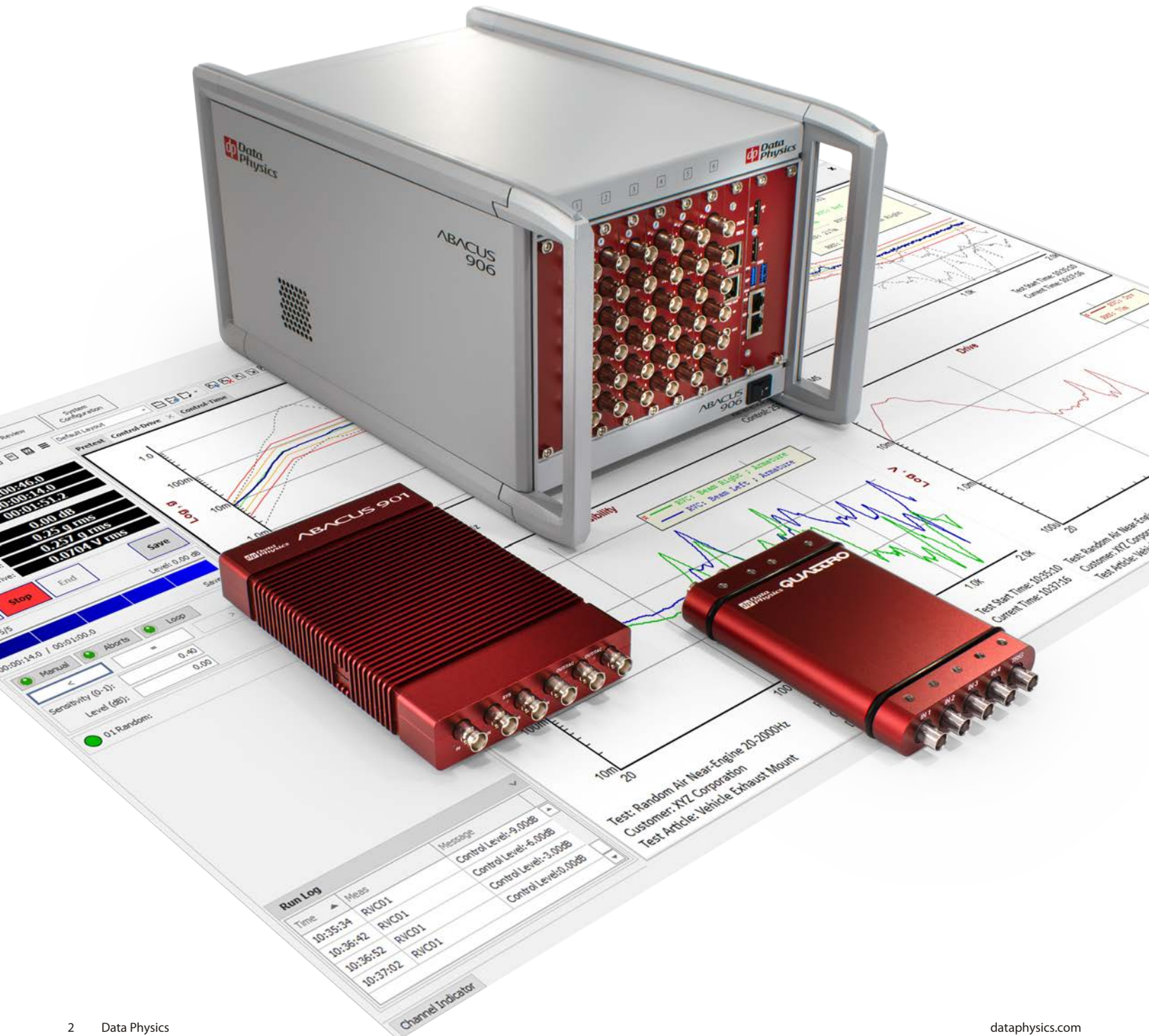




9000 Series

Data Acquisition. Analysis. Vibration Control. Your Versatile, Powerful All-In-One Measurement and Testing Suite.

The 900 Series represents the latest generation of fully integrated systems for vibration data acquisition, signal analysis, and shaker control. Designed for scalability and high-performance, the 900 Series combines powerful distributed processing with an intuitive software interface—enabling users to handle the most demanding test applications without sacrificing accuracy or ease of use.



Key Applications

- Shaker Control (SISO, MIMO, Multi-DoF)
- Dynamic Signal Analysis
- High-Speed Data Recording and Event Capture
- Static and Dynamic Strain / Bridge Measurements
- Structural and Modal Analysis
- Rotating Machinery Diagnostics
- Vibration and Shock Data Acquisition & Analysis
- SRS Analysis & Control



Try the SignalCalc 900 Series Software for Free

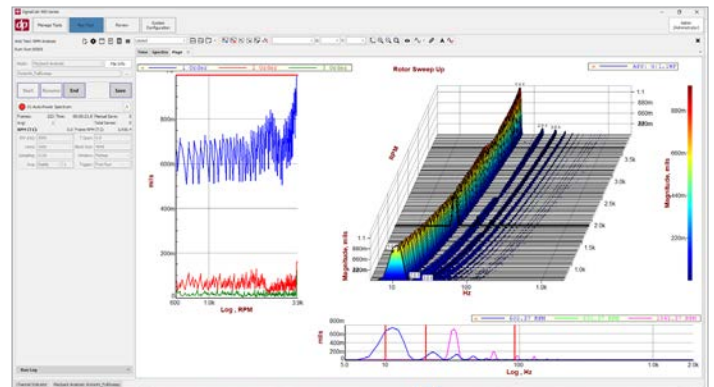
Explore the power of the SignalCalc 900 Series software – with no hardware required. Run simulated tests, review results, and generate reports exactly as you would in a live environment.

Powerful Software to Streamline your Test and Measurement Workflow

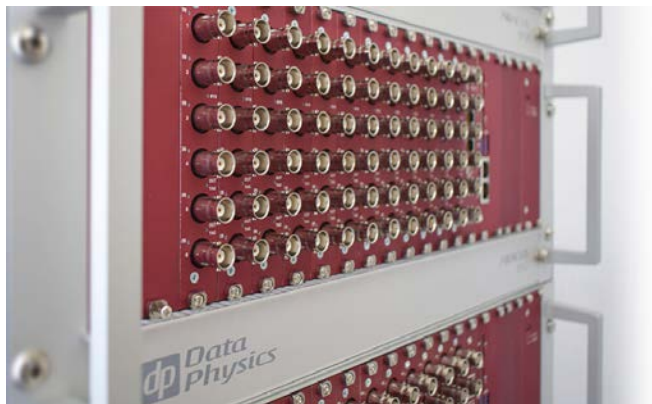
The 900 Series system is powered by SignalCalc 900 – an intuitive, unified software solution for data acquisition, signal analysis, shaker control, and data management.

Users enjoy the streamlined vibration testing setup, control, analysis, and reporting. All test data is automatically organized into a searchable, filterable relational database.

The software can be installed on any PC to view data, manipulate plots, and generate reports – no additional licenses required.



A waterfall plot revealing trends and patterns as a function of speed or time.



Modular Hardware Designed for Growth

Abacus 900 hardware integrates flexible signal conditioning for voltage, IEPE, and bridge-type sensors (full, half, and quarter bridge). Each acquisition module is equipped with dedicated onboard processors, enabling real-time signal processing to run concurrently with data recording or closed-loop shaker control.

This architecture eliminates the need for post-processing or separate acquisition systems. The modular, distributed design ensures for seamless expansion to hundreds or thousands of channels – ideal for complex, large-scale tests.

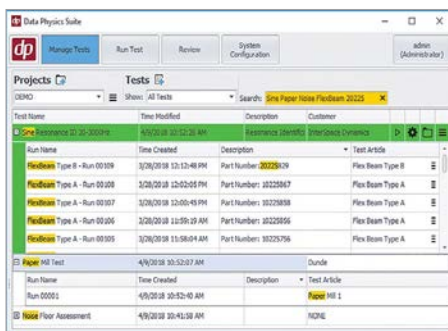
SignalCalc 900 Series Software

SignalCalc 900 is a unified software solution for data acquisition, signal analysis, shaker control, and data management. Designed to modernize and streamline your vibration testing workflow, it combines advanced capabilities with a clean and intuitive interface.

Database Management

The 900 Series Software manages all test and run data for you - never lose data or fumble with files again. Built on a relational SQL database, the 900 Series software automatically archives all data and test setups. Databases can be local to one 900 Series unit, or can be shared between many 900 Series units and PCs, allowing automatic archiving of test data from multiple test stands and the easy access of that data by anyone on your network with no additional software licenses required.

The 900 Series software has searching and filtering tools that let you search through your entire database in a matter of seconds. Find all tests executed by a specific operator, or all tests which used a specific accelerometer SN – just by searching for the operator name or sensor SN in the Search bar. Any run metadata field can be used to search, filter, or sort.



Run Name	Time Created	Description	Part Number	Test Article
Flex Beam Type B - Run 00109	3/28/2018 12:12:48 PM		3022829	Flex Beam Type B
Flex Beam Type A - Run 00108	3/28/2018 12:52:05 PM		3022867	Flex Beam Type A
Flex Beam Type A - Run 00107	3/28/2018 12:00:49 PM		3022838	Flex Beam Type A
Flex Beam Type A - Run 00106	3/28/2018 11:59:19 AM		3022856	Flex Beam Type A
Flex Beam Type A - Run 00105	3/28/2018 11:58:04 AM		3022756	Flex Beam Type A
Flux Mill Test	4/9/2018 10:52:07 AM			Flux Mill 1
Run 00001	4/9/2018 10:52:49 AM			Flux Mill 1
Flux Floor Assessment	4/9/2018 10:41:38 AM			NONE

Search, Sort, and Filter by any metadata entered during the test – searching for a sensor serial number returns all runs which used that sensor.

