LYNX BASIC

Vibration Control and Analysis System

SPECTRAL DYNAMICS

REVOLUTIONIZING

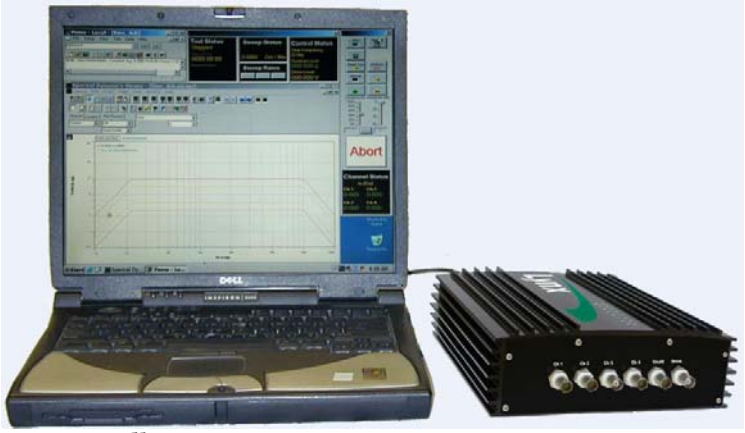
Testing with Modern Vibration Control

- **4 input channels with ICP®**
- **Powerful multiple DSP architecture**
- **Comprehensive vibration test capabilities**
  - **Random**
  - **Sine**
  - **Classical Shock with SRS displays**
- **Autoranging inputs and output attenuators for over 90 dB useable Dynamic Range**
- **Extensive Safety, Automation, and Test Configuration features**
- **Flexible data storage with display overlays of current and stored test results**
- **Powerful hardware Processor for the fastest and most accurate Control possible**
- **Fully documented Post-Test summary with and without Microsoft Office**

LYNX utilizes Spectral Dynamics' innovative *Computer-Aided Test Suite*™ architecture. This architecture takes full advantage of both advanced hardware with distributed processing using powerful 128-bit Floating Point DSP's and the PC's powerful Intel processor, and software, using the latest advancements in Microsoft Windows XP technology. Optimized for multi-tasking, and founded on industry connectivity and data interchange protocols, LYNX makes your entire test and validation process more timely and efficient.

Versatile Test Capabilities

The *Computer-Aided Test Suite*™ vibration control applications were designed to meet a wide range of environmental test requirements. The LYNX BASIC Vibration Control System combines the simplicity of operation required for production screening with the power and versatility required for R&D prototype testing.



User Friendly

LYNX BASIC's graphical user interface provides test operators with friendly operation from setup to report preparation. You can customize the interface so that it's easy to use whether you are a new user or an expert. In addition to normal Windows security, LYNX offers optional security levels, where you can protect against unauthorized changes to the setup or test, with each user having their own security permissions. The *Computer-Aided Test Suite*™ software provides incredible flexibility for display and analysis of data. Full documentation allows seamless report generation in the Windows XP environment.

Superior Control

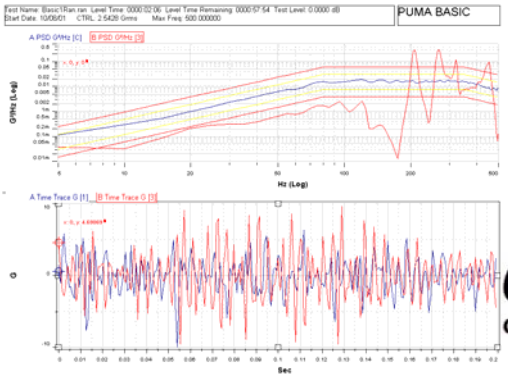
LYNX BASIC is no ordinary controller when it comes to vibration testing. To meet your most stringent test requirements, LYNX BASIC incorporates patented "adaptive" digital vibration control methods, highest quality data acquisition, and signal generation hardware designed with the latest floating point DSP technology. Control is the finest feature of LYNX providing adaptive control in all applications. In sine control, SD has the unique "true Tracking Filter" in addition to adaptive control providing a powerful contrast to a very weak FFT bin based approach with less than 20dB of filtering. In shock, LYNX will update the complete transfer function creating the output in between shock pulses unlike the competition.

