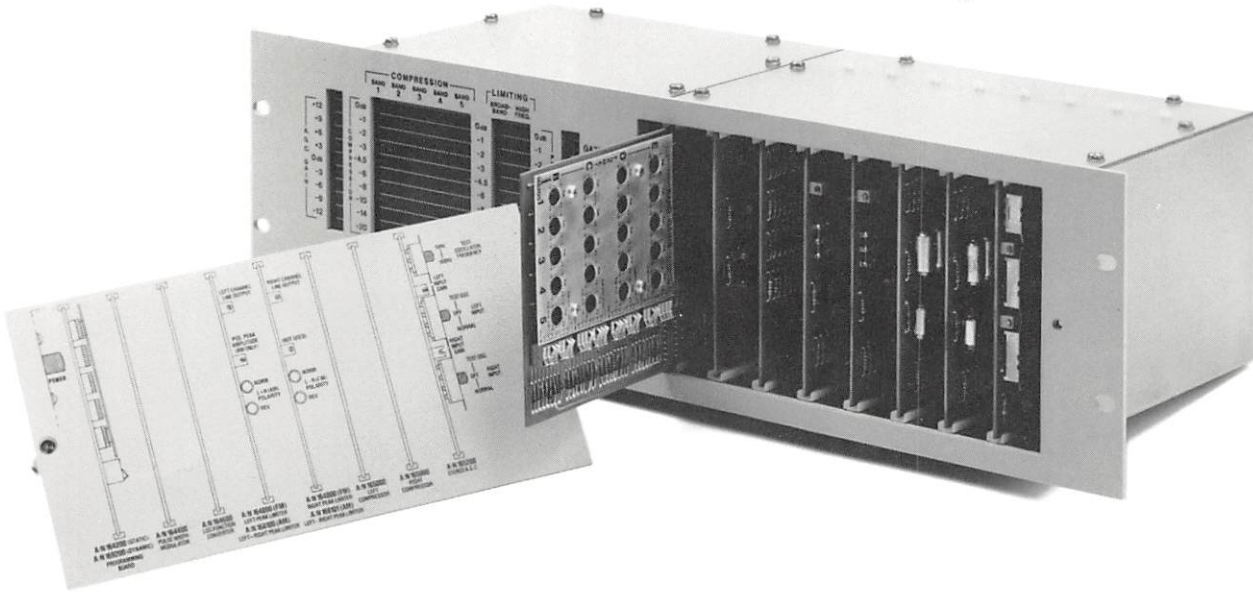
multiple manual presets, or of continuous on-line control by computer or telephone modem with the optional RS-232 serial data interface.

The 250 performs the multiple functions of slow, "gain-riding" AGC, Multiband Compression and Program Equalization, and final Peak Control conforming to FM/TV preemphasis characteristics or matrixed processing for AM stereo.

...The 250 - by Inovonics



Ultimate flexibility in a stereo audio processing system . . . full digital programmability for remote manual or computer control of all processing parameters.



Block Diagram, Inovonics 250

Technical and Philosophical Description

The traditional advantage of multiband audio processing for broadcast has been the ability to maximize carrier modulation density. While a large contingency of broadcasters still subscribe to the theory that "louder is better," a growing number find that emphasis on audio quality and, most importantly, long term listenability is a real and a critical factor in audience satisfaction and competitive ratings. While the Inovonics 250 is certainly capable of yielding very high levels of modulation, the fundamental design emphasis was to provide a simple, versatile and technically "clean" processing system to satisfy the listener demand for better broadcast sound.

GATED AGC

The audio program from a broadcast console is prone to both short- and long-term variations in level. These are generally due to a couple of basic inconsistencies relative to program level monitoring. For not only can level indicators be read and interpreted differently by individual operators, but the ever-popular VU meter responds to all-important program peak content in an uncertain and source-dependent manner.