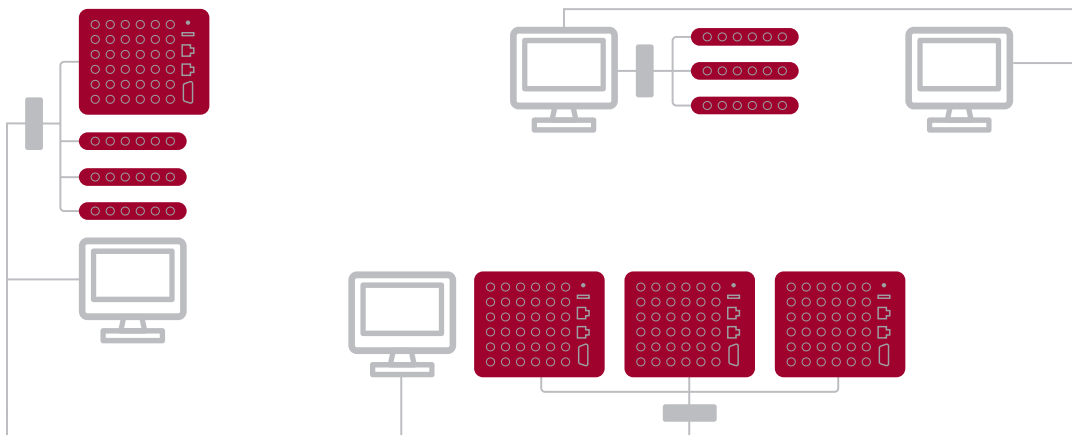
Data Aggregation: Multiple PCs and 900 Series hardware units can share the same test database – automatically aggregating all data onto a single data server.

Designed for Large Databases: The software is designed to handle hundreds of thousands of runs – focusing on recent data unless instructed to look through historic data as well.

Matlab Imports and Exports are fully automated, including exporting long time histories.

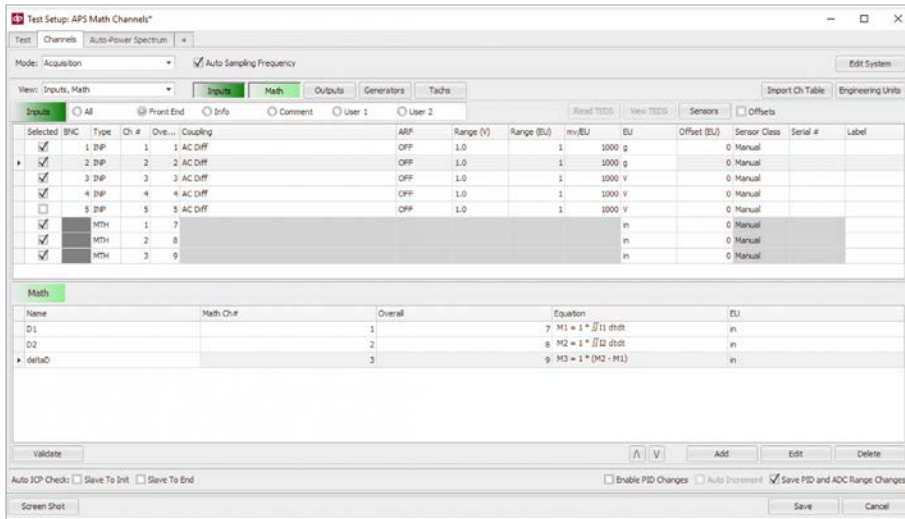
Seamless Data Sharing: Any networked PC can run the SignalCalc 900 software and connect to the Database, review data, and generate reports.

Easily Export Tests or Runs to a file for sharing with non-networked PCs.



Network Access to Multiple Tests

Multiple workstations can connect and disconnect to a test in process. With proper permissions, users can remotely connect, configure, run, transfer control, and monitor multiple tests.



Signal Math

The 900 series offer Math Channels, which are real-time, virtual channels that perform mathematical operations on input/output data during testing. These channels support a wide range of time- and frequency-domain functions such as arithmetic, integration, filtering, FFTs, and coordinate transformations. Math Channels behave like physical channels, allowing them to be displayed, recorded, or used in control and limit settings—especially useful in shaker tests and high-channel-count systems.

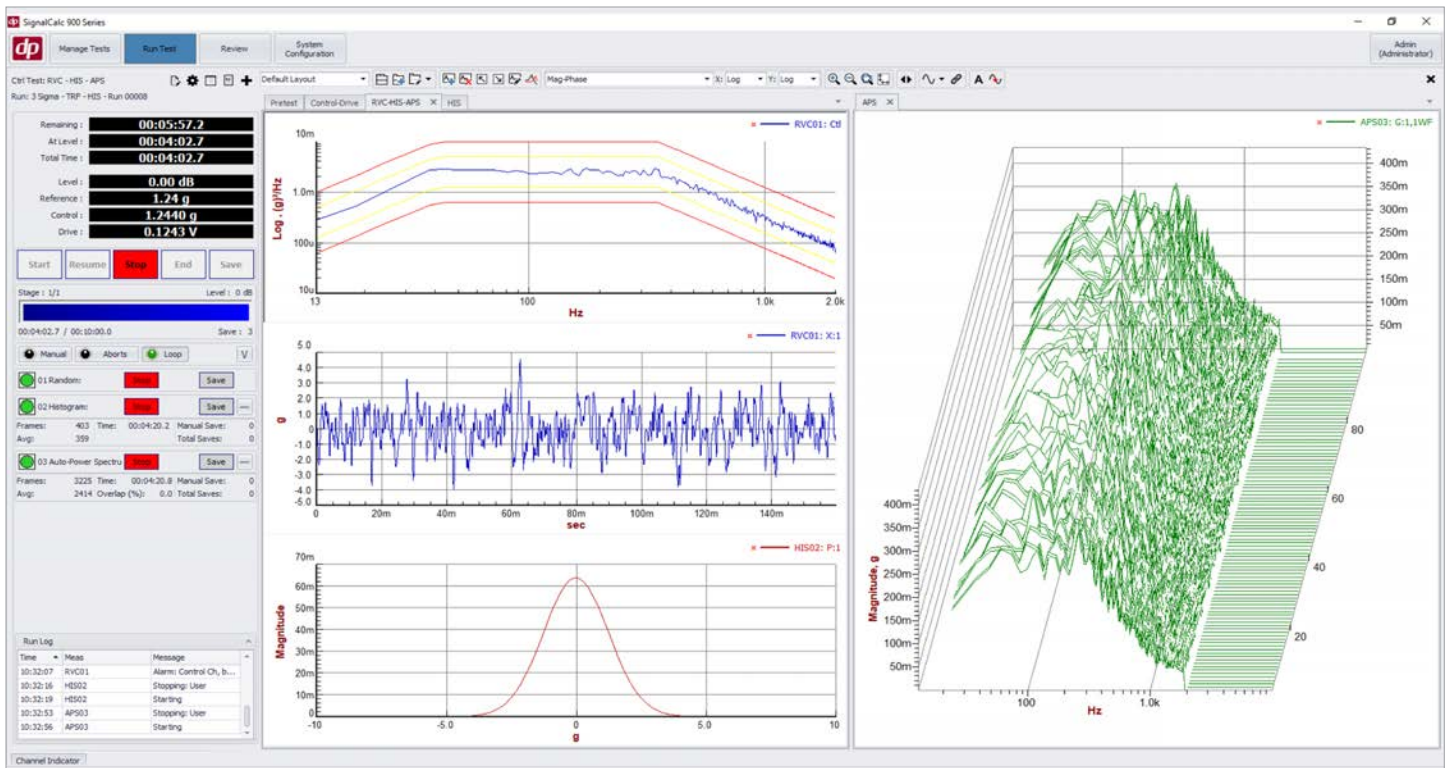
Fully integrated into the test environment, they work seamlessly across multiple chassis and cards without added sample rate constraints, enabling complex signal processing without the need for external tools or post-processing.

Multi-Measurement

The Data Physics 900 Series features a multi-measurement capability that allows users to run multiple analysis types simultaneously on the same set of input data. This means you can perform different measurements—such as FFT, octave, time waveform recording, shock response spectrum, and order tracking—at the same time without reconfiguring hardware or repeating tests.

Each measurement runs independently with its own settings, displays, and storage, enabling efficient data collection across diverse test requirements.

This parallel analysis boosts productivity, reduces test time, and ensures consistent data synchronization across various domains.





Automation in SignalCalc 900

A Comprehensive Suite of Automation Tools for Lab or Production Integration.

With a REST based software interface, digital IO, and a built-in automation scripting language – SignalCalc 900 can be easily integrated into an automated lab environment. Take advantage of SignalCalc 900's powerful data acquisition/control features without losing your workflow or level of automation.

Programmatic REST Interface

Control SignalCalc 900 from any Programming Language – REST is the most commonly used interface for applications to talk. If you are creating software on a computer from this decade, your programming language of choice likely supports REST interface commands. These include Matlab, LabVIEW, Python, C/C++/C#, VB, VBA, and many more.

REST Interface Supports Functionality Such As:

Test Controls Functionality pertaining to running a single test (e.g. Open, Start/Stop/End, Close, Review a test) as well as getting a list of available tests (e.g. get a list of tests associated with a specific Project from the test database) are all supported through the REST interface.

Read Test Status Loading test-specific statuses from the currently running test such as whether the test is stopped/running, test time, test level, shaker drive level, or test frequency (sine tests) can all be done through a REST call.

Test Stop/Abort Reason If a test is stopped, the reason for the stop (e.g. Control Channel abort, or Normal End) can be read through the REST interface.

Creating/Editing a Test Setup Create a new test or open an existing test and manipulate test setup parameters; including input channel settings.

Reading Live or Saved Data The programmatic transfer of time/frequency data (live or already-taken) from SignalCalc 900 is possible through the REST interface. Multiple signals can be requested at a single time, continually, and data can be transferred as text or binary (base64).