Simple Upgrade Paths

LYNX BASIC 2 is only the starting point. It provides all the testing you need today with a simple software upgrade path to the most powerful software of the CATS suite. While limited to four channels the powerful hardware allows an upgrade path available from LYNX BASIC 2 to 5k or 10k Hz or all the way up to LYNX Premiere. With just a software replacement key, your LYNX BASIC can run Foundation or the most advanced Premier programs. Now that's what we call **Value**, enhancing the investment in your control system.

Built By the Experts

Spectral Dynamics introduced the first digital vibration control system in 1969. Over the next eight generations of systems, we perfected and patented industry-leading vibration control technologies. Now LYNX BASIC revolutionizes the way you test – from setup to report delivery.



LYNX BASIC Flexible Displays-2 Graph display with dual Traces on each Graph

CATS™ Computer Aided Test Suite

Hardware

Input Subsystems

Dynamic range	>92 dB
Analog-to-digital converter	24-bit
Amplitude accuracy	Within ±0.20% of value or ±0.03% of full scale
Amplitude linearity	±0.03% of full scale or ±0.2% of measured value, whichever is greater
Voltage ranges	Application dependent; 27 mV to 10V full Scale, in 3dB steps for Random and Shock, 12 mV to 10V full scale, in 1 dB steps for Sine
Overload detection	Full scale on all channels, analog and digital detection
Voltage coupling	AC or DC
ICP power	4 mA (20V maximum into open circuit)
Maximum rated input signal	±35 Volts peak
Sampling rate	102,400 samples per second
Multichannel sampling interval	Simultaneous sampling on all channels-no interval
Frequency accuracy	±5 ppm
Frequency range reduction	Digital decimation and filtering using on-board DSPs
Anti-aliasing filters	
Analog	
Type	Filter matches 64X oversampling A/D converter
Cutoff frequency	Fixed at 225 kHz
Alias attenuation	>96dB
Passband ripple	Within ±0.10 dB
Digital	
Cutoff frequency	Variable
Stopband attenuation	>96 dB at 1.56 times cutoff frequency
Passband ripple	Within ±0.15dB
Channel-to-channel match	
Amplitude (compensated)	Better than ±0.25 dB
Phase (compensated)	Better than ±1.0 degree to 2 kHz
Crosstalk	> -90 dB below full scale
Offset removal	
Type	Digitally controlled offset rejection
Accuracy (compensated)	Better then ±0.5% of full scale, for each input range
Input impedance	1 Meg Ohm shunted by <120 pf
Connector type	BNC
Connection type	Pseudo-differential, 10 Ohms to system ground, low side return

Calibration

Calibration constants	Internal digital calibration, NIST referenced; Digital calibration constants stored in nonvolatile RAM

Hardware Processor Dedicated Floating Point DSP hardware for measurement and Control

Output Subsystem

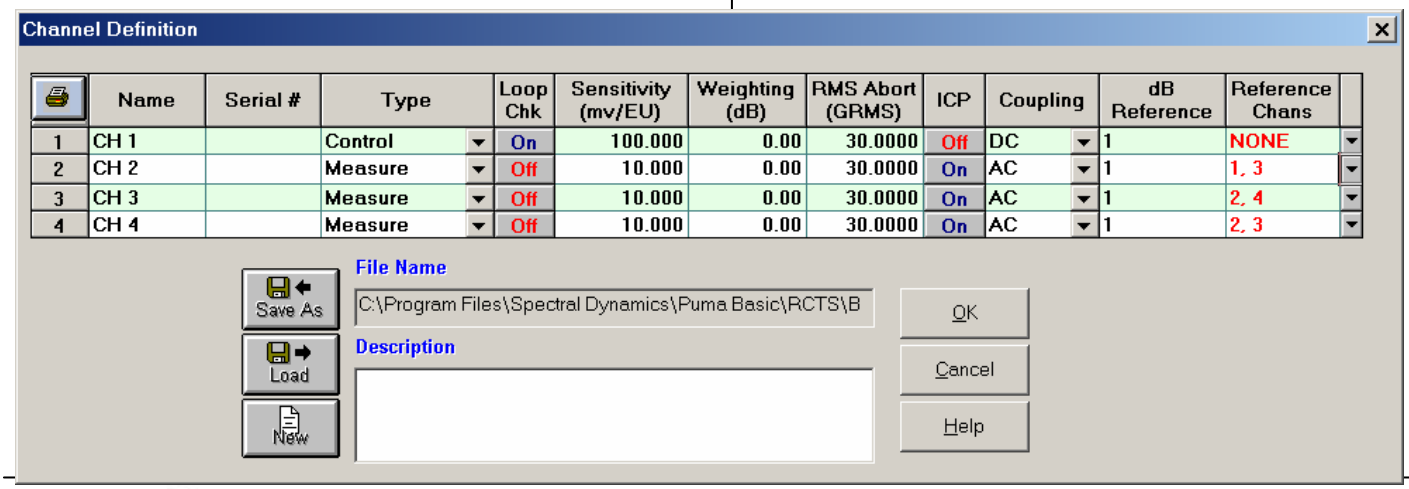
Dynamic range	>90 dB
Digital-to-analog converter	Precision 16-bit
Maximum output amplitude	± 12 Volts peak
Maximum output current	16 mA
Voltage range attenuator	Programmable 48-bit
Attenuator range	0 to -160dB
Attenuator step resolution	
0 to -90dB	0.05 dB
-90 to -110dB	0.10 dB
-110 to -135 dB	0.20 dB
Digital	
Cutoff frequency	Variable
Stopband attenuation	>96 dB at 1.58 times cutoff frequency
Passband ripple	Within ±0.07 dB
Output offset removal	
Type	Digitally controlled rejection of internal and external offsets
Accuracy	Better than ±0.5% of full scale
Output impedance	60ohms
Unattenuated output	Signal available on separate BNC connector
Unattenuated output level	1Volt peak, generated after analog smoothing filter
Output connector type	BNC
Output type	Pseudo-differential, 10 Ohms to system ground low side return
Output cable	Designed to drive up to 50 feet of shielded 50 ohm coaxial cable
Calibration	Automatic Internal digital calibration, NIST referenced
Calibration constants	Digital calibration constants stored in nonvolatile RAM

