



## EDM 9.1

### Engineering Data Management Software Release Notes

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SPIDER VIBRATION CONTROL SYSTEMS (VCS)  
MULTIPLE-INPUT MULTIPLE-OUTPUT VIBRATION CONTROL SYSTEMS (MIMO VCS)  
EXPERIMENTAL MODAL ANALYSIS (EMA)  
DYNAMIC SIGNAL ANALYSIS (DSA)  
POST ANALYZER (PA)



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## RELEASE HIGHLIGHTS

### Introducing Spider-80Ti for Temperature Measurements (Supports RTDs and Thermocouples)

The new EDM 9.1 release and Spider-80Ti hardware supports RTD (PT 100) and thermocouple (k-type) measurements. An individual Spider-80Ti card supports 16 channels of measurements.

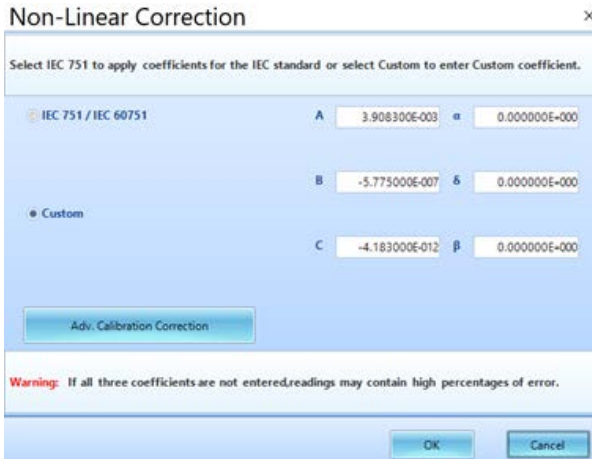


#### RTD Non-linear Correction Standard

EDM 9.1 has built-in non-linear correction for RTD PT 100 measurements which follows the IEC 60751 Standard. This ensures highly accurate measurements from RTD sensors.

Location ID	Measurement quantity	Engineering unit	Sensitivity	Input mode	Non-Linear correction
Tp1	Temperature	°C	N/A	RTD PT100	IEC 751/IEC607
Tp2	Temperature	°C	N/A	RTD PT100	IEC 751/IEC60751 Custom
Tp3	Temperature	°C	N/A	RTD PT100	IEC 751/IEC60751

EDM 9.1 allows users to set custom RTD coefficients for a custom non-linear correction. The A, B and C values can be entered under the custom option.



EDM 9.1 also provides advanced linearized offset correction over a range of temperatures under the Adv. Calibration Correction option. This creates a linearized offset correction between the two breakpoint values, further ensuring the accuracy of the calculations.

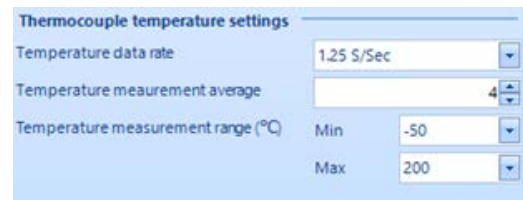
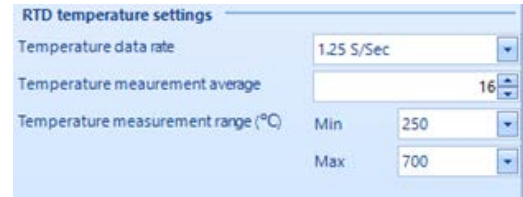
#### K-type Thermocouple Measurements and Cold Junction Compensation

EDM 9.1 and the Spider-80Ti features a built-in cold junction compensation routine that measures the ambient temperature with a high precision temperature sensor. The system uses this information to compensate for not having the cold junction physically at 0°C. The compensation allows the Spider-80Ti to use the NIST

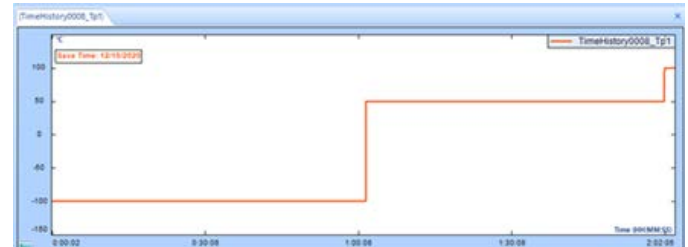
coefficients for the K-Type thermocouple measurements and helps EDM 9.1 accurately interpret changes in voltage measurements to the corresponding temperature measurements.

#### Temperature Measurements – User Selectable Sampling, Averages, Range-based Gain Adjustment and Numeric Display

EDM 9.1 introduces flexibility and options for users to tailor measurements according to an application. Users can set test parameters for temperature measurements independent of any other module present in the Spider system.



The system automatically sets the gain value to improve the accuracy of the measurements based on the temperature range set and expected inputs from sensors. All temperature measurements are recorded as time histories, which allows users to review past data during a current test run while actively collecting new live data. Live data can also be displayed in numeric form.



### Introducing a 16 Channel Strain Measuring Spider-80Gi Module

The new Spider-80Gi module is a low-cost strain measuring front-end that supports 16 channels in a single module (2 chassis slots) and uses compact break-out boxes and D-sub connections. The Spider-80Gi can interface with DC excitation sensors, MEMS sensors, strain gauges and other ratiometric and bridge-based sensors.



The Spider-80Gi combines with other Spider-80Xi front-ends to simultaneously acquire data from various sensors, including the Spider-80Xi, Spider-80SGi and Spider-80Ti.

The Spider-80Gi provides a cost-effective solution when measuring large number of simultaneous strain channels.

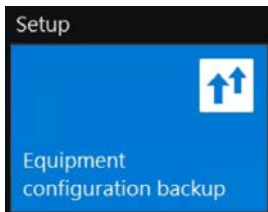
### Introducing Spider-101i and EDC Software – New Temperature and Humidity Controller Hardware and Software

The EDM 9.1 release introduces the rugged new Spider-101i controller accompanied with powerful new EDC software. The Embedded Device Controller (EDC) software supports various features for running temperature and humidity chambers.



The Spider-101i is a compact temperature and humidity controller. Featuring an industrial enclosure, the compact and robust Spider-101i device easily integrates with a temperature chamber.

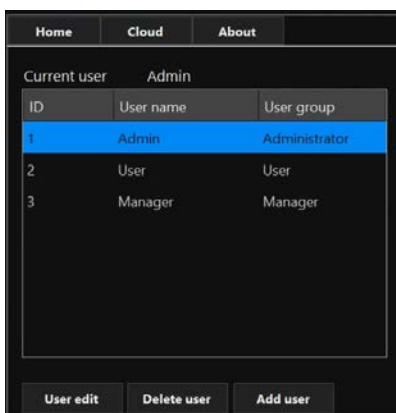
### Equipment Configuration Import/Export



Equipment configuration files specific to each chamber can be created and an option to import/export these files is available. The equipment configuration file can be created and easily ported to another system or software for powering up another test chamber with ease.

### Powerful Account Management on EDC

EDC software introduces three levels of account management tiers (Admin, Manager and User).

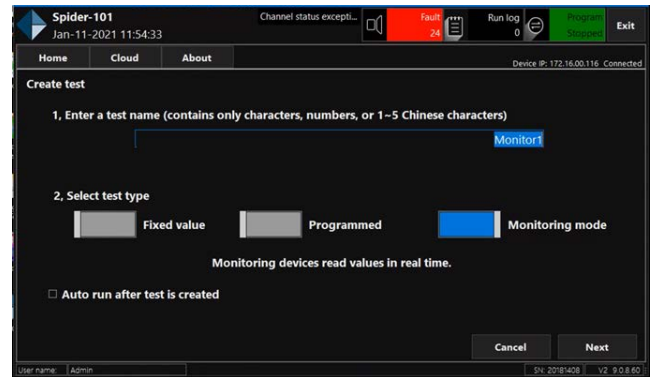


The tiered approach allows configuration of privileges for user types

to ensure a safe operation of the chamber and to avoid user errors.

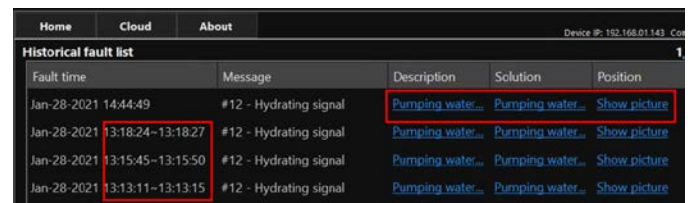
### Run Test in Monitor Mode

The Spider-101i and EDC software allows users to run tests in monitor mode.



This option uses the Spider-101i as a data acquisition system to monitor the temperature and humidity of a chamber while an independent controller is used to control the temperature and humidity test.

### Detailed Alarm Detection



The EDC software records the start and end of an alarm, provides detailed descriptions of the alarm, possible solutions of the alarm and components of the chamber that triggered the alarm. These convenient features included in EDC software allows users to view and address alarms quickly and easily.

### Support for Third-party Modules

EDC supports third-party modules to increase the number of channels for temperature, humidity, and digital inputs. The following modules are supported:

- DAM-3046C: 6 channels for RTD sensors
- DAM-3158A: 8 channels of current or voltage input, for humidity or pressure measurement
- DAM-3016D: 32 channels of digital input







scope of information exchange and data sharing to users within their network to ensure data security. This feature is useful for monitoring the progress and status of environmental tests with classified information.

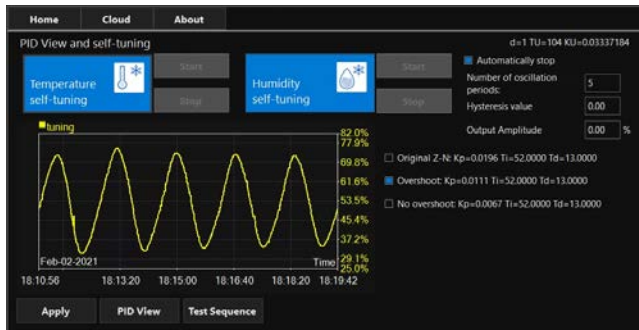
Crystal Instruments will continue investing in EDM Cloud services and will soon provide users with additional data visualization and mobile application features.