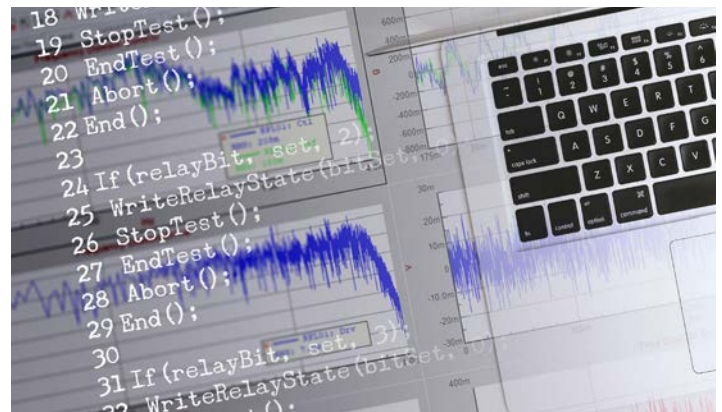
Changing a Controller Test Level Live The test level in a Sine, Random, Shock, Resonance Dwell, or Mixed Mode test can be updated live as the test executes, through REST interface commands.

In addition, test schedules can be traversed manually, or the frequency/direction of a sine dwell/sweep can be changed through the REST interface.

Changing an Output Waveform Live In Analyzer measurements, an output waveform (e.g. Sine or Random) can be changed live through the REST interface. Change the frequency of the sine sweep or dwell; or change the amplitude/phase of the waveform while the test is running.

Read or Write Channel Settings All input channel settings can be changed programmatically through the REST interface. This can greatly simplify the process of configuring a test with tens or hundreds of channels.

An included Excel sample file (with REST functionality included as a Macro) demonstrates this – it grabs all input channel settings from SignalCalc 900 with one click; allows you to modify them in Excel, and then reloads the modified settings back to SignalCalc 900 with a second click.



Automate your entire vibration test, including the vibration controller/analyzer, thermal chambers, device under test, and other test equipment – with the SignalCalc 900 Automation Scripting Language.

The text-based scripting language lets you control the SignalCalc 900 Controller/Analyzer, execute conditional statements, interact with external devices through a relay interface, and much more!

The SignalCalc 900 Automation Scripting Language enables you to sequence logic based on your vibration test status or based on signals from an external system detected via digital

input. The script can then send commands to SignalCalc 900 or to those external devices. This allows you to build nested logic into a simple (or complex) script that can perform specific actions based on the current state of the vibration test and external systems.

For example, a thermal chamber and the vibration test can be stopped in response to a specific failure signal

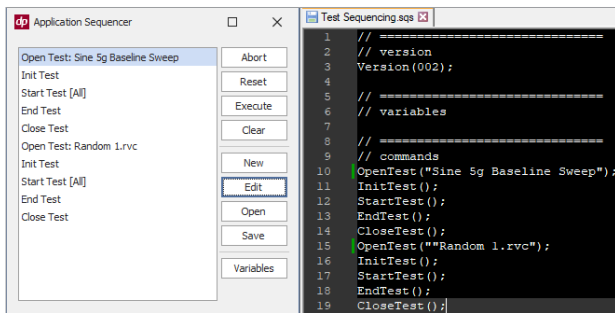
coming from the device under test; and a different signal from the device under test can tell the vibration controller and thermal chamber to start and run a different profile.

With the SignalCalc 900 Automation Scripting Language, highly customized automation is simple and straightforward – and the degree of customization is limited only by your imagination.

Test Sequencing and Automation Scripting

Sequencing tests can be done quickly with the Application Sequencer. Test Sequences are saved as text scripting files that can be edited in any text editor. This dramatically reduces the time it takes to create even complex sequences, with programmable (if/else, etc.) logic.

Control your Entire Lab with programmatic functionality, scripting, reading test status, and reading/writing Digital IO – you can integrate controls of many different systems from SignalCalc 900.



Sequence a list of tests to run sequentially without user interaction.

Read test's status and perform actions based on the current state.

Read Digital Inputs/Outputs and act on them.

Send email notifications based on test statuses or periodically, for remote test monitoring.

Launch external applications based on the vibration test status, digital IO, or time.

Digital Inputs/Outputs

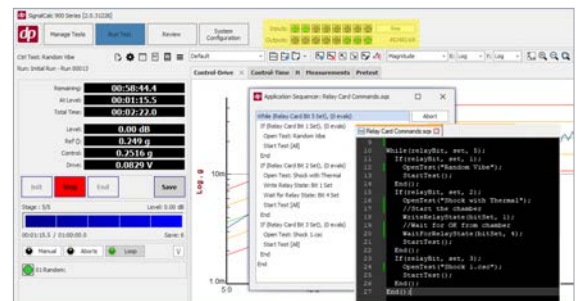
Plug and Play Functionality: Simple IO such as signaling test status or receiving a stop signal.

Control Thermal Chambers using Digital Inputs/Outputs and to wait for a response signal from the chamber indicating it is at thermal.

Display Within SignalCalc GUI shows the state of the Digital IO.

Simple Programmable Logic: Turn outputs On/Off; wait for a response, or perform actions when a specific input is turned on from within the Application Sequencer.

Complex Programmable Logic: Create a custom interface with more complicated logic using the Automation Scripting language; including the use of loops, conditional statements based on digital Inputs' state and/or the currently running vibrate's state.



Reporting Your Way. Quickly create polished, professional test reports for internal use or customer delivery.

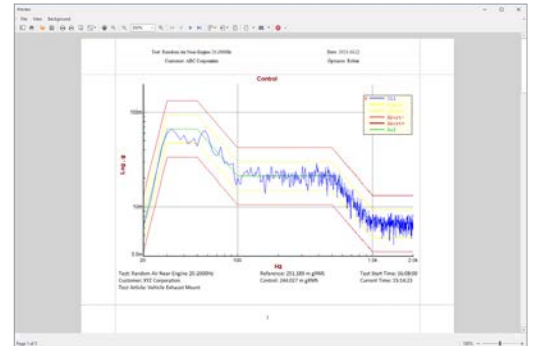
Standard Quick Report

Included with Every System Quick Report is included with every Analyzer and Controller.

Place Custom Plots in Report Your plot or plots can be automatically placed in your report – you can select which plots and how many plots per page.

Export to Word or PDF Automatically export to Word or PDF, or append your report to an existing Word document. Microsoft Word need not be on the PC.

Test Parameter Output Decide which test parameters end up in your report.



Test	Attachment Name	Modified	Type	Size	Function
Random Air Near-Engine 20-2000Hz	Reference profile from customer	2021-05-24 23:20:46	image/png	25.6 KB	
Random Air Near-Engine 20-2000Hz	Shaker Table	2021-05-24 23:21:55	image/jpeg	3.27 MB	
Random Air Near-Engine 20-2000Hz	Vibration Controller	2021-05-24 23:22:52	image/jpeg	813.7 KB	
Random Air Near-Engine 20-2000Hz	Advanced Report Template.docx	2021-05-24 23:24:44	application/vnd.openxmlformats-officedocument.wordprocessingml.document	239.9 KB	Custom Report

Images and Media Archived with Your Data

Attach Media to your Test Images, documents, and other digital files can be attached to a Run, a specific Test, or a Project (set of tests).

Images and Media Archived with your Data Images taken during the test is placed in your database, and is linked to the test data from which it was recorded.

Images in Reports Images can be placed in standard reports automatically – and can be placed in custom report templates as well.

Generate Custom Report Templates in Word

What you See is What you Get Create your template in Microsoft Word, using your own fonts, text sizes, and Word features like Table of Contents and headers/footers.

\$Variables for Test Parameters Test setup parameters, stats, and control result parameters have a \$variable that can be placed in the report.

Placeholder Images for Plots Use placeholder images for plots – placing and sizing them in the document. Placeholder images' metadata is used to specify which plot goes into each placeholder image.

Specify Which Plot goes Where Plots can still be fully customized in the SignalCalc software – and are automatically resized when it is pasted into the template.

Images in Reports Images attached to the test or run can be called by a placeholder image in the report template, similar to a plot.