General

Power	
voltage	100 to 125 Volts or 200 to 240 Volts
Frequency	50 or 60 Hz
Typical power usage	150 watts
Temperature (operating)	50 deg F to 104 deg F (10 deg C to 40 deg C)
Temperature (non-operating)	-13 deg F to 140 deg F (-25 deg C to 60 deg C)
Humidity	20% to 80% non-condensing

Personal Computer (optional)

Type	Intel Pentium
Operating system	MS Windows XP
CPU MHz	2 GHz and higher
Memory	512 MB RAM
Hard disk	40 GB
Floppy disk	1.44 Mbytes 3.5 Inch diskette
CD ROM	Variable speed drive
Color monitor	1280 x 1024 resolution required
Networking	Ethernet, 100BaseT connector standard
Ports	Parallel. Serial
Maximum thermal gradient	15 deg F (8.3 deg C) per hour



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RANDOM CONTROL

Control Methods

Control method	Patented adaptive control algorithm with separate controls loops dedicated to controlling the shape of the drive spectrum and overall RMS level optimizes both control speed and stability
Out-of-Band Noise Rejection	Digital Brick wall filter on each channel after the analog Aliasing filter and the A/D converter

Input/Output

Input channels	4 (four) Independent Channels
Input dynamic range	>140dB with auto-ranging
Output Channels	1 (one)
COLA Output	1 (one)
Output dynamic range	>90dB

Control Performance

Dynamic range	Up to 90 dB
Output	Pure Gaussian noise
Equalization accuracy	Control to within ± 1 dB for a flat reference spectrum with 120 DOF 90% statistical confidence
Loop time	With 4 control channels, 4 new data frames per loop, 2000 Hz, 200 lines 120 DOF, less than 0.5 seconds
Re-equalization rate	For an instantaneous change of 6 dB in all control spectrum lines, the spectrum RMS is re-equalized to within ±1 dB within 8 control loops, for a flat reference with 4 control channels, 120 DOF

Reference Spectrum

Definition	Easily defined by a combination of up to 500 amplitude/frequency breakpoints, (PSD value/frequency value) and slopes (dB/octave values)
Spectral alarm/abort limits	Independent positive and negative alarm and abort tolerances for each breakpoint
Frequency range (DC to)	50, 100, 200, 500,1000, 2000 or optionally 5 or 10k Hz
Frequency resolution	100, 200, 400, and 800, options to 1600
Units	g-in/s-in: g-m/s-mm; m/s^2-m/s-mm

Control Parameters

Number of control channels	1 to 4
Multichannel control strategy	(Optional) Average, maximum, minimum; user-defined weighting for each control channel
Mode of operation	Manual, automatic, automatic only
Test duration	User-defined, maximum 9999:59:59 (hhhh:mm:ss)
Degrees of freedom	User-defined. Minimum 8, maximum 1000
Output level control	Automatic, Manual