### Introducing Crash Control Test in EDM-VCS

The Crash Control test is a specialized version of TTH catering to vehicular incident testing standards. With the advent of smart vehicle technology, many testing standards have been developed to simulate the conditions of a vehicle suddenly braking or crashing, resembling a high displacement shock pulse.

Crash Control currently supports four hard-coded pulse configurations, based on the Half Sine Shock criteria listed in the Vehicle Incident GB testing standard.

### PID Self Tuning



The EDC software has PID self-tuning options for temperature and humidity.

### Introducing EDM Cloud – Cloud-based Test Monitoring and Storage

EDM Cloud is a premium web-hosted service provided for users to monitor the status of all vibration tests across multiple Spider controllers. EDM Cloud allows access to multiple users according to their customized account privileges to view the data and status of Spider systems. Lab administrators can simultaneously monitor multiple tests from anywhere in the world using EDM Cloud.

Storage expansion allows users to store all the required data and to share the test status and results with several individuals or groups. Support has been enabled for both EDM vibration tests and EDC temperature/humidity testing.

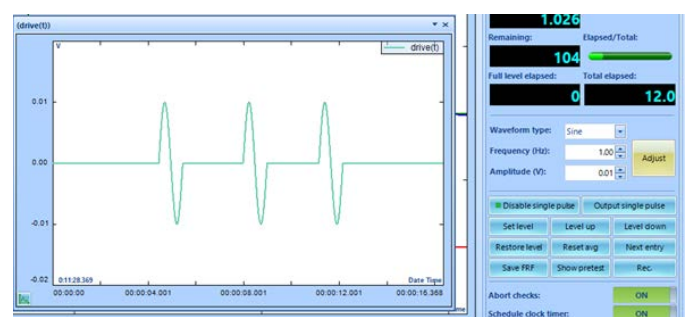
Test Name	Test Type	Test Description	System Information	Test Status	Time Elapsed	Run Count	Actions
DESKTOP-0981610	Amplitude	Resonance	VCS-0981610	Completed	0:00:00	1	View Test Report
DESKTOP-0981610	Amplitude	Resonance	VCS-0981610	Completed	0:00:00	1	View Test Report
DESKTOP-0981610	Amplitude	Resonance	VCS-0981610	Completed	0:00:00	1	View Test Report
DESKTOP-0981610	Amplitude	Resonance	VCS-0981610	Completed	0:00:00	1	View Test Report
DESKTOP-0981610	Amplitude	Resonance	VCS-0981610	Completed	0:00:00	1	View Test Report
DESKTOP-0981610	Amplitude	Resonance	VCS-0981610	Completed	0:00:00	1	View Test Report
DESKTOP-0981610	Amplitude	Resonance	VCS-0981610	Completed	0:00:00	1	View Test Report
DESKTOP-0981610	Amplitude	Resonance	VCS-0981610	Completed	0:00:00	1	View Test Report
DESKTOP-0981610	Amplitude	Resonance	VCS-0981610	Completed	0:00:00	1	View Test Report
DESKTOP-0981610	Amplitude	Resonance	VCS-0981610	Completed	0:00:00	1	View Test Report

EDM Cloud allows users to create their own email address accounts and to invite other coworkers to form a team with groups underneath. Tests can be shared amongst members of the same group after configuring the upload parameters in the EDM VCS desktop application. EDM Cloud allows users to save and share several aspects of the test, including Status, Run Log, and Test Reports.

EDM Cloud can also be deployed on local servers within an organization's network. This allows an organization to limit the



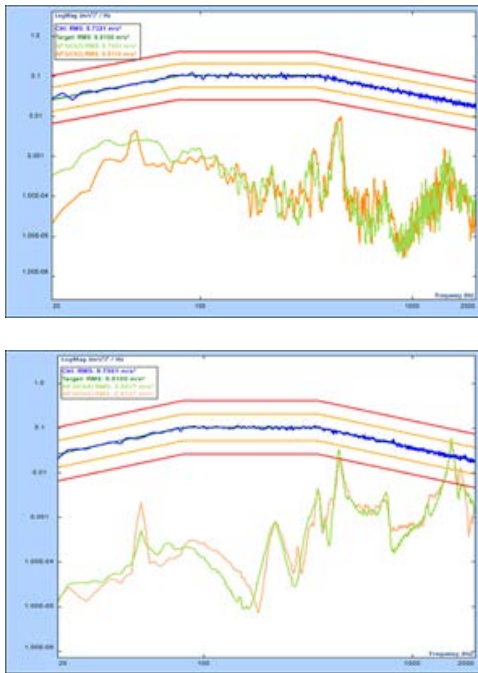
Crash Control is typically performed on a specialized long displacement. Due to the nature of the shock events, the shaker's armature may end up in a different ending displacement than its starting position. In order to accommodate such scenarios, the Crash Control test type also includes a second displacement channel and a manual means of sending pulses to re-adjust the displacement of the shaker back to neutral after each pulse.



### Introducing Control Null in MIMO Random

The Control Null feature allows users to perform single axis or dual axis vibration control tests on a three-axis shaker setup with a simple configuration setup in the software. With this feature, the software nulls the selected directions while maintaining the control in the desired direction(s). Sending the appropriate drives will minimize the target level of vibration for the suppressed direction(s) to achieve lowest possible response. The vibration in the dominant direction(s) will still be under control and executed at the desired target level(s).

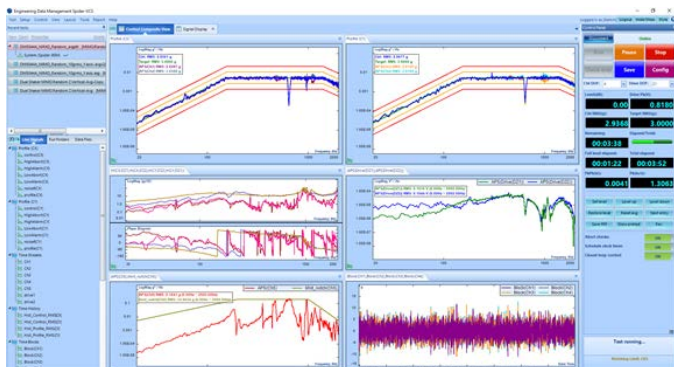
The following results of the MIMO Random with Control null and single shaker random control illustrates the effectiveness of the MIMO Random Control Null feature. The off axes vibration with the control null is suppressed by more than 70%, compared to the single shaker control case.



### Introducing Limiting in MIMO Random and MIMO Sine

#### MIMO Random – Limit

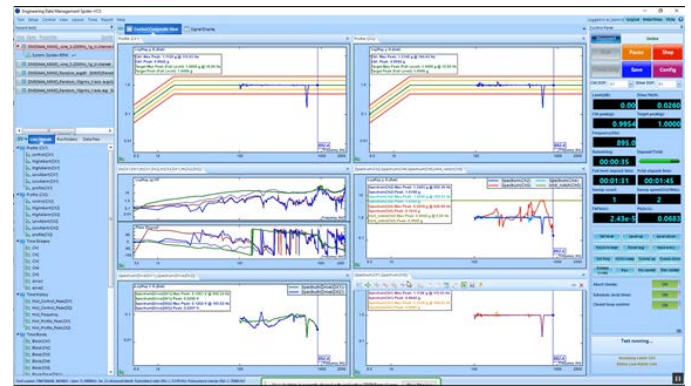
The limit feature of MIMO Random provides protection for the UUT. Users can set up the limit channel(s) on the DUT with an assigned profile. Once the vibration level on the limit channel exceeds the limit profile, the drives will be notched so that the limit channel vibration will not exceed the limit.



#### MIMO Sine – Limit

The limit feature of the MIMO Sine provides protection for the UUT.

Users can set up the limit channel(s) on the DUT with an assigned profile. Once the vibration level on the limit channel exceeds the limit profile, the drives will be notched so that the limit channel vibration will not exceed the limit.

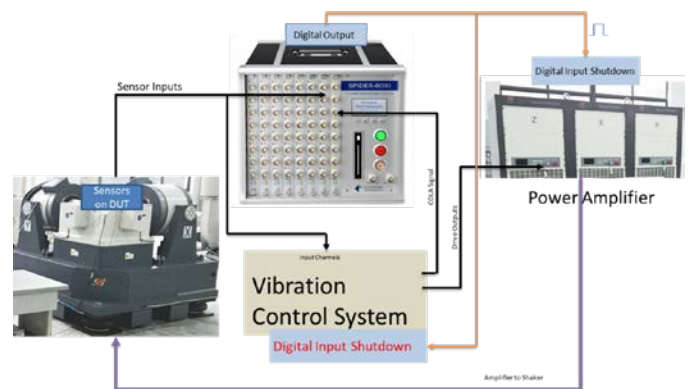


### Deploying Spiders as a Shutdown Protection System

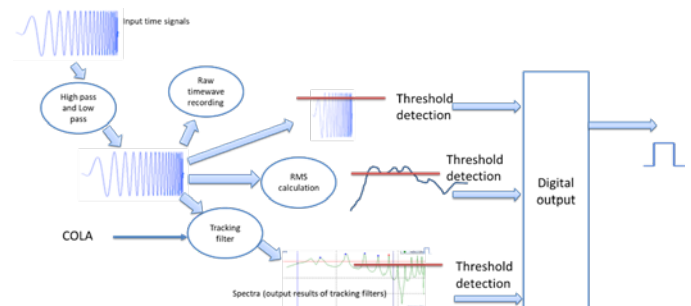
Spiders are reputed as excellent products for vibration control applications. The vibration control system typically runs the control algorithms and takes several milliseconds to respond when an abort condition is encountered. The reaction time to shut down the drive may cause severe damage to the Device Under Test (DUT).