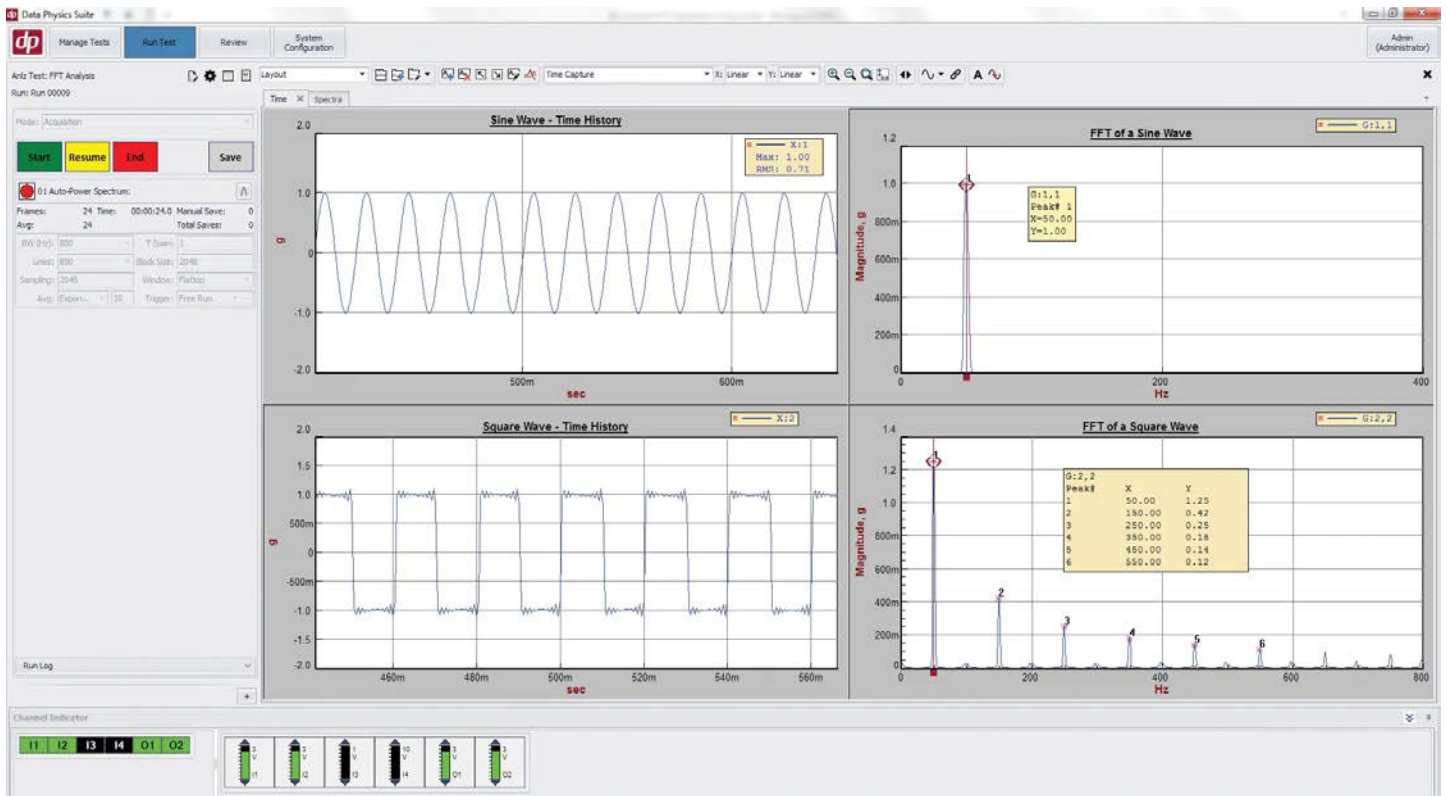


Data Acquisition and Signal Analysis

SignalCalc 900 software is designed with simplicity in mind making it exceptionally easy to use – even for new users. Its intuitive interface features clear setup screens and fully customizable plots allowing users to set up measurements, view live data, and generate reports within a well-designed workflow. Built-in test templates guide users through common tasks like data recording, FFT analysis, or modal/hammer testing, reducing setup time and minimizing the chance for errors.

For experienced users, the software is filled with state-of-the-art and unique processing features which truly set it apart from the competition – all geared towards streamlining your workflow and delivering your results faster.

Analyzer Measurements and Applications



FFT Analysis

General FFT Analysis provides robust, high-performance FFT capabilities for converting dynamic signals from the time domain into the frequency domain to reveal their spectral content. In practice, it supports time waveform capture, synchronous averaging, octave synthesis, correlation, zooming, windowing, and live/averaged spectrum formats (linear, auto-power spectrum, PSD).

The hardware enables high sampling rates (up to 216 kHz), fine frequency resolution (up to 51,200 lines), high dynamic range (≈ 140 dB), and precisely synchronized multi-channel acquisition. The system also offers standalone (PC-less) operation, customizable reports, overlay analysis, data export (Excel, Matlab, UFF, MEScope), and real-time processing.

The breadth of capability makes the system suitable for many real-world FFT applications across industries such as aerospace, automotive, defense, and manufacturing.

Applications

- Vibration surveys
- Diagnostic testing
- Trouble shooting
- Design validation
- Predictive maintenance
- Acceptance testing
- Acoustic and noise analysis

Time Data Recording

Many dynamic measurement applications benefit from real-time analysis and real-time results in the frequency domain. However, some measurements require an archive of the raw time data.

All Dynamic Signal Analyzers and Vibration Controllers are capable of recording the live time data parallel to any processing or control tasks.



The Data Physics 900 Series recording and playback system provides high-speed time data acquisition (up to ~216 kS/s) with the ability to record simultaneously alongside real-time measurements, reducing overall test time. It supports multi recorder acquisition with independent sampling rates and event-based triggering for precise data collection, while enabling gap-free recording directly to SSD and export to formats like MATLAB, CSV, and UFF.

The playback functionality uses the same interface as live testing, allowing users to reanalyze selected or all channels, adjust processing speed, and repeat tests consistently.

Additionally, built-in tools enable editing of time histories—such as cutting, splicing, filtering, and adding ramps—making it a comprehensive solution for capturing, modifying, and extracting insights from vibration and time-domain data.

The recorded time data can be saved at maximum sample rate independent of the bandwidth of the processed data.

The recorded time data can be sent over the LAN connection to a PC for post processing or export.

Applications

- Recording real-world driving loads and replaying them on lab shaker systems to simulate actual road conditions.
- Capturing transient noise or vibration events (rattles, squeaks) and later analyzing for detailed root-cause analysis.
- Reproducing long-term operational loads in accelerated lab tests to evaluate component lifespan.
- Recording in-flight vibration and acoustic data and replaying it on ground test rigs for deeper analysis.

Modal/Structural Analysis

The SignalCalc 900 system offers a full-featured modal and structural test solution for measuring how structures respond dynamically. It supports Frequency Response Function (FRF) measurements using impact hammers or modal shakers, with outputs from sensors like accelerometers, velocity probes, or displacement transducers. Key technical features include > 140 dB dynamic range (for high-Q structures), multiple windowing functions, high frequency lines (good for resolving closely spaced modes), and multi-input/multi-output (MIMO) capabilities for complex excitation.

The software automates tagging of measurement points/directions, supports structural geometry (rectangular, cylindrical, spherical), and provides flexible data export (e.g. MScope, UFF, MATLAB, ASCII/CSV). It also has tools for overlaying and reviewing data, damping estimation, and handling large multi-point measurement projects.



Applications

- Validating finite element models via test-analysis correlation.
- Characterizing mode shapes and damping in aerospace or automotive structures.
- Evaluating structural integrity or fatigue life.
- Optimizing designs through modal sensitivity studies, and troubleshooting vibration issues in machinery or infrastructure.



RPM Analysis

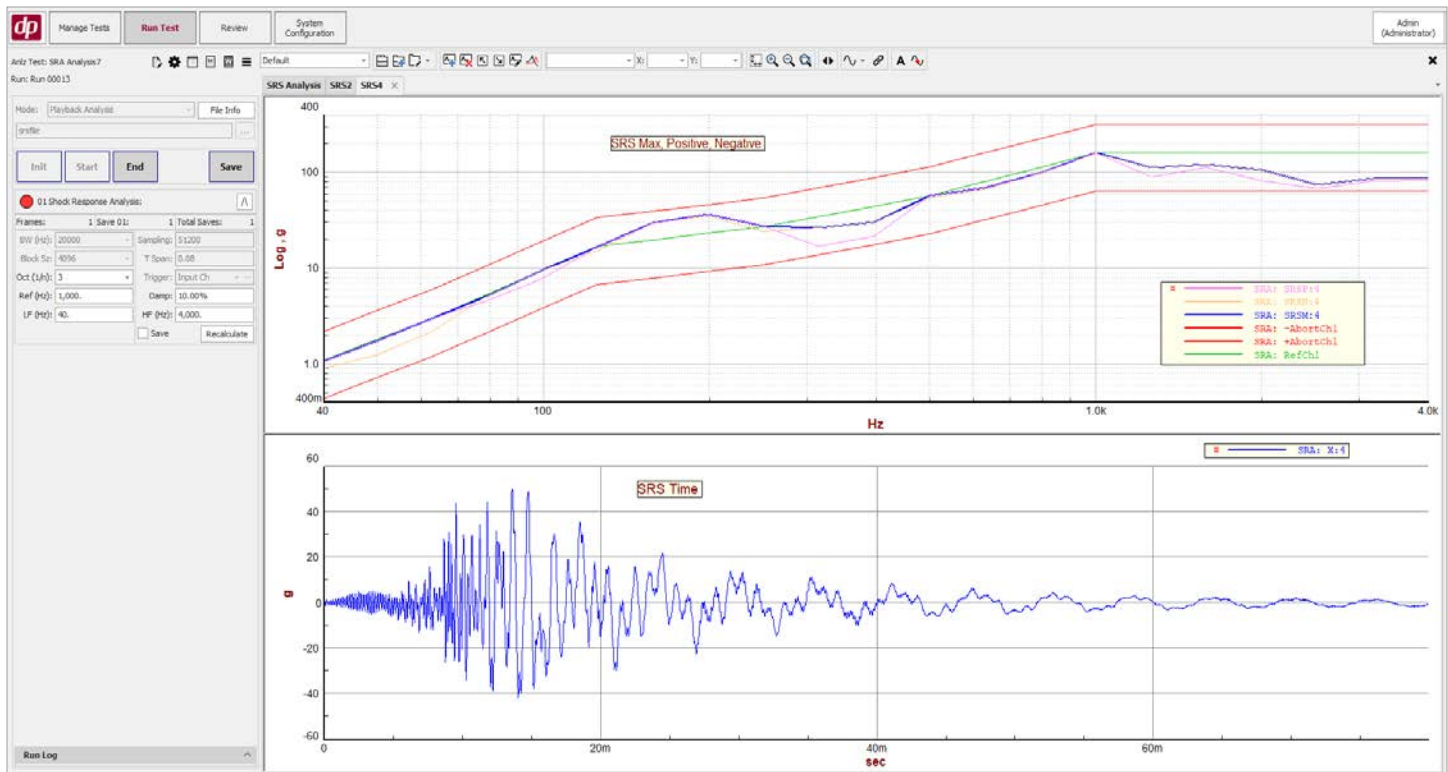
The Rotating Machinery Analysis feature in the SignalCalc-900 system enables vibration measurements that are synchronized with rotating machinery's speed (RPM), using tachometer inputs. It supports different RPM-modes: Sweep (monitors RPM during ramp-up or coast down with interval-based triggers), Stepped (averaged measurements at discrete RPM levels), Steady (collect data when RPM is within a band), and Delta (handles abrupt sweep changes).