Startup Parameters

Initial test level	User-selectable; -80 to 0 dB
Time at initial level	User-defined number of loops
Level increment	1 to 20 dB
Pre-stored drive startup	User-selectable (No/Yes/Yes with verify before start)

Test Automation Features

Level scheduling	Up to 500 test levels; each level with programmable time at level, time between levels, abort/ignore action
Security	Selectable levels of Security per User (Optional) Provides User Name and Password plus access to 16 separate functions
RCI	16 line Remote Communications Interface (Optional) Provides High and Low action, lines for Off, Abort, Start, Stop, Full Level and Resume; Segment Name and message lines included

Safety Features

Shaker limits	Pretest verification that spectrum dynamic limits are within shaker operational limits (acceleration, velocity displacement and voltage)
Loop check max. drive	User-selectable, 0 to 5000 mV RMS
Alarm/Abort RMS	RMS acceleration limit in dB or Absolute units
Alarm/Abort spectral lines	Number of lines, or percent of lines within user-specified range
Channel RMS abort	Aborts test if any channel RMS threshold exceeded
Control signal loss	Automatic detection with smooth drive shutdown
Manual abort	Graphical and keyboard abort buttons
External kill-switch	Rack or desktop mountable external abort circuit with programmed shutdown (option)
Drive signal clipping	2.5 to 6 sigma
Startup/shutdown rates	Independently selectable 1 to 50 dB/sec

Channel Setup

Channel type	Control, measurement, inactive
Sensitivity	0.001 to 9,999 mV/g or mV/(m/s^2)
Transducer Power	Constant Current source On or Off
Coupling	AC or DC
Channel loop check	Enabled, disabled
Channel label	Up to 20 characters for each channel
Transducer serial number	Up to 10 characters for each channel
Control channel weighting	Individuality defined, 20 to 6 dB
RMS abort	Individually defined, 0 to 999 grms or (m/s^2)rms
T Reference	Channels to use for Transmissibility reference

On-Line Status Monitors

Test status	Elapsed and remaining test time
Level status	Schedule level number, elapsed and remaining level time
Control status	Test dB level, drive RMS level, Control Level GRMS
Channel status	RMS levels for all active channels
Message log	Records all test operations, including operator commands, and reports on alarm or error conditions

On-Line Controls

Start/Abort test	Smoothly initiates or terminates test
Resume test	Restart test and complete remaining time
Store Data Set	Store on Command
Drive update	Update of drive spectrum on or off
Level	Step up or step down
Pause	Lower drive level to -90 dB, hold until Resume
Test Mode	Manual or Automatic

On-line Analysis

Real-time displays	Spectra or time histories for all available channels may be simultaneously displayed during the test
Spectra analyzed	PSD, Auto-spectrum, Error-spectrum, Transmissibility
Averaging control	User-selectable; DOF exponential or linear averaging

Display Control:

Number of Graphs	Selectable: 1, 2 or 4
Display Parameters	Graph Color Properties, Plot Colors, Cursor type
Display Limits	User entered X, Y Min and Max or Autoscale
Axis Type	Independent selection of Lin or Log for each axis
Current and Stored Test	Provides overlay of stored vs. current data

Data Storage

Setup options	Automatic storage every 1 to 10,000 seconds, save on level change, save on alarm, manual save
Playback	Automatic play of entire test data file, with adjustable display update delay; manual selection
Run message log	Text file records all system status messages displayed during test run

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

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SINE CONTROL

Control Methods

Control loop	True analog-quality sine sweep with a double precision integrated phase algorithm for low distortion

Input/Output

Input Channels	4 (Four) Independent Channels
Input Dynamic Range	> 120 dB with Auto-Ranging
Output Channels	1 (One) Controlled Output
Unattenuated Output	1 (One) COLA: fixed amplitude Sine at test frequency
Output Dynamic Range	>90 dB

Control Performance

Dynamic range	Greater than 80 dB with 0.05 dB level step control over the full range
Output signal	Analog-quality digital sine generation, using a double precision integrated phase algorithm for low distortion
Level accuracy	Control to within ± 1 dB at a sweep rate of1 oct/min through a 600 Hz resonance of a linear system with a Q of 70 with an internal 20% proportional tracking filter Sweep frequency resolution±0.5% of the drive frequency
Loop time	Less than 5 msec for single channel control
Compression rate	Up to 3,500 dB/sec with unconditionally stable feedback control loop
Harmonic distortion	< -75 dB at full output