To protect the DUT, a redundant shutdown protection system must be employed to continuously monitor the abort conditions and to abort the shaker/amplifier or the vibration control system within a small fraction of time.

The Spider platform of products can now provide redundant shutdown protection of a shaker system that is running a valuable DUT. The shutdown is achieved in under 10ms for single module systems and under 20ms for high channel count systems.

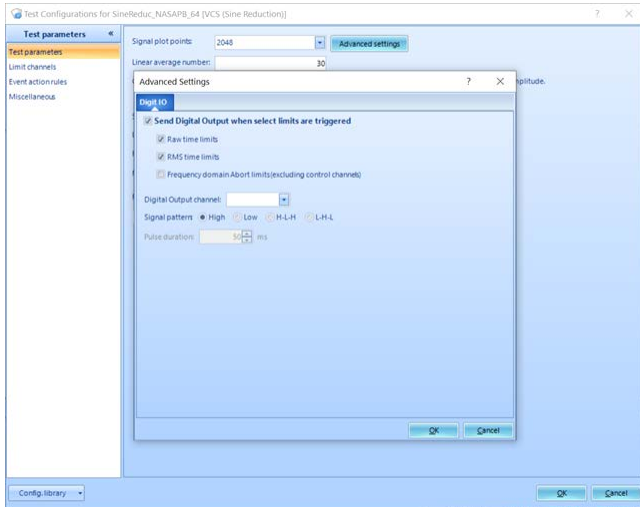


In addition, the Spider system can be attached as a redundant system to any of the current vibration control systems.



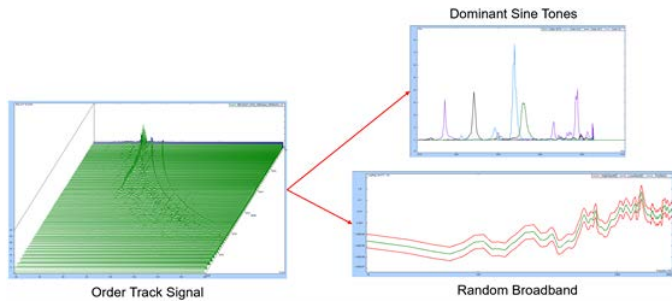
Users can define limits for raw time domain signals, RMS time signals, and frequency signals to trigger abort signals.

The availability of digital outputs on Spider products with configurable digital output signals enables the rapid communication of abort conditions with the principal vibration control system or the shaker/ amplifier system, providing an ideal shutdown protection system for our users.

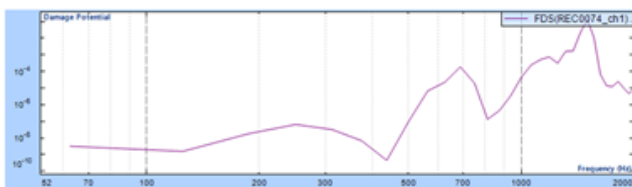


### Automatically Convert Time Domain Recordings to Random or Sine on Random Profiles with Post Analyzer (PA)

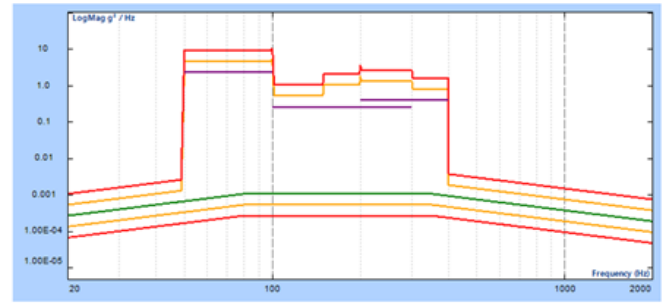
The new PA 9.1 version allows users to capture tach pulses and vibrations from rotating machinery and performs order analysis on the gathered data. Users can choose to further analyze the data to extract dominant sine tones and broadband spectrum.



Users are now able to combine the two spectral signals to create a sine-on-random signal or can use these profiles independently to excite the necessary profiles separately. In addition, users can choose to either use the profile as is or can perform accelerated life testing with FDS (fatigue damage spectrum). Users are allowed to input information about the total expected life of the DUT and the shortened testing time.



Fatigue Damage Potential



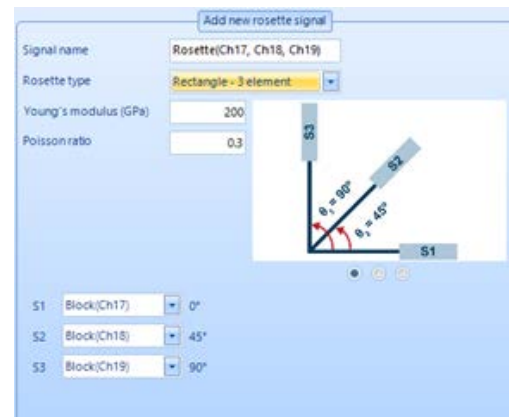
Accelerated SOR Profile

Based on user inputs and the analyzed signal, PA creates an accelerated SOR test profile with the equivalent damage of a total lifetime using the built-in FDS functions. This accelerated profile and its subsequent parameters imports into a VCS test with one click and is ready to run on a shaker.

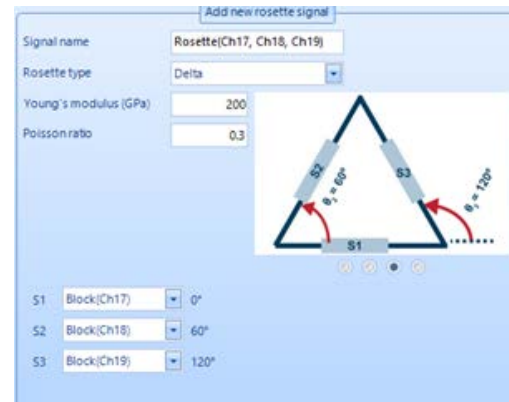
### Introducing Rosette Configuration Measurement of Strain Gages

Rosette measurements are vital in strain data acquisition, and the release of EDM 9.1 provides capabilities to measure rectangular, delta or custom rosette configurations. This addition to EDM DSA allows users to measure the complete strain state of a DUT's surface.

#### Rectangular Rosettes

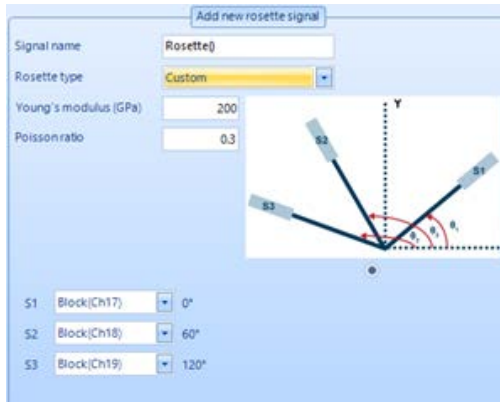


#### Delta Rosettes



#### Custom Rosettes





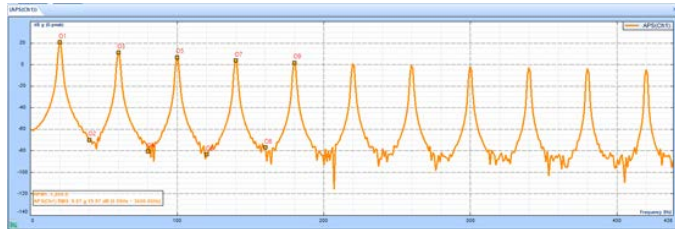
Various measurements including Principle Stress and Strain, Principal angle, Shear Stress and Strain are calculated from the measurements.

With these options the user can chose the option most convenient to their application and measure the strain on the DUT. The system also calculates the other stress and strain states associated with the measurements.

### Introducing Tacho Tracking Test Type in EDM-DSA

A new test type "Tacho Tracking" is being introduced in the Dynamic Signal Analysis (DSA) of EDM 9.1 release.

This is an easy to use diagnostic and troubleshooting tool test type for rotating machinery. The tachometer signal is used to identify the user selected orders on the APS spectrum and keeps track of the order values as the RPM changes.



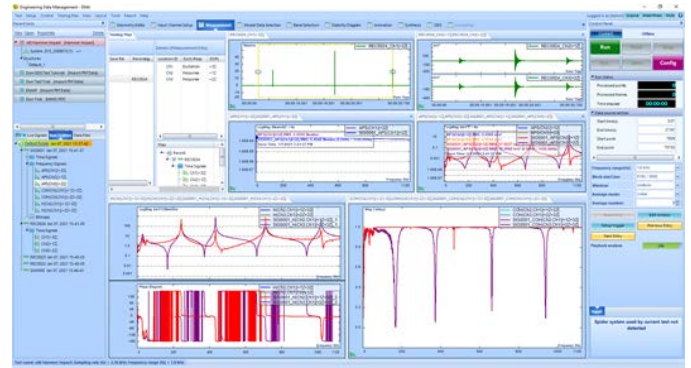
Signal Name	Select Tacho	AVG	Display Format	Frequency amplitude	Freq.Low [Hz]	Freq.High [Hz]	X1	X2	X3	X4	Order
APSD-0	Ref tacho FPM	Acceleration	PPS	11.845	0.00	0.00	11.876	7.2686	7.2686	2.2175	0
APSD-1	Ref tacho FPM	Acceleration	PPS	11.851	0.00	0.00	11.578	7.2987	7.2987	2.2177	0
APSD-2	Ref tacho FPM	Acceleration	PPS	0.0024048	0.00	0.00	4.1797E-05	3.034E-05	3.034E-05	2.719E-05	0
APSD-3	Ref tacho FPM	Acceleration	PPS	0.0027678	0.00	0.00	5.0017E-05	3.348E-05	3.348E-05	3.124E-05	0
APSD-4	Ref tacho FPM	Acceleration	PPS	0.0026349	0.00	0.00	5.1917E-05	3.028E-05	3.028E-05	5.6437E-05	0
APSD-5	Ref tacho FPM	Acceleration	PPS	0.0027562	0.00	0.00	5.0011E-05	5.6967E-05	5.6967E-05	4.9079E-05	0
APSD-6	Ref tacho FPM	Acceleration	PPS	0.0028874	0.00	0.00	5.0013E-05	7.2574E-05	7.2574E-05	3.5748E-05	0
APSD-7	Ref tacho FPM	Acceleration	PPS	0.002782	0.00	0.00	5.0011E-05	9.954E-05	9.954E-05	5.3488E-05	0

A simplistic visualizing tool allows viewing the selected orders for each channel in a user specific measurement quantity. The test type allows use of both Tachometers and allows selection of any of the Tachometer to calculate and represent the data.