The system also supports auto or multiple tachometer channels. Additional measurement tools include RPM-based FFT, synchronous averaging to discard asynchronous vibrations, demodulation (via Hilbert transform), order tracking (resampling input to the instantaneous shaft angular velocity), and waterfall (RPM vs amplitude/order vs time/speed) displays.

Display formats for waterfall data include color cascades, surface maps, spectrograms, and more, with options for compression along axes and child windows for detailed plot comparison.

Applications

- Diagnosing vibration issues in turbines, pumps, compressors, engines, and gearboxes.
- Detecting bearing faults, imbalance, or looseness.
- Performance validation during speed ramps or coast-downs.
- Condition monitoring for predictive maintenance.
- Analyzing order-related harmonics and resonance behavior.
- Acceptance testing or troubleshooting of rotating systems in industrial, aerospace, power generation, and machinery environments.



SRS Analysis

The Shock Response Spectrum (SRS) module enables accurate transient capture and shock response spectrum computation to evaluate the damaging potential of impulsive loads. The system uses triggering to capture shock pulses and allows live recomputation of SRS curves with different damping percentages, octave spacing, and octave placement. It supports high sample rates (up to 216 kHz), linear phase filters to avoid distortion, and input ranges up to 30 V to accommodate high-amplitude shocks without clipping.

Users can integrate or differentiate captured signals to view acceleration, velocity, or displacement, overlay multiple runs for comparison, and export data.

Applications

The SignalCalc 900 SRS solution is well suited for critical shock-response applications, including:

- Qualification testing of aerospace or military equipment under transient loads
- Drop test analysis
- Shock absorber and packaging design
- Seismic event simulation
- Component ruggedness validation

Engineers use SRS tools to:

- Assess how shock pulses excite resonances in structures,
- Determine worst-case dynamic stresses,
- Validate finite element shock predictions
- Ensure compliance with standards for shock tolerance in electronics, mechanical assemblies, and safety-critical systems

SRS Measurements

Tolerance Bands: Enter Tolerance bands for pass/fail error checking.

Input Ranges up to 30 Volts: Capture high amplitude shock events without clipping the input signal.

High Quality Linear Phase Filters: Eliminate distortion of transient signals due to filtering.

Sample Rates up to 200 kHz: Accurate measurement of high frequency shock events.

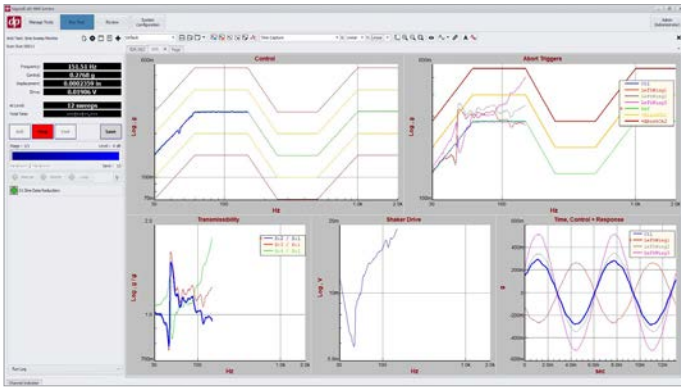
Live Manipulation of Analysis Parameters: SRS type, octave spacing and critical damping percentage can be modified to recompute the SRS during the measurement.

Integration/Differentiation of Captured Signals: Display data in acceleration, velocity and displacement.

Sine Data Reduction

Data Physics' Sine Data Reduction is designed to operate alongside a swept-sine vibration control test, supplementing the controller by monitoring hundreds or thousands of channels in real time.

It can apply user-specified tracking filters (fixed or proportional bandwidth), monitor for transients gap-free (and abort the test within milliseconds if tolerances are exceeded), and compute channel averages, peaks, RMS, or other metrics.



Engineers can define alarm and abort profiles to protect valuable test articles and safely shut down (soft shutdown) when limits are triggered.

The system also supports live channel and signal math (e.g. summing forces or moments), computes transmissibility between channels, and simultaneously runs secondary measurements (such as harmonic visualization) without post-processing delay.

Applications

- Verifying structural response during swept-sine durability or qualification tests.
- Protecting high-value test specimens (e.g. satellites, aerospace components).
- Evaluating transmissibility between subassemblies, and gathering additional dynamic insights (harmonic response, resonance behavior) concurrently with the control test.

In short, it enhances test safety, expands the measurement scope, and accelerates insight during sine vibration testing campaigns.

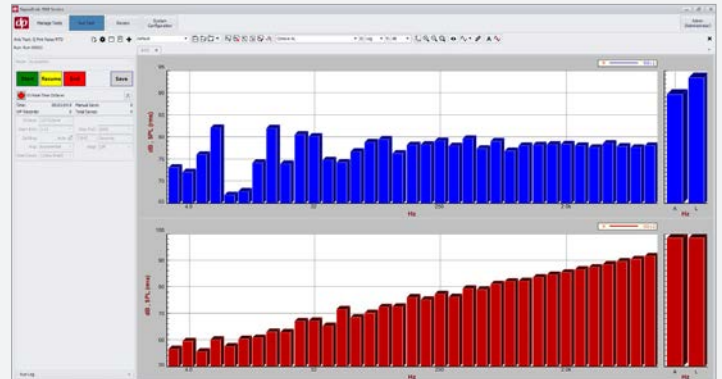
Acoustic Analysis

The Acoustic Analysis module of the SignalCalc-900 provides tools for quantifying noise or sound power emitted by products, complementing vibration measurements.

It supports real-time octave measurements with customizable octave filters (ANSI S1.11), up to 20 kHz on all channels. Alternatively, octave bands can be synthesized from narrowband FFT data.

The system allows acoustic/octave measurements to run in parallel with vibration measurements, using separate sample rates.

On the hardware side, it features 24-bit ADCs giving over 140 dB dynamic range, use of high-quality or ICP microphones, and very low noise operation (e.g. Abacus 901 is passively cooled, 906 has a quiet fan-off mode).



Applications

- Quantifying noise emitted by machinery or products.
- Correlating vibration sources to acoustic noise.
- Performing environmental noise testing.
- Diagnosing tonal noise or broadband sound sources.
- Conducting direct field acoustic tests (DFAT/MIMO control).
- Integrating acoustic measurements during qualification or validation vibration campaigns.

Vibration Control

The 900 Series vibration controllers incorporate Data Physics' renowned shaker control algorithms with a modern software interface. **The 900 Series vibration controller can quickly be set up to control any shaker** – while the 900 series platform offers advanced features such as auto-aggregation of data from all test stands, custom Word-based reporting, unlimited expandability, concurrent data recording and signal analysis, intrinsic safety, and more. Achieve reliable control results and accurate measurement data for all your vibration test profiles.



Production/Repetitive Product Testing

Running the same tests sequentially sounds like an easy task – but the 900 Series software has features which make your life easier for both the day-to-day and on the off day when you need to track down data from months or years ago.

- Test are highly repetitive and data is automatically aggregated into your test database
- Metadata entered at test time (e.g. a part's serial number) can be used as a search term to locate a specific result after-the-fact. For example – if a Sensor is found to be out of calibration, a search of its SN will yield all Runs which used that sensor.
- Images can be taken before or during the test and attached to the test dataset. The image then lives with the test data and can be automatically printed into any reports generated.
- Test profiles and data can be seamlessly shared/ aggregated across multiple test stands. Any connected PC (with or without hardware) can view the test database, create profiles, review data, and create reports.
- Integrate the 900 Series controller into your lab's custom environment with the Relay Card or through our software (REST) interface.
- Software user/login rights can prevent users from inadvertently changing test profiles.
- The Sensor Database keeps track of calibration dates and will warn the operator if you try to use sensors that are out of calibration.

Reproduce any Vibration Profile

Whether running a profile from a specification or generating your own profiles, the 900 Series software has the flexibility to run all common profile types including:

- **Sine** (Sweep, Dwell, Resonance Dwell)
- **Random**
- **Shock / SRS**
- **Mixed Mode** (Sine/ Random on Random)
- **Time Replication**

Shaker Control Applications

Test Labs

Each customer has their own specifications and profiles, and is interested in seeing something unique in their test results. The 900 Series software has the smarts to meet the most demanding of customers, and will save you time with our advanced reporting tools. The modular hardware allows you to reconfigure multiple controllers into a single larger system as needed, to meet the demands of the one-off tests.



- Support for test profile types from all common vibration testing standards.
- Custom (what-you-see-is-what-you-get) report templates can be created in Microsoft Word using template images and metadata variables allowing for highly customized reports to be generated automatically after each test.
- Reports can be saved directly to PDF or to Microsoft Word format.
- Multiple test reports can be concatenated into a single report.
- Photos taken before or during the test can be placed in your report.
- Simple thermal chamber connectivity through USB Digital IO card.
- Daisy chain any of your licensed 900 Series Controllers together for higher channel counts when needed.
- Intuitive software and YouTube video library reduces training time for new operators.



R&D

Working on unique vibration tests demands more than the baseline vibration testing features. The 900 Series has several unique abilities to support your custom test needs.