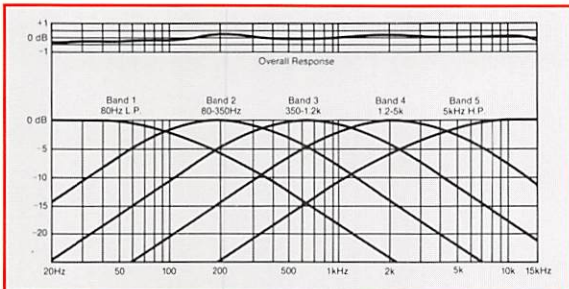
The AGC stage of the model 250 is thus given the 10-millisecond-integration response characteristic of the precise UK/EBU-standard Peak Program Meter. The actual correction rate, on the other hand, is a slow and unobtrusive 0.5dB-per-second. The net effect is comparable to careful manual gain-riding by a conscientious operator watching a PPM level meter. Stereo AGC gain is based on the higher level of the two channels with cross-correlation to prevent the stereo image from wandering.

A frequency-weighted "gating" circuit inhibits AGC action during brief program pauses. This keeps background sounds from slowly rising out of proportion. Longer interruptions in the program audio cause AGC gain to slowly return to a 0dB "resting" value. One processor programming option is to defeat the AGC altogether, as might be prudent in a classical music format.

The AGC assembly includes a 500Hz/5kHz audio test tone generator to facilitate system setup.

MULTIBAND COMPRESSION

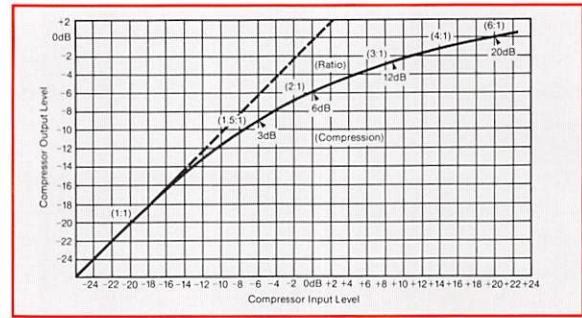
A form of "dynamic graphic equalization" is afforded by the five band Compressor section of the 250. As shown in the graph, filter skirts are a gentle 6dB/octave to prevent the unpleasant "phasing" or "swishing" effects frequently associated with elementary multiband processors.



Bandpass Compressor Filter Response

Feedforward gain control with well defined, semi-logarithmic control channel conversion yields the gentle transfer function shown in the next figure.

As graphed, the compression ratio increases with level. Since the input gain of the five-band Compressor is a programmable parameter, the user can control both the compression ratio and the overall amount of average compression. The output level from each band is individually variable for program equalization programmability as well.



Compressor Transfer Function

Compressor attack and release timing is fixed. The optimum figures for each of the five bands is determined by a simultaneous requirement for rapid action, low distortion and negligible audible effect. Both channels of compression track on a band-for-band basis for stereo image stability.

PROGRAM PEAK CONTROL

The 250 is supplied with either of two Peak Controller assemblies. One (-00 version) is for stereo FM, TV and studio production applications. The other (-01 version) is exclusively for stereo AM broadcasting. Both Peak Controllers feature feedforward gain control with a "gently abrupt" transition from a linear to the limited state.

The FM Peak Limiter is a split-band design which furnishes separate, yet interdependent control of a 50- or 75-microsecond preemphasized signal, and of a second signal composed of the difference between the preemphasized and the broadband program components. This "parallel limiting" assures that the output conforms to the frequency-selective ceiling requirement imposed by the transmission system with minimal sonic degradation.

The Stereo AM Peak Limiter provides sum and difference final limiting of the Left and Right program signals, and includes the necessary matrix and dematrix circuitry. In addition, the Inovonics 250 does not sacrifice the traditional modulation advantage of asymmetrical AM carrier modulation. A phase-follower monitors the matrixed L + R signal, and a phase "rotator" puts both the L + R and L - R signals through a simultaneous, inaudible 180-degree "roll" as required to maintain a predominance of positive-going L + R peaks. Asymmetry in the L + R channel may be adjusted for up to +130% with perfect peak symmetry in the L - R channel.