### Introducing Playback Analysis in Modal Analysis

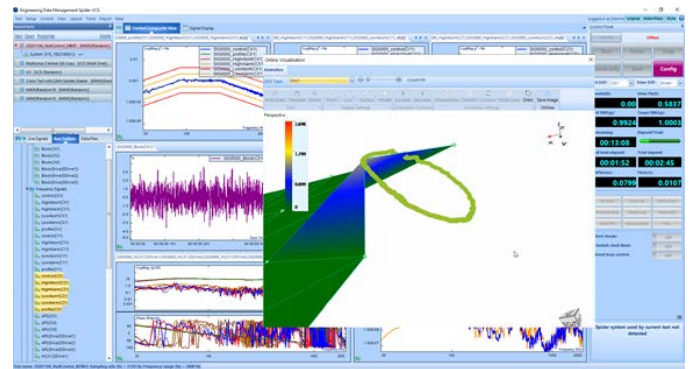
In EDM 9.1, a playback analysis feature has been added which allows the user to import recorded time signals and process these modal measurements to obtain the related frequency domain signals. This feature allows the user to carry out all the field measurements in a single go before post-processing and analyzing the measured data on a lab PC. This is available in the Hammer Impact, MIMO FRF and Operational Modal Analysis test types to support ambient excitation data and experimental data obtained

through hammer impact or shaker excitation. This feature makes the modal measurements easier, faster, and simpler for the user.



### Introducing Orbit Plots in Modal Analysis

This feature helps users observe the phase and magnitude relationship between the different directions. The time data from the different accelerometers can be used to trace an orbit plot. If the magnitude of the response is the same in all directions with a phase difference of 90 degrees in any of the two directions, then a circular trace is obtained as shown below. Similarly, if the magnitudes are different, the circle would be elongated into an ellipse. This feature is provided in EDM Modal, VCS and DSA software.



### Spider-80SG Supports IEPE Sensors

EDM 9.1 introduces IEPE measurements on the new Spider-80SG (version 2) front-end. This new feature allows the Spider-80SG (version 2) to virtually support all types of sensors including IEPE Sensors, DC Excitation sensors, MEMS sensors, strain gauges and other ratiometric and bridge-based sensors.



The new Spider-80SG (version 2) has BNC terminals to interface directly with BNC cables or through the breakout box for open wire terminals.

### Introducing In-line Charge Amplifier Support for Spider-80SG & Spider-80SGi

EDM 9.1 enables the Spider-80SG and Spider-80SGi to use in-line charge amplifiers to support charge sensors. Users can enable this input mode by navigating to **Setup->Input Channels->Input Mode** from the drop-down menu to select **In-Line Charge Converter**.

	On/Off	Location ID	Measurement quantity	Engineer's unit	In-Line charge converter sensitivity	Sensitivity	Power supply	Input mode
16	<input checked="" type="checkbox"/>	Ch16	Acceleration		2 mV/pC	4903.32500 (pC/g)	2.5V	In-Line Charge Converter
17	<input checked="" type="checkbox"/>	Ch17	Acceleration		2 mV/pC	4903.32500 (pC/g)	2.5V	In-Line Charge Converter
18	<input checked="" type="checkbox"/>	Ch18	Acceleration		2 mV/pC	4903.32500 (pC/g)	2.5V	IEPE
19	<input checked="" type="checkbox"/>	Ch19	Acceleration		2 mV/pC	4903.32500 (pC/g)	2.5V	AC-Differential
20	<input checked="" type="checkbox"/>	Ch20	Acceleration		2 mV/pC	4903.32500 (pC/g)	2.5V	In-Line Charge Converter
21	<input checked="" type="checkbox"/>	Ch21	Acceleration		2 mV/pC	4903.32500 (pC/g)	2.5V	Bridge based Sensor

### Introducing "EDM-Vibration Utilities" Mobile App

Crystal Instruments in partnership with our sister shaker company Sentek Dynamics announces the release of the Vibration Utilities mobile app on iOS and Android. This app provides calculation features for sizing your vibration profile (Random, Sine or Shock) and searches through our catalogue of shakers and controllers for the best fit.



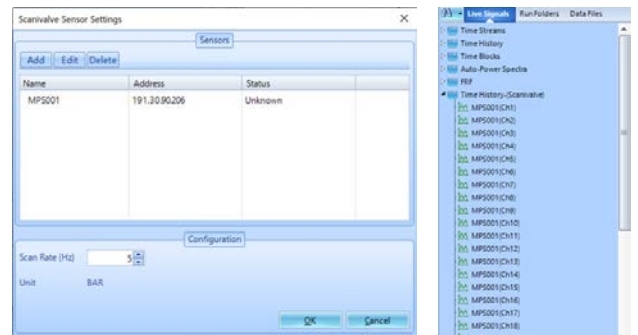
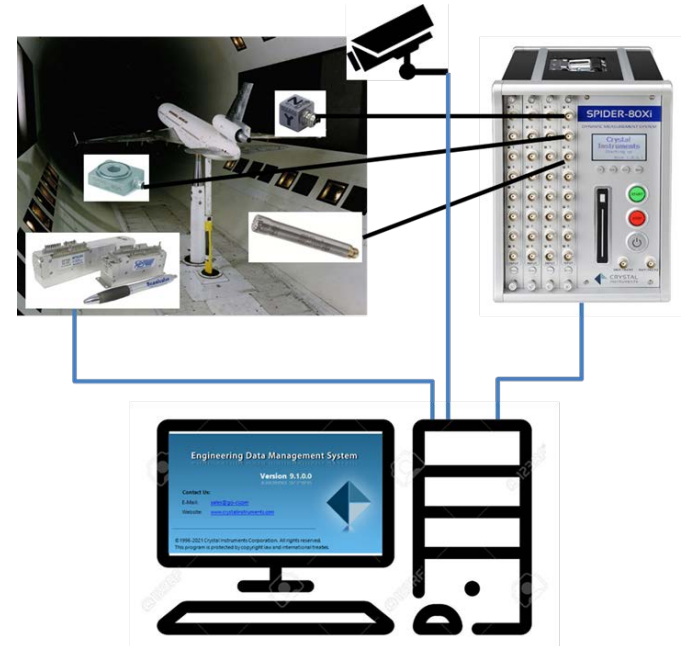
Enter your vibration profile into the Vibration Utilities app to calculate the projected force, acceleration, velocity, and displacement needs. Add in the mass of the test object and the app will search through its catalogue of shakers for the most appropriate one. Attributes such as the shaker force rating, velocity and displacement limits, and armature mass will be accounted for in the calculation.

### Introducing Integration of Scanvalve Pressure Sensors with EDM (Wind Tunnel Applications)

Scanivalve sensors are the most widely used sensors for pressure and temperature measurements in wind tunnel applications.

A wind tunnel set up typically requires a wide range of sensors including accelerometers, strain gages, microphones, pressure transducers, temperature sensors, etc.

The Spider range of products are optimally designed to accurately acquire data from accelerometers, microphones, strain gages and a wide range of strain gage based or IEPE sensors. The additional support for Scanivalve sensors combined with the powerful Spider systems provides a complete package for wind tunnel applications.



This feature supports reading pressure and temperature data from any number of Scanivalve sensors. Each Scanivalve sensors supports 64 pressure channels and 8 temperature channels.

EDM-DSA 9.1 allows users to add all sensors connected on a network, configures the acquisition parameters of sensors, collects and displays live data from sensors, and also supports recording data from sensors.

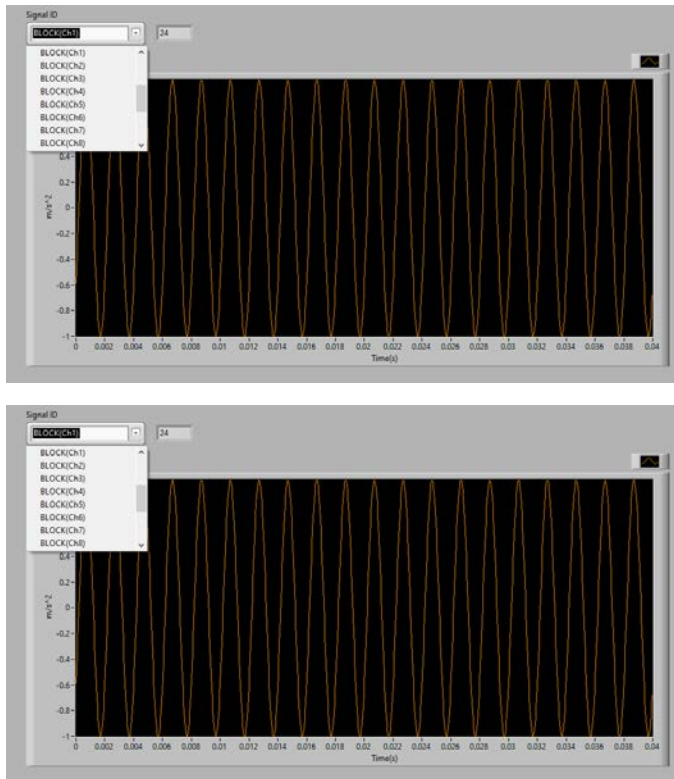
### Introducing Spider LABVIEW Utility

The Spider platform of products is equipped with a DSP core processor that handles data acquisition and processing.

Users can configure the analysis parameters of a Spider using

LabVIEW. Raw data along with processed data can be visualized or saved through LabVIEW.