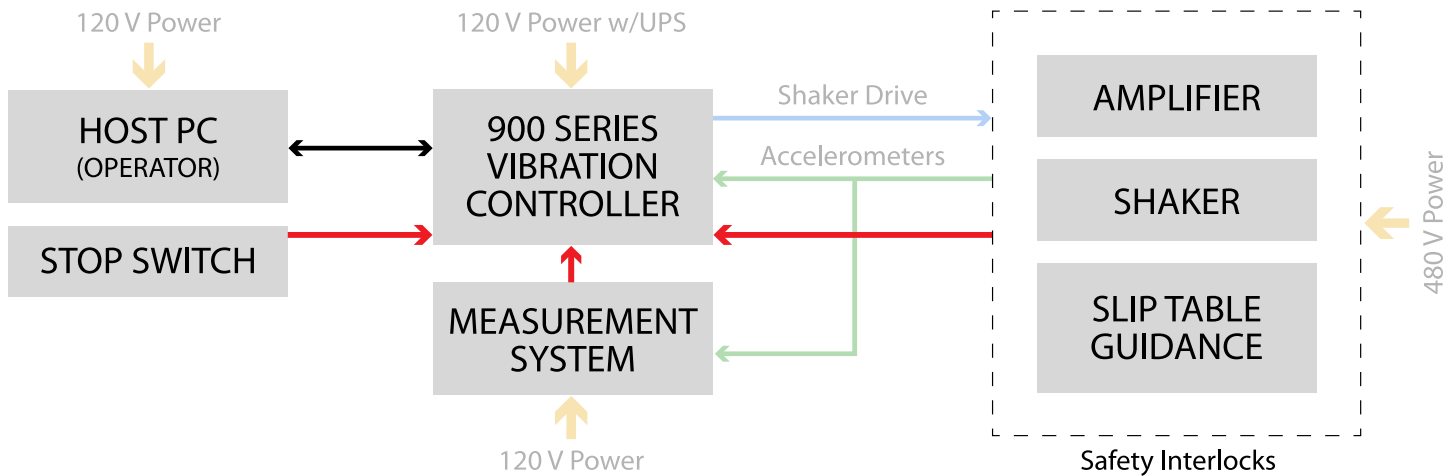
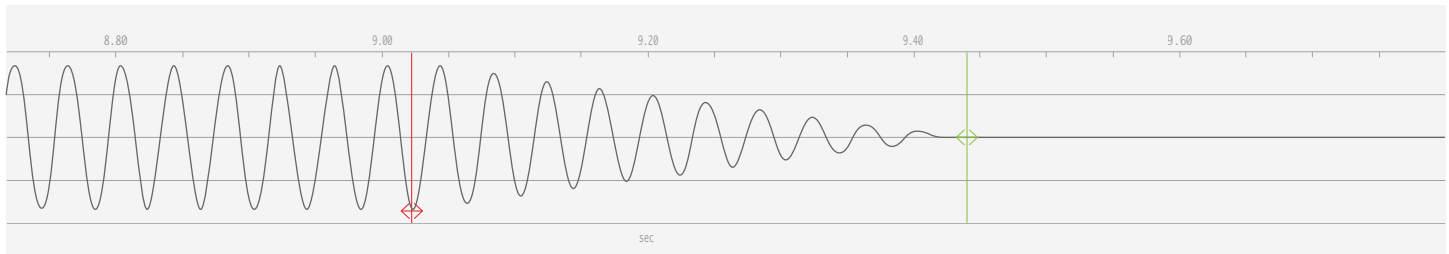
- Simultaneous time data recording at independent sample rates from the vibration test.
- Math channels allow math operations to be performed on sampled time data in real-time. Resulting Math Channels appear as new BNCs in the test setup, and can be used for Control, Limit, or Measurement purposes.
- Multi-Measurement allows you to perform traditional post processing in real-time, resulting in one dataset available as soon as your shaker test completes. Secondary analysis measurements are fully independent, and can be configured with their own sampling, block sizes, triggering, and averaging.
- Supports higher channel counts - 72ch in a single chassis and any of the 6/36/72ch chassis can be daisy chained together for a higher channel count test.
- Matlab/Python (or other) Integration– Control your test execution, define test profiles, or even stream time data live to your Matlab/Python programs.

Shaker Control Applications

Aerospace and Satellite Qualification

Structural testing of a precision-engineered satellite can be nerve racking. When selecting a vibration controller to test a valuable test article, risk mitigation is critical. Data Physics has been involved in testing some of the most valuable satellites ever put on a shaker – and developed the 900 Series controller from the ground up with advanced safety features to ensure testing success.

Soft Shutdown - when paired with a Data Physics IGBT amplifier, the system is capable of ramping down safely in the most unexpected cases – even a total loss of 480V power to the amplifier.

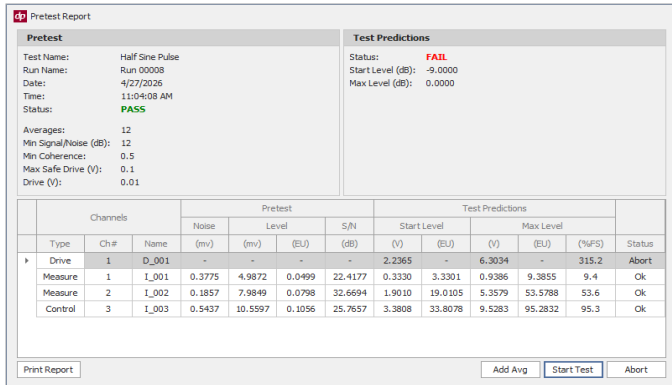


The Sierra Space Dream Chaser Spaceplane undergoes swept sine testing.

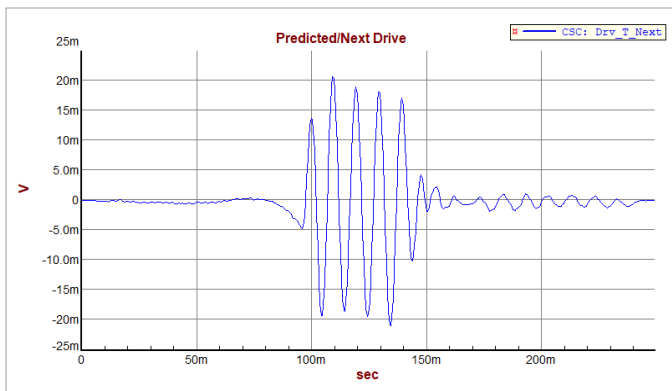
External Abort Triggers – External subsystems can trigger the controller to ramp down the test – a process which starts within a few milliseconds of receiving the trigger.

Host PC Independence – All control/measurement happens in the chassis – any crash or failure on the host PC simply causes the controller to ramp down the test with no data loss.

Shaker Control Features



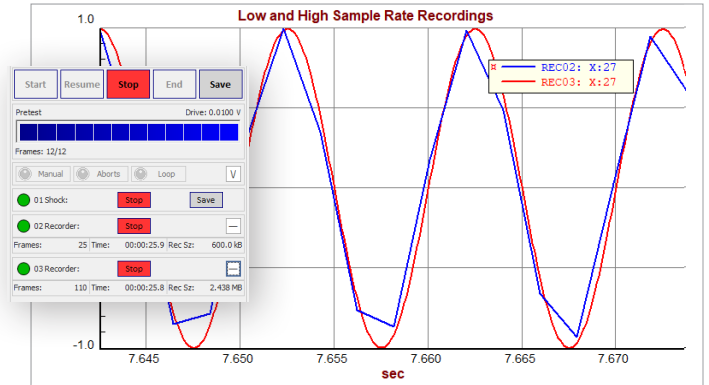
Pretest features predict control, response, and drive levels before profile execution begins.



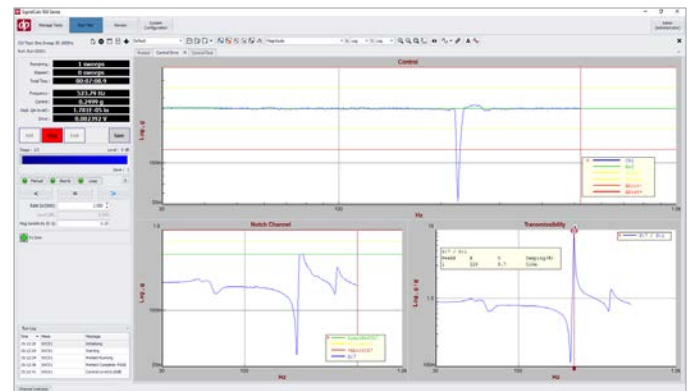
“Next Drive” signal displayed before each Sine Burst pulse, allowing operator to prevent improper shocks during test.

View:	Inputs, Math	Inputs	Math	Outputs				
Selected	BNC	Type	Ch #	Ove...	Usage	Name	Coupling	Range (V)
<input checked="" type="checkbox"/>	58	INP	58	58	Measure	516Z	AC SE	10.0
<input checked="" type="checkbox"/>	61	INP	59	59	Measure	16X	AC SE	10.0
<input checked="" type="checkbox"/>	62	INP	60	60	Measure	31X	AC SE	10.0
<input checked="" type="checkbox"/>	63	INP	61	61	Measure	511X	AC SE	10.0
<input checked="" type="checkbox"/>	64	INP	62	62	Measure	517Z	AC SE	10.0
<input checked="" type="checkbox"/>		MTH	1	67	Limit	X Forces		
<input checked="" type="checkbox"/>		MTH	2	68	Limit	Y Forces		
<input checked="" type="checkbox"/>		MTH	3	69	Limit	Z Forces		
<input checked="" type="checkbox"/>		MTH	4	70	Limit	X Moments		
<input checked="" type="checkbox"/>		MTH	5	71	Limit	Y Moment		
<input checked="" type="checkbox"/>		MTH	6	72	Limit	Z Moment		

Math Channels can be used to compute an overturning moment or summed force, and the resulting Math channel can be used as a Control or Limit channel.



Simultaneous time data recording at independent sample rates from the vibration test.



Industry leading limit/notching performance in both Sine and Random test modules.



Data redundancy – Time history data can be saved on the chassis and streamed to the PC simultaneously during test execution.

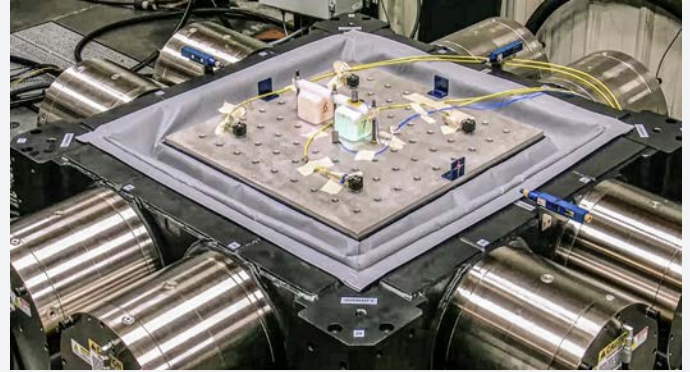
Shaker Control Applications

Multi-Shaker Testing

There are many reasons to run a Multi-Shaker Vibration test. Multiple shakers can be combined to run a higher force test in a single axis (Multi-Shaker Single Axis), or multiple shakers can be connected to run a multi-axis test.