Reference Profile

Definition	Up to 500 frequency segments
Segment types	Constant displacement, velocity, acceleration, and straight line acceleration (linear or logarithmic)
Crossover frequencies	Automatically calculated to avoid segment boundary discontinuities
Alarm and abort limits	Independent positive and negative alarm and abort margins
Sweep range	User-defined sweep range from 1 to 5000Hz
Sweep resolution	User-defined resolution of 450 to 800 points per sweep
Spectrum dynamic limits	Acceleration range, maximum or minimum acceleration, maximum velocity and maximum displacement

Control Parameters

Mode of Operation	Manual, Automatic
Sweep	Up, Down, Dwell (Hold)
Manual Control	Amplitude, Compression Rate
Master Control	Abort, Start, Stop
Test duration	Maximum 99,999 sweeps or 9999:59:59 (hhhh:mm:ss); unlimited test
Measurement processing	RMS
Number of control channels	1 to 4
Multi-channel control strategy	RMS, arithmetic average, min, max
Compression	5% to 100%
Units	m/s^2 - m/s - mm; g – in/sec - in; g – m/s – mm
Startup/Shutdown Rate	1 to 99 dB/sec

Sweep Parameters

Sweep mode	Linear, logarithmic
Sweep duration	User-defined, maximum 999:59:59 (hhh:mm:ss)
Number of sweeps	0.01 to 100,000
Sweep rate-linear	0.00003 to 300 Hz/sec (0.0018 to 18,000Hz/min)
Sweep rate-logarithmic	0.1 to 800 Oct/min
Initial sweep direction	Up, down

Safety Features

Shaker limits	Pretest verification that spectrum dynamic limits are within shaker operational limits (acceleration, velocity, displacement and voltage)
Loop check max. drive	User-selectable, 0 to 5,000 mV RMS
Control signal loss	Continuous automatic detection
Manual abort	Graphical and keyboard abort buttons
Maximum drive signal	0.0001 to 12 Vpeak
Startup/shutdown rates	Independently selectable, 1 to 99 dB/sec

Channel Setup

Channel type	Control, measurement, reference, inactive
Sensitivity	0.001 to 999,999 mV/g or mV/(m/s^2)
Channel loop check	Enabled, disabled
Channel label	Up to 20 characters for each channel
Transducer serial number	Up to 10 characters for each channel
Transducer Power	Constant Current Source: On or Off
Input Coupling	AC, DC, Ground

On-Line Analysis

Display functions	Control, drive, measurement channel 1 to 4, Frequency Response Function (Magnitude)
Cursors	X and Y value readout,
Data Comparison	Display/Overlay current test and stored data file
Scaling of display	Log/Linear, auto-scaled/fixed

On-Line Status Monitors

Test Status	Elapsed and Remaining test time
Level Status	Schedule level number elapsed and remaining level time
Control Status	Test dB Level, Drive RMS Level, Control Level GRMS
Channel Status	RMS levels for all active channels
Message Log	Records all Test operations including Operator commands, and reports on Alarm or Error conditions

Data Storage

Setup options	Sweep Increment, first sweep, last sweep, timed
Playback	Scan through the entire test data file, with adjustable delay

Documentation

Test summary	Fully documented post-test summary, easily printed or incorporated into any document using standard word processing software
Run message log	Text file records all system status messages displayed during test run

Safety Features

Shaker limits	Pretest verification that spectrum dynamic limits are within shaker operational limits (acceleration, velocity, displacement and voltage)
Loop check max. drive	User-selectable, 0 to 5,000 mV RMS
Control signal loss	Continuous automatic detection
Manual abort	Graphical and keyboard abort buttons
Maximum drive signal	0.0001 to 12 V_peak
Startup/shutdown rates	Independently selectable, 1 to 99 dB/sec

On-Line Controls

Start/Abort Test	Smoothly initiates or terminates test
Resume Test	Restart test and complete remaining time
Test Mode	Manual or Automatic
Drive update	Update of Drive Spectrum On or Off
Level	Step Up or Step Down
Pause	Lower Drive level to -90dB, hold until Resume