The EDM 9.1 release now supports the FFT Analysis test through LabVIEW. Functions such as creating a new test, setting up the input channel table, retrieving live data, initiating recording commands, and downloading recorded raw time data are available.



Real-time time and frequency data can be used through LabVIEW for saving or any post processing applications. Spider LabVIEW Utility includes several examples and virtual instruments (vi) to configure the Spider with a user’s desired settings and to receive/visualize data.

LabVIEW helps users control a wide range of industrial equipment through the status of sensors read by Crystal Instruments’ Spider systems.

The Spider product line includes front-ends such as the Spider-80SG that acquire data from a wide range of sensors including strain gages or systems like the Spider-80Ti that connect to RTD and thermocouples for temperature measurements. The addition of LabView to the Spider product line supports a wide range of sensors to be read, processed and successfully deployed in large industrial and production systems.

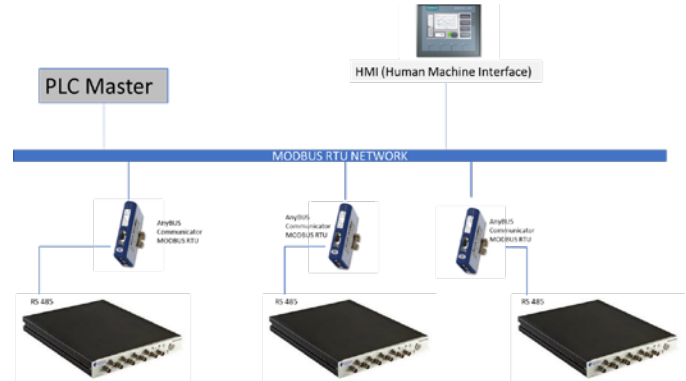
### Introducing Send Data Over PLC Networks

Spectral Analysis in real-time and using its data for industrial automation has been increasing in recent times. Spectral Analysis on several critical machines can identify failing machines or failing components within the machines to ensure timely repairs and results in maintaining high productivity and safety.

The Spider platform of products is a popular choice for a wide range of applications requiring real-time spectral analysis. The Spider-80X and Spider-80SG support a wide range of sensors including strain gages, accelerometers, DC sensors, MEMS sensors, and

microphones that connect to the system to perform real time processing.

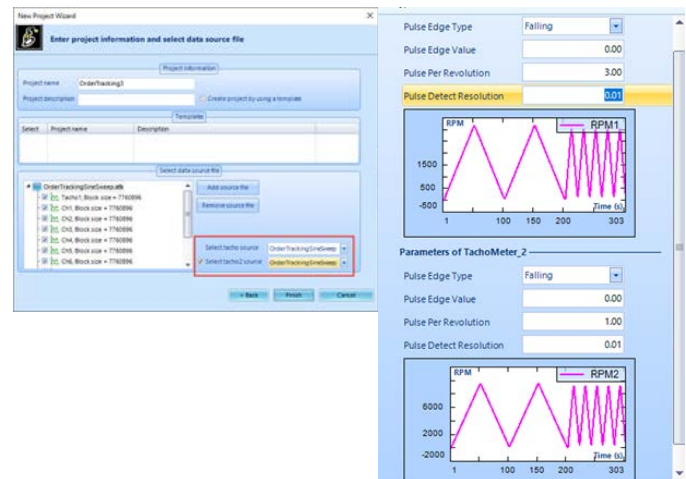
With the help of a built-in DSP core within the Spider, once configured, the Spider can run and perform the desired spectral analysis without the need of a PC. The relevant results in both time and frequency domain are readily available that could be used by machine diagnostics or the PLC to take necessary actions, when needed.



The Spider devices that are equipped with a RS 485 port, including the Spider-81, Spider-80X, Spider-80SG, Spider-80T, can be successfully deployed within the Industrial Automation networks through an Anybus communicator. The Anybus communicator acts as a bridge between the Spider and PLC to convert data into a desired format. The Anybus communicator is available for a range of protocols including PROFIBUS, MODBUS RTU, MODBUS TCP, Ethernet/IP, which enables the use of a Spider over any of the supported types of networks.

The introduction of this function allows users to customize data sent over a PLC including status, statistics or alerts based on time or frequency data. This feature equips the Spider system as an ideal choice for applications requiring continuous monitoring of industrial equipment.

### Post Analyzer Supports Simultaneous Order Analysis with Two Tachometers

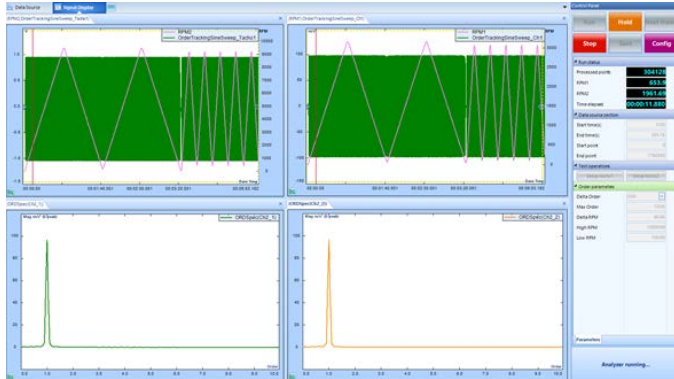


Order tracking applications sometimes require two tachometers to simultaneously obtain RPM data from two dependent or independent shafts. Order re-sampling is typically accomplished using one of the tachometers. Using both tachometers to simultaneously order sample the input data into two streams derives order spectrum



values from each tachometer which greatly simplifies the order analysis process. This is an immensely useful feature where independent shafts are contributing to the vibrations on the test object.

Spider systems consist of two dedicated tachometer channels that can continuously record raw time data. The Spider-20 allows one of the input channels to be used to record data from the second tachometer.

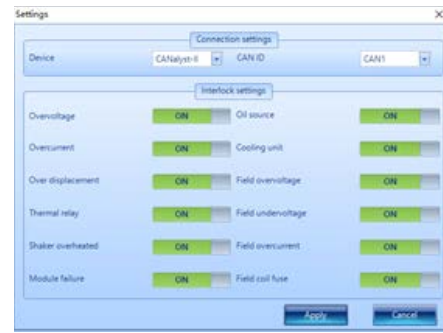
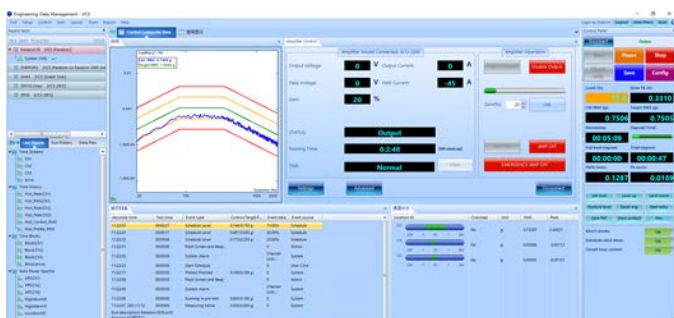


Post Analysis (PA) perform Order Analysis with this data by simultaneously using both tachometers. Two sets of order analysis signals are available for each channel, including the order spectrum, band RMS spectrum and order tracks.

## NEW FEATURES

### New Features in EDM-VCS Vibration Control Software Introducing Amplifier Control Software in EDM-VCS

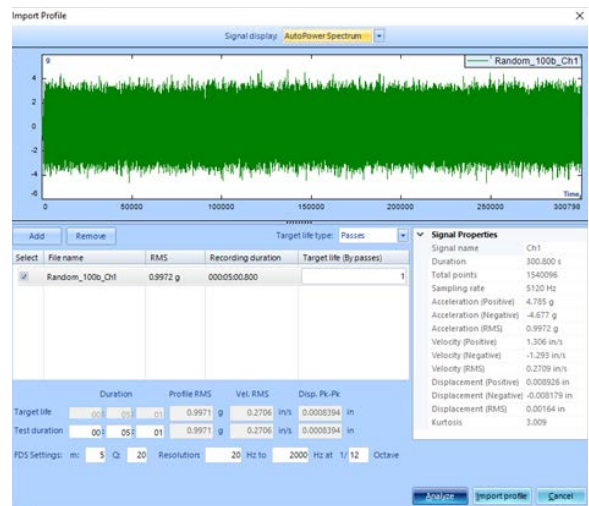
The amplifier control software is designed for specific Sentek Dynamics amplifier models. It features a flexible display, a user-friendly UI, and an interlock feature to prevent or stop the controller from running when the amplifier is not in an operating state.



### Ability to Analyze Multiple Waveforms to Generate FDS Profile

The **Analyze from Signal** option under the **Test Profile** page opens a dialog to analyze and import a previously recorded time stream using Fatigue Damage theory. It is useful for calculating a Random PSD containing the same fatigue damage levels as the time stream, with an additional feature to extrapolate the testing time duration to a lifetime duration.

At a high level, the time domain signal data is processed into a Random PSD spectrum. It then converts the spectrum into Damage Potential using criteria proposed by Henderson and Piersol 95. Multiple time waveform recordings can be combined together, and then the final spectrum can be scaled.