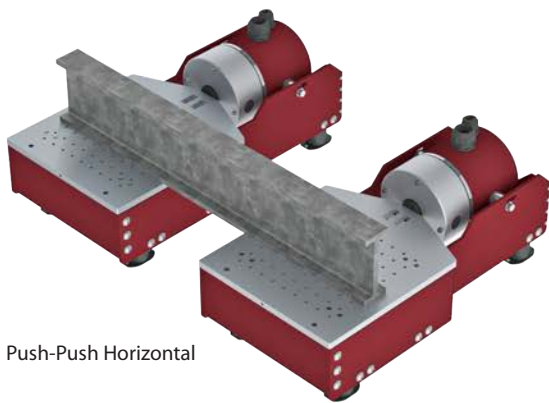
Shakers can be connected to a table with or without bearings, or they can be connected directly to the test article for a modal-type excitation – such as Impedance Matched Multi-Axis Vibration Testing (IMMAT).

In all cases, the 900 Series MIMO controller has the specs and the smarts to bring the system into control.

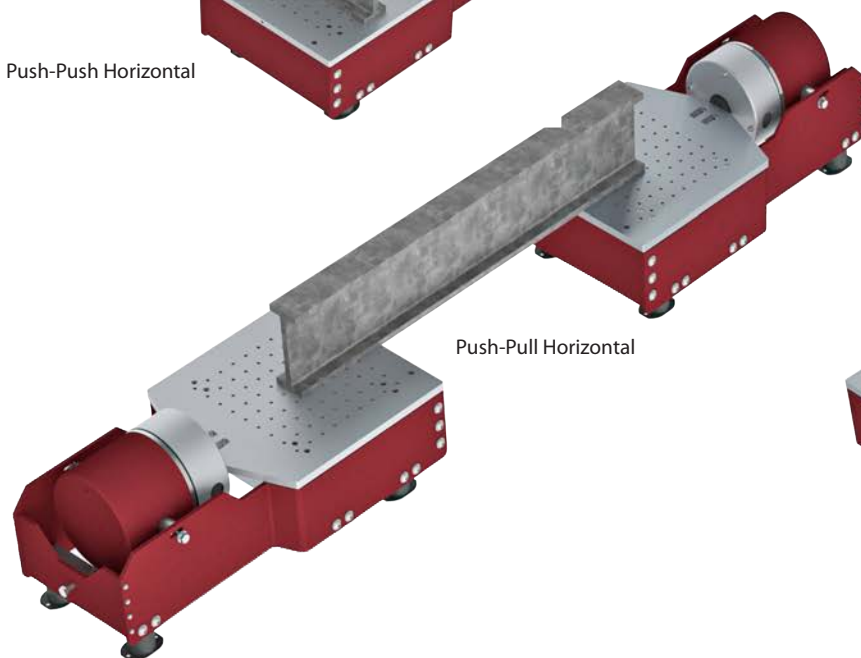


Multi-Shaker Single Axis Shaker Testing

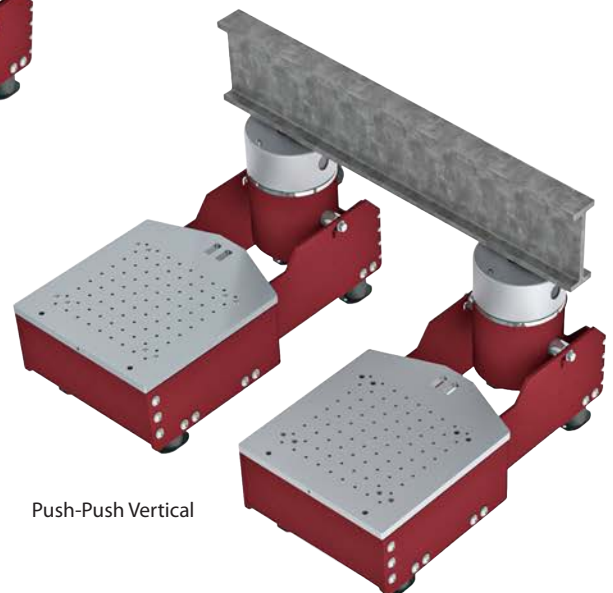
Controlling two (or more) shakers in the same axis can effectively double your available system force – if the shakers are controlled properly. The 900 Series Controller can optimally control Push/Push or Push/Pull dual shaker configurations – compensating for differences in the shakers/amplifiers and ensuring the shakers don't generate equal and opposite forces.



Push-Push Horizontal



Push-Pull Horizontal



Push-Push Vertical

Shaker Control Applications

Fully Characterizing Multi-DoF Dynamics

The 900 Series MIMO controller can control more than 24 shakers coupled together in any orientation – without the shakers being matched in any way.

The 900 Series Controller does this by automatically developing a digital model of the system it is controlling. The user need not tell it the orientation/polarity of the shakers – just the desired test profile(s) to be reproduced at each control sensor. Through a pretest procedure, the controller identifies the complex coupling between all shakers and control sensors.

With this information the controller can counteract differences in the amplitude/phase response of each shaker, counteract cross coupling between different shakers and control sensors, counteract offset masses, optimally drive over constrained systems, and even counteract/control mode shapes of a table or device under test. The 900 Series Controller is well suited for IMMAT style testing, and has control settings to optimally drive specific modes of a structure.



Multi-Axis Testing

Control multiple shakers oriented to act on a single table or test article in multiple axes, or control a custom multi-axis table. The vibration controller is unmatched in its ability to control complex MIMO vibration systems and is used extensively by the US DOD, DOE, and National Labs, in the transportation and automotive industries, as well as for satellite qualification testing, and more.

When running multi-DoF testing, Math Channels can be used as kinematic transformations – transforming your control accelerometer data to 6-DoF translations/rotations. This greatly simplifies profile entry into the SignalCalc 900 software, and provides a “global language” for all 6DoF profiles.

Reproduce any Vibration Profile in Multiple Axes

Data Physics MIMO Controllers support all the same vibration test profile types as traditional single shaker controller. The varying profile types are similar to their single shaker counterparts, but in each case includes a phase or coupling terms between control profiles.

- **Sine** – Enter an amplitude/phase versus frequency profile for each control channel to run Sweeps or Dwells.
- **Random** – Enter a control PSD for each control location – or a spectral density matrix (SDM) to define PSDs and cross spectra between control channels. Cross spectra can also be auto-computed to minimize drive requirements.
- **Shock** – Control to a specific shock pulse on each control sensor.
- **SRS Shock** – Generate/import an SRS shock pulse for each control sensor.
- **Mixed Mode (Sine/Random on Random)** – Define PSDs (or a spectral density matrix) for background Random noise, and superimposed sweeping Sine or Random components atop the background noise.
- **Time History Replication** – Import an arbitrary time history for each control channel.



900 Series Hardware

Compact and rugged, the Abacus 900 Series is engineered for both lab and field use, with seamless scalability to over 1,000 channels. Its distributed processing design ensures consistent performance across all configurations – regardless of system size or number of chassis. All specifications and software features remain fully supported, even in large-scale or multi-channel test environments.



901

Full specifications on page 22

The Abacus 901 is an ultra-portable system well-suited for field use. Multiple systems can be combined for larger tests.

- Six channels (input/output/tach)
- 6-channels per chassis – expandable to over 60
- Passive cooling for silent operation
- Power over Ethernet
- Remote and autonomous operation

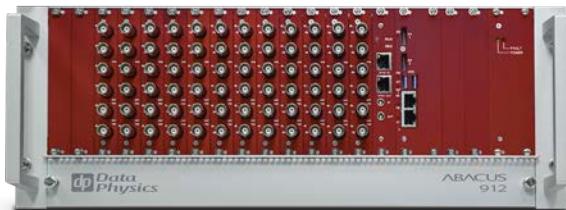


906

Full specifications on page 22

The Abacus 906 is a compact, durable system for both lab and field applications. Multiple systems can be combined to create larger systems.

- 6-36 channels per chassis – expandable to over 1,000
- Flexible input/output/tach configuration
- Quiet mode for acoustic applications
- Strain/bridge conditioning option



912

Full specifications on page 22

The Abacus 912 is a high channel count system for laboratory use. Multiple systems can be combined for larger tests.

- 36-72 channels per chassis – expandable to over 1,000
- On-board solid-state memory
- Strain/bridge conditioning option



Quattro

Full specifications on page 24

The rugged USB-powered Quattro can travel with you and is fully operational – even in the absence of line power.

- 4 input channels, 2 sources
- USB powered
- 120-150 dB Dynamic Range
- Dedicated high speed tachometer input

Hardware Comparison Table

	Analyzer	Controller	Channels	Expandable	Strain	Power	Warranty
Quattro	Yes	—	4	—	—	USB	3 Year
901	Yes	Yes	6	Yes	—	POE	3 Year
906	Yes	Yes	6-36	Yes	Available	AC	3 Year
912	Yes	Yes	6-72	Yes	Available	AC	3 Year

Strain Measurement*

Multi Function Bridge, Voltage and ICP Channel Card (906 and 912)

*Full specifications on page 22

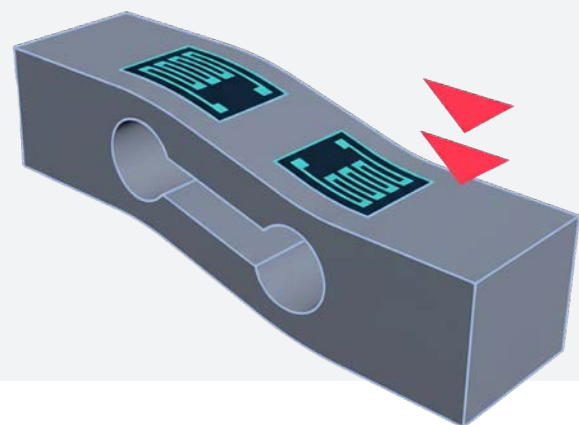
An integrated and synchronized solution for all SignalCalc 900 analyzer and controller applications – the multi function precision measurement card adds strain/bridge conditioning to the 900 Series platform, and is an all-in-one solution for bridge, voltage and IEPE/ICP (including TEDS) signal conditioning.