Both Peak Controllers feature safety clipping to assure instantaneous peak control without overshoot. A "floating platform" release function furnishes a quick release for occasional fast peaks, while program peaks of a repetitive nature are given a delayed, low distortion release characteristic. Programmability of Limiter input drive gives user control over signal density; from affording conservative, simple overmodulation protection to considerably more aggressive results.

PROGRAMMING OPTIONS

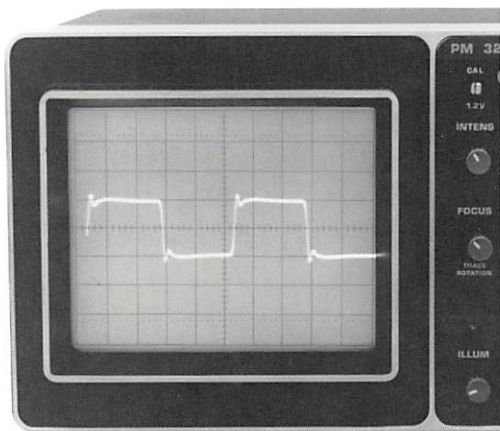
Either of two, interchangeable Programming Boards may be used with the Inovonics 250 for STATIC or DYNAMIC control.

The STATIC Programming Board, supplied as standard with the 250, incorporates a simple series of four, on-board presets for the adjustable processing parameters. A fifth, flat "default" preset and a "Proof" mode are included as well. The different presets may be set up manually, then remotely selected by a series of back-panel control line closures to ground.

The DYNAMIC Programming Board, available as an option, places all variable parameters under external computer control. An RS-232 serial data bus accepts a stream of 8-bit digital commands to alter processing on an ongoing and continuous basis. User-designated software options are easily incorporated for creative control of the Inovonics 250. Computer programs may be based on such external data as input signal spectral dynamics, station automation equipment commands, time of day, etc. An override provision could even put the 250 under the direct control of a remote terminal with dial-up access to the controlling computer. There is virtually no limit to the programming options available with the 250 under DYNAMIC control.

PWM: QUASI-DIGITAL DYNAMIC CONTROL

Pulse Width Modulation (PWM) is used throughout the Inovonics 250 for simple, predictable and colorless program signal gain control. The switching rate, analogous to the sampling rate in digital audio systems, is 100kHz; better than six times the 15kHz system cutoff frequency. Input signal aliasing is averted with relatively simple lowpass filters which do not compromise the remarkably linear phase response of the entire processing system. The 'scope-face photo shows actual 1kHz squarewave response of the 250 in "Proof." In this mode all signal circuits are active, but PWM control elements are programmed at fixed loss values to give the system overall unity gain.



MODEL 250 FEATURES

- **Feedforward Pulse Width Modulation (PWM)** utilized exclusively for colorless, quasi-digital program signal control.
- **Unique "soft knee"** compression function yields smooth, "program-adaptive" transfer ratios.
- **Peak Controller "platform"** release characteristic allows maximum limiting with negligible processing artifacts.

MODEL 250 SPECIFICATIONS

Tabulated below are those performance specifications which are not given in the text of the discussion or implied in accompanying graphs and photos. Data were taken with the Processor adjusted for 10dB Compression and 10dB Limiting of typical program material.

- **Frequency Response** (below Compressor and Limiter thresholds); ± 0.5 dB, 10Hz - 15kHz.
- **Noise**: better than 70dB below 100% modulation, 10Hz - 20kHz.
- **Distortion**: $< 0.5\%$ THD, 20Hz - 15kHz; $< 0.2\%$ THD, 50Hz - 10kHz.
- **Inputs** (LEFT and RIGHT): active-balanced, bridging; accept "zero-level" program inputs between -20 dBu and $+10$ dBu.
- **Outputs** (LEFT, RIGHT and MONO): active-balanced, 600-ohm resistive source; provide 100%-modulation levels adjustable between 0dBm and $+15$ dBm.
- **Power**: 115/230VAC (internally strappable) $\pm 10\%$, 50/60Hz; 20W.
- **Physical**: 5" x 19" x 8" (3U); 11 lbs. (shipping).



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