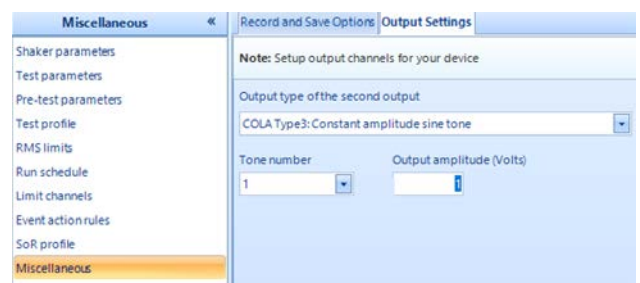


Given the length of the recording (Record file), EDM can replicate the signal to simulate a lifetime of environmental stress (Target life), in the desired testing time span of (Test duration).

$$\frac{RMS_{Test}}{RMS_{Life}} = \left( \frac{T_{Life}}{T_{Test}} \right)^{1/m}$$

### Introducing New Type of COLA Output for SoR Test

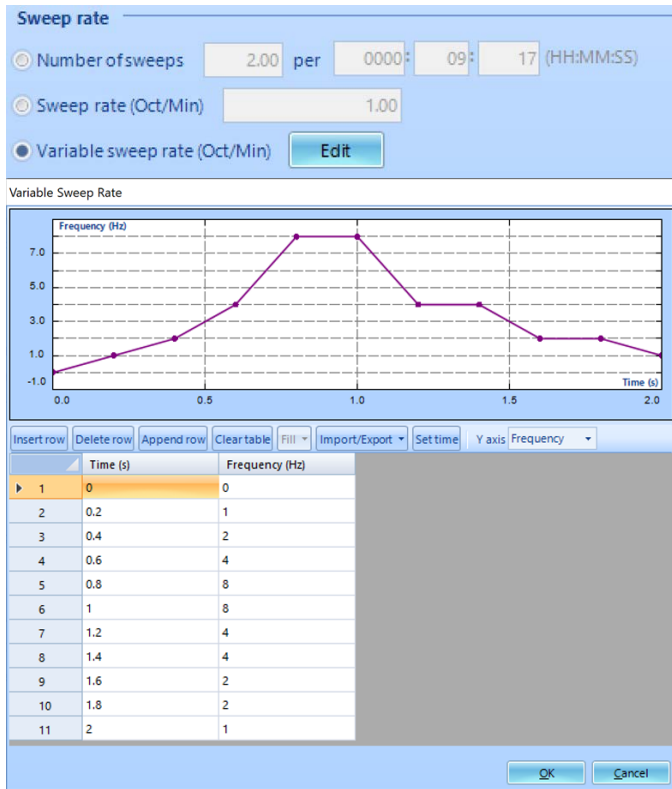
A sine wave with constant amplitude and frequency following any of the sine tones of an SoR test.





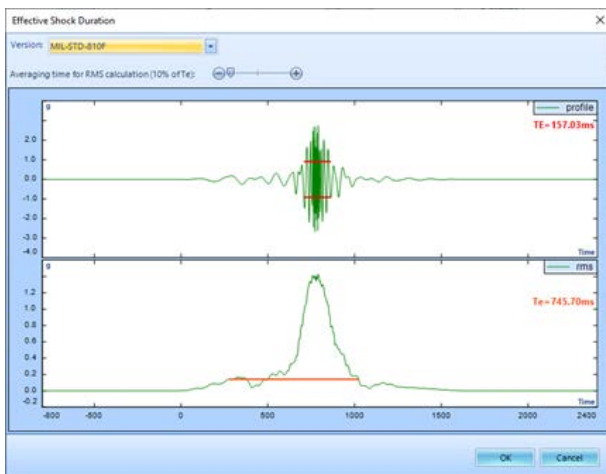
**Introducing Variable Sweep Rate of a Sine Tone in SoR**

Variable sweep rate of each tone in a SoR profile is introduced in the EDM 9.1 release.



This feature helps users accurately simulate the rotating speed of a real-world object with sweep speed that is typically variable.

**Te & TE Calculations Support MIL-STD-810 Variants (810F, 810G, 810G + CHG1, 810H)**



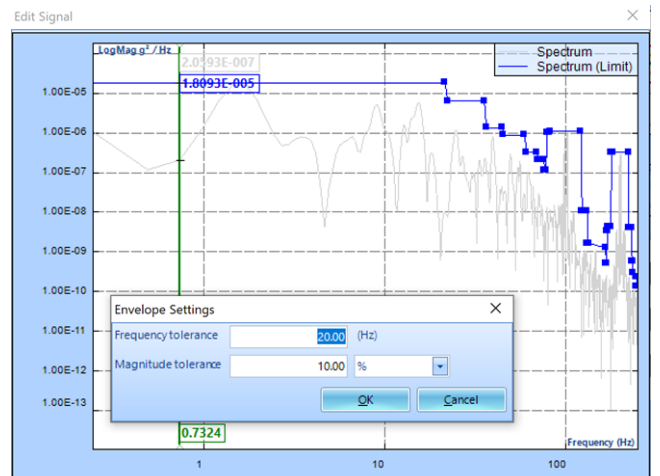
**Te and TE** are two standards for measuring the length of a shock pulse, dictated by MIL-STD-810. The exact methods of calculation depend on the version of the standard, as shown below:

	Te	TE
MIL-STD-810H MIL-STD-810G + CHG1 MIL-STD-810G MIL-STD-810F	<p>Te is defined from the zero crossing for the first measurement acceleration “above the instrumentation noise floor” until the perceived termination of the shock.</p> <p>The minimum length of time containing the RMS time history amplitudes above 10% of peak RMS amplitude.</p> <p>The averaging time for the RMS computation is 10-20% of Te</p>	<p>The minimum length of time containing any time history magnitudes above <math> A_{pk}  / CF</math></p> <p><math> A_{pk} </math> is the shock peak magnitude</p> <p>CF is the Crest Factor, in small intervals over the duration <math>T_e</math>, (e.g. <math>T_e / 10</math>). It is the maximum computed value across all intervals.</p> <p>Crest Factor is the ratio between peak / RMS. The minimum length of time containing any time history magnitudes above <math> A_{pk}  / 3</math></p>

As both versions of the MIL-STD-810 definition are slightly open-ended, the user will need to provide some calculation parameters to calculate an exact number for both  $T_e$  and  $TE$ .

The general calculation approach in both cases is to display a plot of both the pulse time waveform, and a frame-by-frame processed version of the pulse (calculating either the RMS or Crest Factor, depending on the MIL-STD-810 version). Both plots are then analyzed to derive the  $T_e$  and  $TE$  estimates.

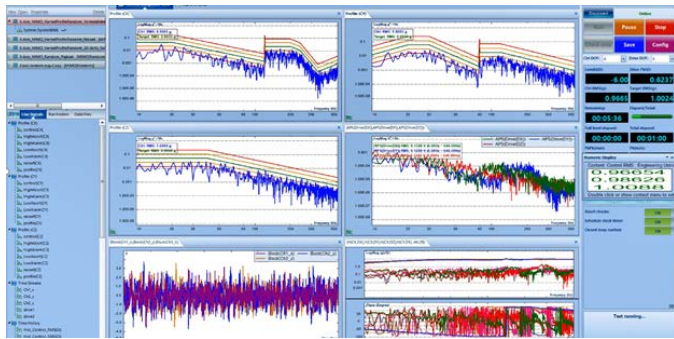
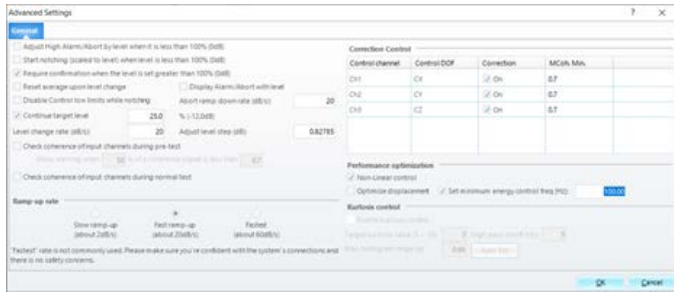
**Easily Create Envelope of Imported Spectrum Signal to Create a Random Profile**



A random profile is now be easily generated using an existing spectrum signal.

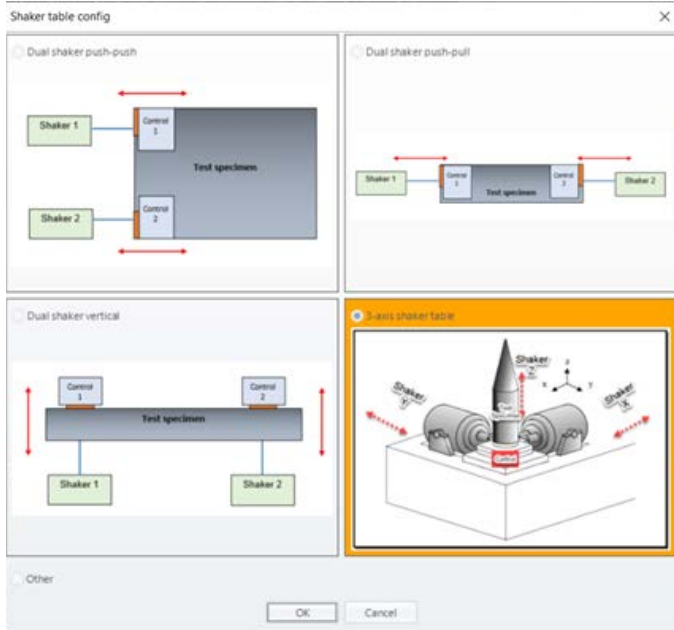
## New Features in MIMO Vibration Control Software Introducing Minimum Energy Option in MIMO Random

The minimum energy option of MIMO Random aids in handling the nonlinearity of a shaker table to result in a fast convergence of control.



## Visually Selecting Shaker Table Config in MIMO VCS

For each MIMO control type, the addition of a shaker table configuration selection window provides users with help to visually select from the available configurations. The test configuration is much easier and allows users to select from a list of pre-configured sets (e.g., push-push, push-pull, 3-axis, etc.)