Featuring 4 versatile input channels with secure micro-D9 connectors in the front-end, the multi function card can tackle a wide range of dynamic signal measurement applications.

- Integrated strain gauge database enables a quick and intuitive test setup.
- Built in bridge balancing, nulling, and ± 5 V bridge power with DACs.
- Real-time temperature compensation of strain using thermocouple data.
- Real-time principal strain and stress calculations for strain gauge rosettes.
- Quarter/half/full-bridge, voltage, and ICP/IEPE channels.

Ideal for environmental and structural test engineers, who want to measure strain during a controller test or run a high channel count analyzer test.

A fully integrated platform that eliminates synchronization and integration problems of using external data acquisition systems – unlike using triggers to start external data recorders.



901/906/912 Series Hardware Specifications

Inputs

- **ADC Resolution:** 24 bits Sigma Delta
- **Sample Resolution (Digital Filtering/ Processing):** 32 bits floating point
- **Maximum Sampling Frequency:** 216 kSamples/s
- **Coupling:** AC/DC, DIFF/SE, ICP, TEDS
- **Input Impedance:** 1 MOhm + 1MOhm (DIFF), 1MOhm + 50 Ohm (SE)
- **Digital Anti-Alias Filter:** -100 dB (0 to 40 kHz), -90 dB (40 to 90 kHz)
- **Analog Anti-Alias:** 3 poles
- **Dynamic Range:** 120 to 150 dB
- **Input Ranges:** 0.1V, 0.31V, 1V, 3.1V, 10V, 31V
- **CMMR:** 60 dB
- **Max Voltage:** 80 V max/1 MOhm; 5 V max/50 Ohm
- **Amplitude Accuracy:** +/-0.2% FS at 1 kHz for 0 deg < T < 55 deg C
- **Frequency Response:** +/- 0.5% 0 to 40 kHz, +/- 1% 40 to 80 kHz, +/- 2% 60 to 80 kHz on 30V Range
- **Phase Accuracy:** 0.5 deg at 40 kHz
- **THD+N:** 90 dB min @ 1kHz
- **Offset:** -/+ 0.1% FS Max (0.5% Max on .1V Range)
- **Crosstalk between inputs:** -90 dB
- **Crosstalk between inputs and outputs:** -90dB
- **Frequency Accuracy:** 25 ppm

Outputs

- **DAC:** 24 bits Sigma Delta
- **Sampling:** up to 216 kSample/s
- **Ranges:** 1V, 2V, 5V, 10V; SE
- **Output Current:** 10 mA
- **THD:** 90 dB
- **Reconstruction Filter:** 100dB Stop Band

Tachometers

- **Input Ranges:** 0.1V, 0.31V, 1V, 3.1V, 10V, 31V
- **Max Voltage:** 80 V /1 MOhm; 5 V/50 Ohm
- **Coupling:** AC/DC/DIFF/SE
- **Signal Frequency:** DC to 500 kHz
- **Programmable:** Threshold, Hysteresis, Hold-Off, Pre-Scaler, Polarity

Physical Measurements

901

Depth:	7.32 in.	18.60 cm
Width:	4.64 in.	11.78 cm
Height:	1.40 in.	3.57 cm

906

Depth:	15.00 in.	38.10 cm
Width:	9.29 in.	23.60 cm
Height:	7.87 in.	20.00 cm

912

Depth:	11.00 in.	27.94 cm
Width:	19.0 in.	48.26 cm
Height:	7.0 in.	17.78 cm

Multi Function Bridge, Voltage and ICP Channel Card Specifications

General

4 individually configurable inputs via micro-D9 connectors

Supported inputs:

- Voltage / ICP / IEPE
- Quarter, Half and Full Bridge

ADC Resolution: 24 bits Sigma Delta

Maximum Sampling Frequency: 216 kSamples/s, arbitrarily selectable

Coupling: AC (0.5 Hz) / DC, DIFF / SE

Input Range: 0.1 V, 0.31 V, 1 V, 3 V, 10 V

Impedance: DIFF: 1 M Ω / 100 pF + 1 M Ω / 100 pF
SE: 1 M Ω / 100 pF + 50 Ω

Input Common-Mode Range: 200 % FS (100% FS, 10 V)

Common-Mode Rejection Ratio: 100 dB (0.1 V input range, at 50/60 Hz)

	SNR (20 KHz BW)	SFDR (20 KHz BW)
0.1V:	-95dB	-134dB
1V:	-110dB	-147dB
10V:	-114dB	-150dB
	SNR (2 KHz BW)	SFDR (2 KHz BW)
0.1V:	-104dB	-138dB
1V:	-117dB	-150dB
10V:	-120dB	-158dB

Amplitude Accuracy: $\pm 0.2\%$ FS at 1 KHz

Phase Accuracy: $\pm 0.5^\circ$ at 40 KHz

CrossTalk: -100 dB at 1 KHz

Residual Offset: $\pm 0.1\%$ FS Max

Total Harmonic Distortion (THD): -90 dB at 1 KHz

Bridge

Bridge Configuration:

- Full Bridge (6 Wires + Shunt line)
- Half Bridge (5 Wires + Shunt line)
- Quarter Bridge (3 Wires)

Bridge Voltage: 0 to $\pm 5V$ arbitrarily selectable and symmetrical excitation with 0.1% accuracy with excitation sense lines

Bridge Current: 60 mA per channel pair, with overcurrent protection

Completion Resistors (QB): 120 Ω and 350 Ω , $\pm 0.02\%$, 0.2 ppm

Completion Resistors (HB): 2.5 K Ω / 2.5 K Ω , $\pm 0.05\%$, 2 ppm

Zeroing / Offset Calibration: Automatic offset compensation with nulling DAC (HW) and zeroing (SW)

Shunt Calibration Resistor: 100 K Ω , $\pm 0.1\%$

Gauge Resistance	Shunt Reference
120 Ω	599 $\mu\epsilon$
350 Ω	1744 $\mu\epsilon$

Voltage

ICP: 24 V, 5 mA ($\pm 5\%$)

Transducer identification: TEDS v1.0, IEEE 1451.4

QUATTRO Hardware Specifications

Inputs

2 to 4 channels

ADC Resolution (Analog AAF): 24-bits

Sample Resolution (Digital AAF): 32-bit floating point

Coupling: AC/DC, DIFF/SE. ICP, TEDS

Anti-alias Filters: 100 dB protection, all ranges

Dynamic Range: 120 to 150 dB

Input Ranges: 0.1, 1, 10 V Full Scale (20 V optional)

Input Impedance: 100 k Ω symmetric for Diff.;
100 k Ω with 50 Ω shield to GND for SE

Max Input Voltage: 80 vPeak, 2.5 V rms Shield (SE)

CMRR: 60 dB (typical), $f < 40$ kHz

Amplitude Accuracy: +/- 0.020 dB (0.2% FS) at 1 kHz
for 59°F (15° C) < T < 104°F (40° C)

Amplitude Ripple: (Digital AAF) - 0.005 dB for
 $0 < f < f_S / 2.56$

Amplitude Droop: (Analog AAF) - 0.005 dB at 5 kHz;
0.010 dB at 25 kHz; 0.050 dB at 49 kHz

Residual Offset: +/- 0.1% FS AND not larger than 3 mV DC

Phase Accuracy: 0.05° to 0.5° for DC to 40 kHz

Crosstalk between Inputs: < -100 dB

Crosstalk between inputs and source: < -90 dB

THD: -100 dB @ 1 kHz

Minimum SampleRate: < 1 Hz

Maximum Sample Rate: 204.8 kHz (900 Series)
102.4 kHz standard and 204.8 kHz optional with 200 Series

Maximum Useful Frequency: 80 kHz (900 Series)
40 kHz standard and 80 kHz optional with 200 Series

Frequency Accuracy: 25 ppm

Time Accuracy: 25 ppm

Tachometer Input

1 channel

Maximum Frequency: 200 kHz

Input Range: +/- 24 V FS

Adjustable threshold, holdoff, prescaling

Outputs

1 to 2 channels

Dynamic Range: > 100 dB

Resolution: 24-bit

Voltage Range: 10 V FS

Output Current: 1 mA min., continuous short

THD: -100 dB @ 1 kHz

Output Waveforms: 65536 max blocksize for arbitrary;
unlimited for recorded (optional)

Chassis Detail

Depth: 5.6 in. 14.2 cm

Width: 4.0 in. 10.2 cm

Height: 0.9 in. 2.3 cm

Weight: 1.2 lbs (.54 kg)

Operating Temperature: 32 to 131°F (0 to 55° C)

Power: USB 2.0 Bus Powered

Lights: Input OK (4), Output Active (2), Trigger Signal (1),
DSP Active (1), USB Active (1)

Corporate Headquarters

1111 Spruce St.,
Riverside, CA 92507 USA
+1.408.437.0100
dataphysics.com

Data Physics Instruments

3100 De La Cruz Blvd.,
Suite 101
Santa Clara, CA 95054, USA
+1.408.437.0100

Asia Pacific

32 Segar Road #17-15
Singapore 677722
+65 96333545

Data Physics (France) S.A.

142 Avenue Joseph Kessel
78960 Voisins le Bretonneux
France
+33(0)1.39.30.50.60

Data Physics (UK) Ltd.

South Road, Hailsham
East Sussex, BN27 3JJ, UK
+44(0)1323.846464

