

Control Methods

Control loop Patented adaptive control with cross-coupling compensation, frequency response matrix updating and coherence smoothing to accurately and quickly compensate for non-linear or time varying changes in the dynamic load. Control response vector is controlled to user specified amplitude and relative phase profiles. Square control method is standard.

Advanced features See separate sheet for optional methods including rectangular control, I/O matrix transformations and multiple variable control.

Outputs / Inputs

Output channels 2 to 16. Consult the factory if more are needed.
Input channels 6 to 96 (depends on outputs and chassis type).

Control Performance

Dynamic range Up to 90 dB with .05 dB level step control over the full amplitude range. Amplitude adjustments are ramped between set-points.

Output Analog quality digital sine generation using a double precision integrated phase algorithm for low distortion and smooth relative phase control.

Level accuracy Control to within ± 2 dB for 1 oct/min sweep through a 150 Hz resonance of a linear system with a Q of 50 using 4 control channels, each with an internal 80% proportional tracking filter. Control accuracy applies to both limit and control channels.

Phase accuracy Control to within ± 2 degrees with a sweep rate of 1 oct/min wire-to-wire using 4 control channels, each with an internal 80% proportional tracking filter. Level and phase accuracy may be limited by exciter systems and instrumentation.

Sweep resolution $\pm 0.5\%$ of the drive frequency.

Loop Time The greater of either 5 ms or one half-cycle of the fundamental amplitude with no more than 0.5 ms increase for each additional control channel.

Compression rate Up to 3500 dB/sec with unconditionally stable feedback control loop.

Harmonic distortion Less than -80 dB at full output.

Reference Spectra

Definition Up to 100 frequency segments with amplitude and relative phase to other control channels.

Segment types Constant displacement, velocity & acceleration and straight line acceleration – linear or logarithmic.

Phase adjustment From -180 to +180 degrees.

Crossover frequencies Automatically calculated to avoid discontinuities.

Alarm and abort limits Independent positive and negative alarm and abort margins for both amplitude and phase.

Sweep range User defined between 0.5 Hz and 2000 Hz.

Sweep resolution User defined from 200 to 2000 points per sweep.

Dynamic limits Range (dB) and maximum/minimum for acceleration, velocity and displacement.

Limit profiles Defined using up to 40 frequency segments with amplitude; defaults to reference spectrum.

Control Parameters

Mode of operation Manual or automatic with fixed parameters.

Measurement process Tracking filter processing for all channels in parallel.

Tracking filter types Proportional to drive frequency or fixed bandwidth.

Transducer types Control via acceleration or displacement transducer with programmable transition frequency band.

Control channels Up to the number of installed output channels for square control. May be greater than active Drives for optional rectangular control.

Limit channels Limit profiles override defined control method on spectral line by line basis to prevent over-test. May select any/all available channels for limit.

Abort channels Abort test when specified level is exceeded.

Compression 1% to 100%.

Strategy

Pre-stored [Z(f)] Import a measured Impedance matrix from MIMO Random or Identification for the initial sweep. Update factor selectable from 0.05 to 1. Selectable from 0.0 to 0.1. Allows pseudo-inverse when "deep notches" are detected in [H(f)].

Adaptive Z(f) gain Adaptive inverse frequency response matrix.

Singularity threshold Sinusoid during startup and continuously during test with swept-sine wave responses.

Equalization method

Characterization signal

Start-up Parameters

Characterization level -30 to 0 dB (relative to maximum reference). System increases drive rms until one of the control channels has an amplitude equal to or greater than specified characterization level. Charge amp sensitivities and characterization levels need to be chosen such that the control channel's response voltage, for the least responsive control channel, is at least 50 mV rms. Characterization level to 0 dB.

Initial test level 0.1 to 10 dB.

Level increment Automatic or manual (up/down/full level).

Output level control

Sweep Parameters

Sweep mode & rates Linear: 0.0001 to 300 Hz/s. Log: 0.1 to 100 oct/min.

Initial direction Sweep up or down in frequency.

Manual control Hold, resume or reverse. Manual sweep start.

Safety Features

Shaker limits Pretest verification that dynamic limits are within shaker operational limits (acceleration, velocity, displacement and voltage). Selectable maximum from 10 to 1000 mV RMS. An independent profile for each limit channel. Continuous automatic detection. Graphical and keyboard abort buttons.

Loop check drive 0.01 to 10 Vpeak.

Limit profiles Independently selectable, 0.1 to 50 dB/sec.

Control signal loss

Manual abort

Maximum drive signal

Startup/shutdown rate

Channel Setup

Channel type Control, auxiliary, limit, abort or inactive.

Sensitivity 0.01 to 100,000 mV/g or mV/(m/s²).

Channel loop check Enabled or disabled for each channel.

Channel labels Up to 45 characters for each channel.

On-Line Displays

Simultaneous displays Up to 12 windows with up to 4 grids per window.

Traces per grid Up to 4 (192 traces for 48 grids).

Auxiliary monitor Optional second monitor for test displays.

On-Line Analysis

Spectral functions Control, drive, control, error, auxiliary, monitor spectra; transfer function magnitude/phase.

Spectra averaging Linear, exponential; user-defined DOF

Cursors X and Y value readout, peak search, trace tagging, multi-window locked positioning.

Scaling of display Log or linear; auto-scaled or fixed.

Data Storage & Review

Setup & format Store every N sweeps, last sweep only or manual. Binary files, well-documented and published format, easily converted to UFF and easily transferred to PC via network or floppy disk.

Playback Scan forward/backward through multiple sweeps.

Record annotation Date/time stamp, sweep number, sweep direction.

Test summary Fully documented post-test summary, easily printed or incorporated into any document using standard word processing software.

Message log Records system messages displayed during test.

Automatic plot Automatic plot generation at test completion.

Batch plots Plot modes for sending all displays to the printer with single or multiple grids per page.



S P E C T R A L
D Y N A M I C S

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