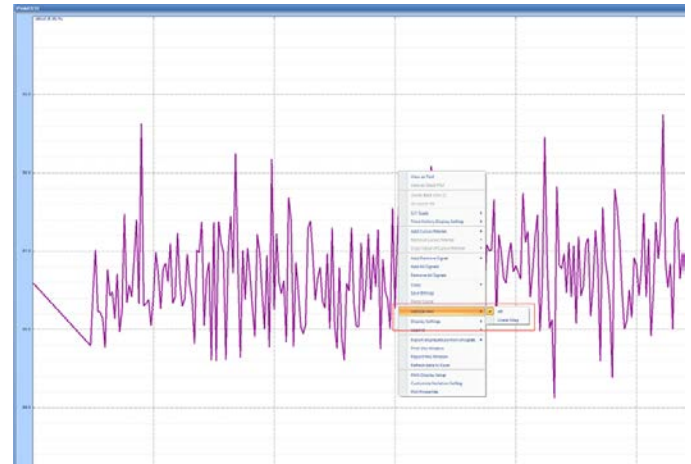


## New Features in EDM Dynamic Signal Analysis

### Ability to Plot Sound Pressure Time Data in dB

Sound pressure data is typically analyzed through octaves and is typically displayed in dB with reference to 20  $\mu$ Pa. In some applications, such as measuring the instantaneous sound pressure levels from a gunshot or a blast, it is necessary to display the time

data in dB to easily identify the instantaneous sound pressure levels.

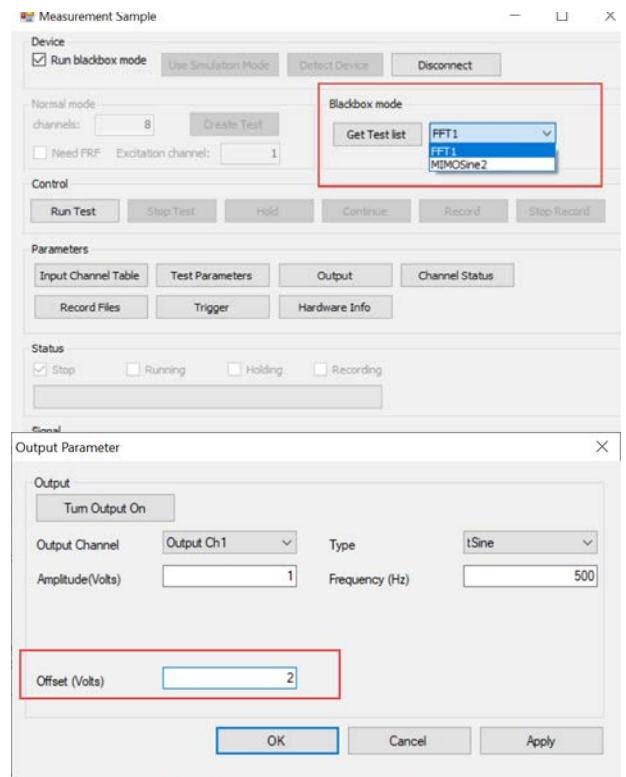


EDM 9.1 introduces a feature to display the Peak/RMS Sound Pressure level time data to be plotted using dB.

### DSA API Capability to Select and Run Black Box Tests

Black Box mode is the most powerful mode offered by Crystal Instruments where a Spider can run independently of a PC and still perform all calculations in addition to saving and recording processed or raw signal data.

EDM also has an option to define several tests or configurations and upload it to Black Box mode. With EDM 9.1, the API now has the ability to select one of the desired configurations and run the Spider in the Black Box mode.

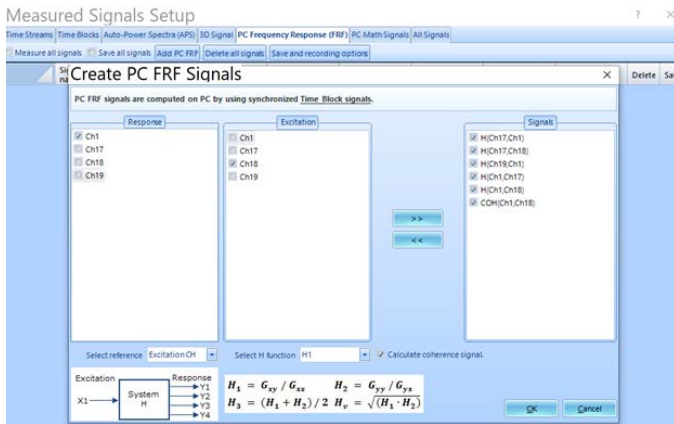


This greatly simplifies running tests and acquiring data from Spider through customized or integrated software applications.

Other notable enhancements to the API include the ability to select the DC Offset to be output along with the desired signal.

### Introducing PC FRF Signals with Spider-80SG/SGi

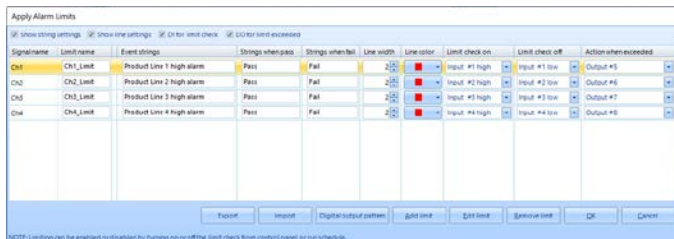
The new EDM 9.1 allows PC FRFs to be computed on the Spider-80SG channels and also cross computed between the channels of the Spider-80SG, Spider-80SGi and the Spider-80Xi. Under **Setup->Measured Signals->PC Frequency Response (FRF)**, the various combinations of FRF signals to be calculated can be added. Coherence between these channels can also be calculated.



### Digital Inputs to Enable/Disable Specific Limit Checks

The alarm limit feature in EDM-DSA is a widely used feature for production testing to qualify a product. Dynamic signal analysis (DSA) allows users to create multiple limits for each signal on each channel.

When deployed under production testing, it is much easier to use digital inputs on the Spider to designate certain actions. One of the primary actions is to enable or disable certain limit checks to ensure that limits are being compared to only the desired signals at any time.



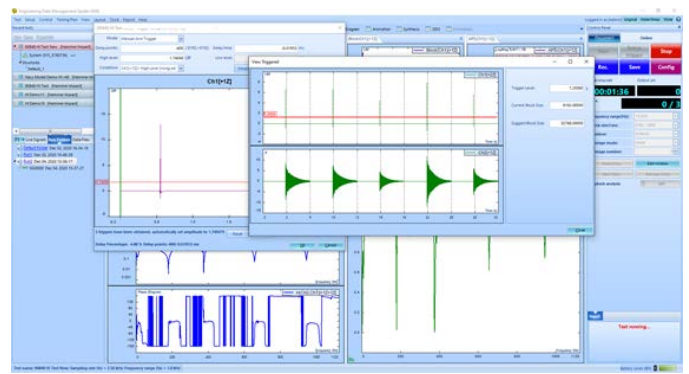
This new feature in EDM 9.1 allows users to select specific digital inputs to enable or disable each limit.

Thus, users can configure all the desired limits and enable or disable them using only digital signals and without having to use EDM software. This ensures switching limits is a seamless and fast process as desired by those working in a production line test setup.

### New Features in EDM-Modal

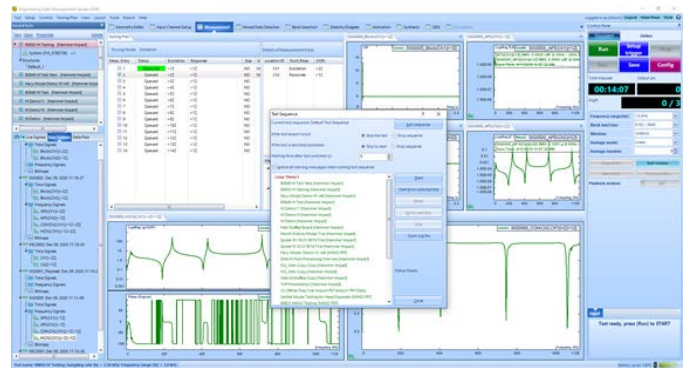
#### Added Suggested Trigger Level and Block Size

Setting an appropriate trigger level with a manual arm trigger guides the user in avoiding measurements triggered by noise. This feature helps in prevent the setup of higher-level triggers. By averaging a few impact measurements, the software suggests an appropriate trigger level for the modal test. The block size suggestion observes the response decays and suggests an appropriate block size to help users avoid implementing windows. These user-friendly suggestions help with modal hammer impact testing in EDM Modal.



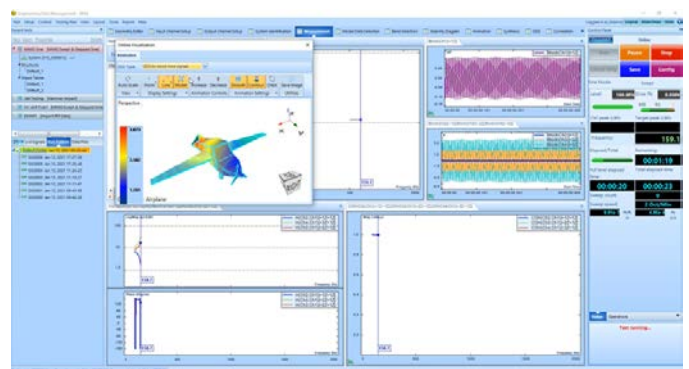
### Introducing Test Sequence in Modal Analysis

The test sequence in EMA software can be used to run different tests lined up by the user. This helps users execute different modal tests that have been setup experimentally without any manual operation. The test sequence can also be used to loop the different tests. This feature can be used to test the reliability and stability of high channel count systems for long hours of operation.



### Optimization of Online Visualization Capabilities

The online visualization feature in the EMA suite has been optimized to guide the user while executing the test in real-time. This feature offers the ability to animate decimated time signals, block signals and provides an orbit display. Using this data to visualize the deformation of a structure in an online test assists the user in optimal measurement point selection for the unit under test.