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D Y N A M I C S

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SHOCK CONTROL

Control Methods

Control loop	Patented adaptive control algorithm with transfer function updating and coherence smoothing to accurately and quickly compensate for nonlinearities or time varying changes in the dynamic load

Input/Output

Input Channels	4 (four) independent channels
Output Channels	1 (one)

Control Performance

Dynamic range	Up to 90 dB

Pulse Definition

Types	Half-Sine, Trapezoidal; Terminal Peak Sawtooth waveform easily created from Trapezoidal definition
Pulse duration	0.1 to 32000 ms
Buffer duration	10 ms to 64 sec
Pulse amplitude	0.01 to 500 g
Rise time (trapezoidal)	0.1 to 10,000 ms
Peak time (trapezoidal)	0.1 to 10,000 ms
Fall time (trapezoidal)	0.1 to 10,000 ms
Units	g-in/s-in; g-m/s-mm, m/s^2-m/s-mm
Frequency range	from 50 Hz to 10 kHz; dependent on the pulse duration and type of compensation,
Frame size	Automatic selection of 512 - 8192 samples, in powers of 2 steps
Pulse dynamic limits	Maximum input voltage, max/min acceleration, max/min velocity, max/min displacement, calculated and displayed

Pulse Compensation

Type	Pre- and post-pulse, pre-pulse only, post- pulse only
Displacement optimization	(Pre- and post-pulse) Single sided, double sided
Compensation method	(Double sided) Displacement, symmetrical acceleration, non-symmetrical acceleration
Pre-pulse amplitude	5 to 100%
Post-pulse amplitude	5 to 100%
Symmetrical Compensation	5 to 100%

Display Tolerances

Type	None, MIL-STD-810, user-specified
Specified segments	+ pre-pulse, - pre-pulse, + main pulse, -main pulse, + post-pulse, - post-pulse
Specified tolerance	1 to 99%; independent for each segment

Control Parameters

Mode of operation	Manual-only
Number of control channels	Any one channel selectable as control
Repetitive pulses	1 to 1,000,000
Delay between pulses	0 to 8,000 ms

Control Strategy

Drive update	Off, on (equalization function updated after every pulse)
Output polarity	+/-
Weighting for averaging	User-selectable: 0.05 to 1
Feedback gain	User-selectable: 0.05 to 1
Equalization method	Transfer function
Equalization level	0 to -80 dB
Input for equalization	Pulse, random, pseudo random
Waveform trend removal	Disable, enable (removes DC offset before integrating from Acceleration to Velocity or Displacement).

Start-up Parameters

Initial test level	Equalization level to 0 dB
Level increment	1 to 20 dB
Equalization delay	0.0 to 8,000 ms

Safety Features

Shaker limits	Pretest verification that spectrum dynamic limits are within shaker operational limits(acceleration, velocity, displacement and voltage)
Loop check max. drive	User-selectable, 1 to 5,000 mV rms
Loop check max. noise	User-selectable, 1 to 1,000 mV rms
Max average error alarm	0.01 to 100 %
Max average error abort	0.01 to 100 %
Max peak error alarm	0.01 to 100 %
Max peak error abort	0.01 to 100 %
Control signal loss	Continuous automatic detection
Maximum drive signal	0.01 to 12V peak

Test Automation

Multiple pulse	User-selectable number of full level pulses and delay between pulses

Channel Setup

Channel type	Control, auxiliary, inactive
Sensitivity	0.001 to 999,999 mV/g
Channel loop check	Enabled, disabled
Channel label	Up to 20 characters for each channel
Transducer serial number	Up to 10 characters for each channel
Transducer Power	Constant current source On or Off

On-Line Analysis

Real-time analysis	Pulses and spectra for 1 to 4 channels simultaneously displayed
Time functions	Control, drive, and auxiliary waveforms
Display units	Acceleration, Velocity, and Displacement
SRS displays	Maxi-max
SRS Resolution	1/1, 1/3, 1/6 Octave
SRS damping	0.1 to 99 %, user selectable
SRS definition	Absolute Acceleration, Relative Displacement
Cursors	X and Y value readout
Scaling of display	Log/linear, auto-scaled/fixed, full control
Current and Stored Test	Provides overlay of Stored vs. current data

Data Storage

Data storage setup	Every pulse, last pulse, off
Playback	Scan through the entire test data file, with adjustable delay
Test summary	Fully documented post-test summary, easily printed or incorporated into any document using standard word processing software
Run message log	Text file records all system status messages displayed during test run

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