

## Control Methods

**Control loop** Patented adaptive control method with cross-coupling compensation, frequency response matrix updating and coherence smoothing to accurately and quickly compensate for non-linear and time varying changes in the dynamic load. Control channel response vector controlled to the reference spectral density matrix. The control methods support a wide range of acoustic reverberation times.

## Control Performance

**Dynamic range** Greater than 80 dB.  
**Output signals** Up to 16 outputs of pure Gaussian noise with smoothing filters and choice of Kaiser-Bessel or Half-Sine windows. Drive signals have zero coherence and random phase and may be further split via an external cross-over network (not supplied) to drive multiple bandwidth acoustic exciters.  
**Equalization accuracy** Control to within  $\pm 1.0$  dB for a flat reference spectrum with 120 DOF and 90% statistical confidence (accuracy may be limited by exciter system and instrumentation).  
**Loop time** Less than 1.2 seconds typical for 4 controls, 4 new frames per loop, 10kHz BW, 1600 lines and 120 DOF (dependent on host model).

## Reference SDM

**Definition** For each control channel, easily defined by a combination of up to 100 frequency breakpoints (frequency, PSD value) and slopes (dB/octave). The same reference can be copied into each diagonal element of the Spectral Density Matrix (SDM). The phase & coherence between references may be set to zero (random phase between control channels) or arbitrary values may be specified.

**Units** Use EU label for common units of Pascal<sup>2</sup>/Hz or psi<sup>2</sup>/Hz for acoustic spectra or enter directly in dB SPL (displays OASPL). You may also use g<sup>2</sup>/Hz or (m/s<sup>2</sup>)<sup>2</sup>/Hz for acceleration. Uses V<sup>2</sup>/Hz for drives.  
**Alarm and abort limits** Independent positive and negative alarm and abort tolerances for each breakpoint.

**Frequency ranges** DC to 50, 80, 100, 200, 400, 500, 800, 1K, 2K, 4K, 5K, 10K and 20K Hz.

**Frequency resolution** 1/n octave spacing (select n from 1 to 24). Control loop uses FFT spacing of 100, 200, 400, 800, 1600 or 3200 lines depending on the specified lowest 1/n octave frequency.

**Rescale reference** User may enter a new overall RMS level; reference table values are rescaled to achieve the new level.

## Control Parameters

**Multiple channel control** The maximum number of control channels is equal to the number of installed drive channels (max 16).  
**Limit profiles** Supports drive limiting based on limit profiles entered via features described under Reference Spectrum. Overrides control, if needed.

**Test duration** User defined up to 999:59:59 (h:m:s).  
**Degrees of freedom** User defined from 8 to 10,000.  
**Output level control** Automatic or manual (step up/down/full level).

## Control Strategy

**Pre-stored [Z(f)]** Select equalized impedance from previous tests.  
**Adaptive gain** Z(f) update rate; selectable from 0.0 to 1.0.  
**Singularity threshold** Specifies when pseudo-inversion is used for Z(f).  
**Equalization method** Adaptive inverse frequency response matrix. May specify frequency range for PSD level control.  
**Characterization** Random signals with flat power spectral density.

## Startup Parameters

**Equalization start level** Selectable from -30 dB to 0.0 dB.  
**Initial test level** Selectable from equalization level to 0.0 dB.  
**Time at initial level** Off or timed in seconds or loops (0 to 10,000).  
**Level increment** 0.1 to 10 dB.

## Safety Features

**Loop check drive** Selectable maximum; 10 to 3300 mV RMS.  
**Alarm/Abort RMS** RMS limit in EU or dB with choice of DOF.  
**Alarm/Abort FFT lines** Number or percent of FFT lines or number of 1/n octave bands within specified range.  
**Control signal loss** Automatic detection.  
**Manual abort** Graphical and keyboard abort buttons.  
**Startup/shutdown rates** Independent selections; 0.1 to 50 dB/sec.  
**Acoustic limits** Separate limits for your acoustic exciters.

## Test Automation

**Mode of operation** User (manual) interaction during a test or automatic "hands-free" operation.  
**Microphone calibration** Uses analyzer mode to calculate channel sensitivities for selected microphones.  
**Level scheduling** User defined levels, time at level, transition time to reach the level and number of cycles.

## Channel Setup

**Channel type** Control, auxiliary (measurement) or limit.  
**Transducers** Microphone or accelerometer (for auxiliary).  
**Coupling** Select AC, DC or ICP with 24V supply.  
**Sensitivity** 0.000001 to 1,000,000 mV/(Units).  
**Loop check** Select as enabled or disabled (each channel).  
**Import sensor table** Import from ASCII spreadsheet file or other app.  
**Weighting** A, C or no acoustic weighting.

## On-Line Displays

**Simultaneous displays** Up to 12 windows, each with up to 4 grids.  
**Waveforms per grid** Up to 4 (up to 192 on 48 grids).  
**Auxiliary monitor** Optional second monitor for test displays.

## On-Line Analysis

**SDM functions** Reference, control and drive with magnitude, phase and coherence. Z(f) with mag. and phase.  
**PSD functions** Error, monitor, limit and auxiliary measurements.  
**MIMO H(f)** True MIMO [H(f)] magnitude and phase.  
**Spectra averaging** Auxiliary measurements processed with linear or exponential averaging separate from control loop.  
**Cursors** X and Y value readout, peak search, trace tagging and multi-window locked positioning.  
**Scaling** X: linear, log or log-1/n for 1/n octave display. Y: linear, log or dB (ref) for acoustic displays. Control, reference, monitor, auxiliary, error and limit PSD may be displayed with FFT or 1/n octave spacing. Drive, Z(f), H(f) & coherence only FFT spacing.

## Analyzer Mode Acquisition

**Functions acquired** Spectra (PSD) acquired in non-control mode. Also used for microphone calibration.  
**Averaging** Select linear or exponential average and the desired DOF with 1/n octave or FFT spacing.

## Host Data Storage & Review

**Setup & format** Automatic timed (any level) or timed at full level or manual mode. Binary files of narrow-band data converted to UFF or Matlab formats.  
**Playback** Scan forward or backward through test data file.  
**Test overlay** Select files from multiple tests for overlay.  
**Annotation** Test name, test time & level for each record.

## Documentation

**Test summary** Documented post-test summary; easily printed or incorporated into documents using standard word processing software.  
**Message log** Text file records all system status messages that were displayed during the test.  
**Batch plots** Automatic plot generation at test completion. Plot modes for sending all displays to the printer with single or multiple grids per page.

## Throughput Disk (TPD)

**General description** Supports 1-6 drives for storing all time domain data to disk during a test. Data may be replayed to recreate spectral test displays or replayed via Signal Analysis. See separate TPD data sheet.



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