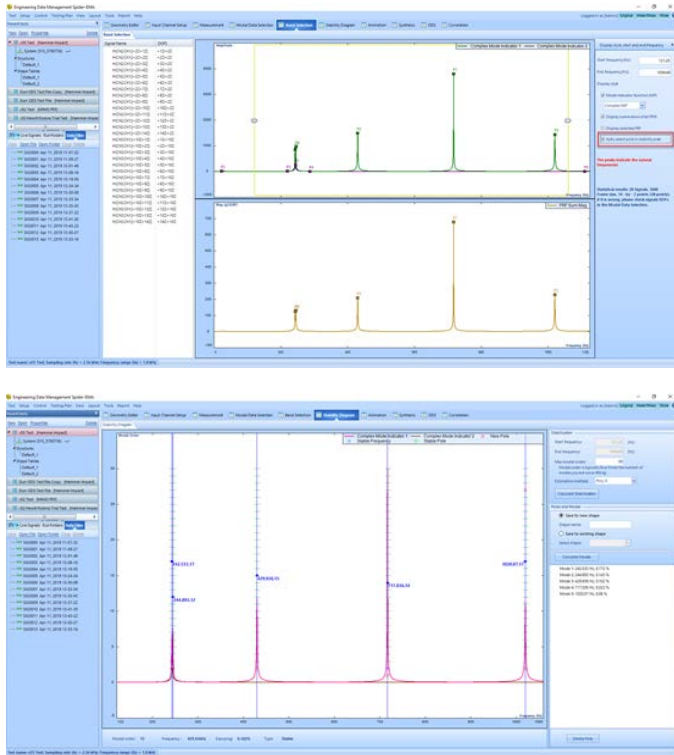


### Automatic Pole Selection

The user obtains the modal characteristics of the unit under test by curve-fitting the measurement FRFs. Choosing a stable pole helps in ensuring that the chosen mode has a stable frequency, stable damping, and a stable mode shape. This process could be tricky for a new user as there are a few parameters to setup. The new feature of automatic pole selection in EMA suite makes this process significantly easier by automating the procedure. The modes with



stable poles are identified by the software and automatically chosen to display the natural frequency, damping and mode shapes.



### Optimization of Testing Plan

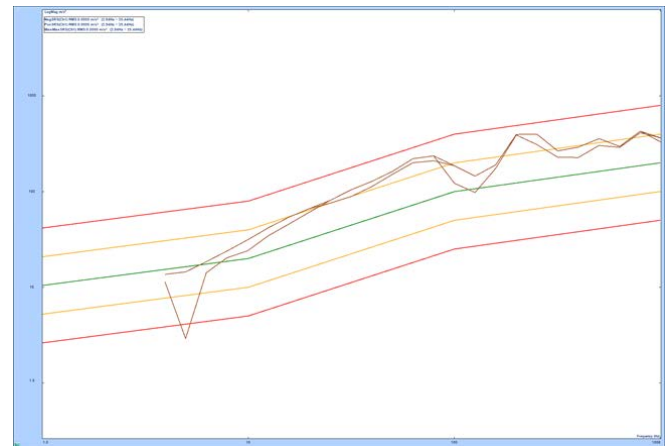
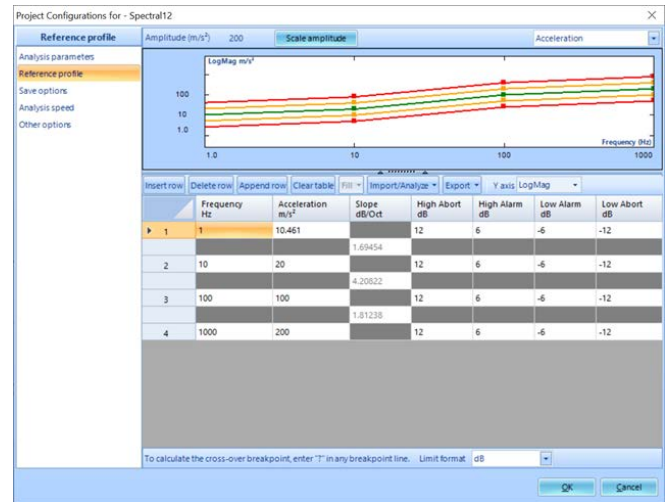
Measurements acquired online and those that are recorded and imported for post processing are automatically loaded into the testing plan and associated with their respective measurement entries. The recorded time signals can be opened for post processing and the associated post analysis signals will be automatically saved to the corresponding measurement entry.



### New Features in Post Analyzer

#### SRS Reference Profile Includes Alarm and Abort Limits

Post Analyzer now includes SRS-Alarm and Abort limits. This allows users to define two levels of thresholds.

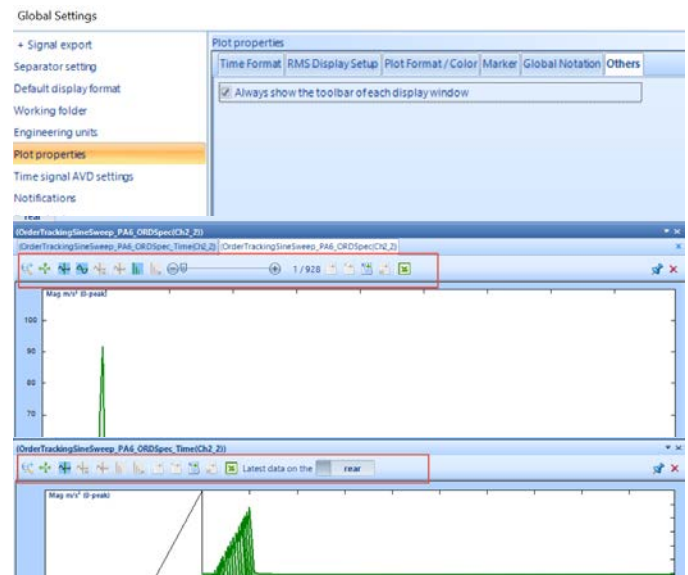


Both the upper bound and lower bound reference limits can be defined for alarm and abort limits.

#### Dock the Signal Display Toolbar by Default

Post Analysis operations typically require the graphics display toolbar which provides users with a convenient menu to modify the display parameters, move through several frames of saved signals, zoom in/out, plot cursors/markers, etc.

Docking the toolbar by default makes it very convenient to use the most basic operations with ease.



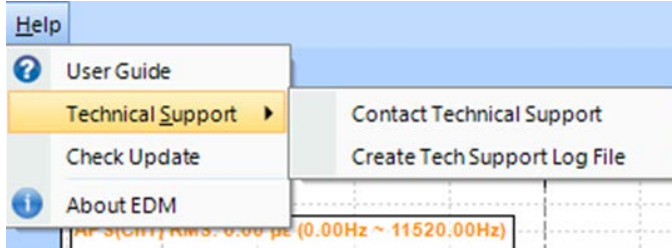


PA 9.1 provides an option that docks the signal display toolbar by default instead of having to manually dock it to each signal window.

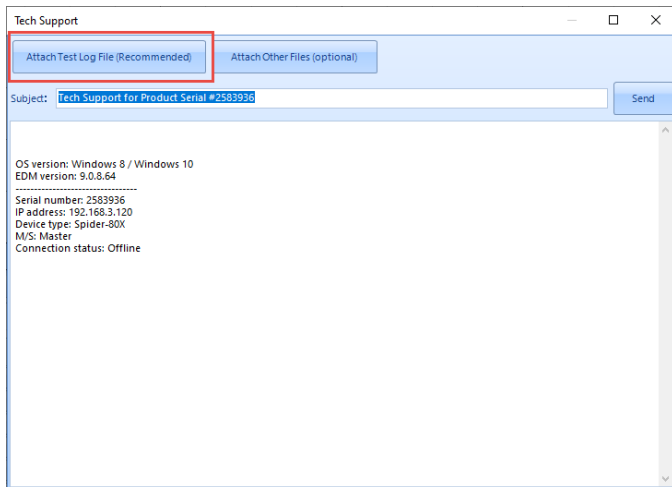
## New General Features

### Introducing a Tech Support Log File

Providing excellent technical support is a primary goal at Crystal Instruments. Software enhancements are developed to enhance and simplify technical support for users and technical support staff to understand and quickly resolve issues.



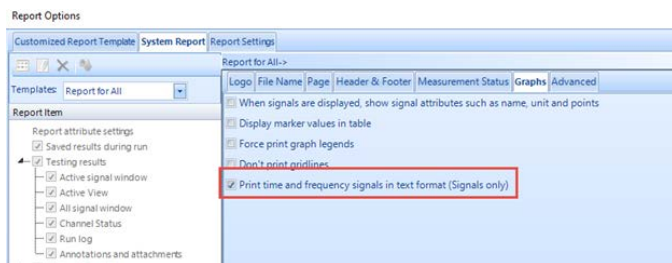
A newly added feature allows users to pack all the important data necessary for technical support. With one click, users can send essential PC information, crash logs, and application logs along with test and user settings through EDM software.



An automated email can send out with the test log file to enable quick and efficient technical support.

### Introducing Reports with Signals in Text Format

Reports (Word/PDF/XML) can now consist of signals in text format in addition to the supported graphically formatted reports.



Test parameters  
Frame: 298  
Block Size/Line: 1024 / 450  
Average number: 8

Frequency range (fa): 23 kHz  
Window: Hanning

Sampling Rate (fs): 51200 Hz  
Average mode: Exponential

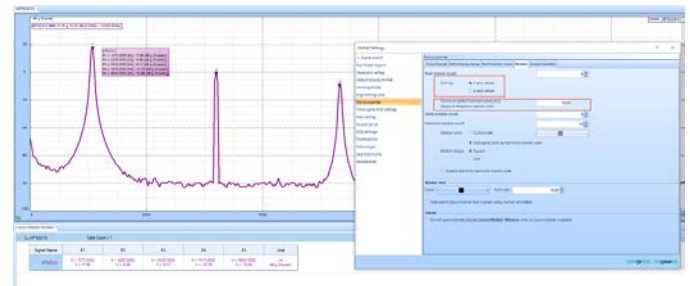
(OCT(ch1),OCT(ch2),OCT(ch3),OCT(ch4), etc.[8])

Signal Name	OCT(ch1)	OCT(ch2)	OCT(ch3)	OCT(ch4)	OCT(ch5)	OCT(ch6)	OCT(ch7)	OCT(ch8)
X-Frequency (Hz)	YMag (RMS)	Pa (RMS)	YMag (RMS)	Pa (RMS)	YMag (RMS)	Pa (RMS)	YMag (RMS)	Pa (RMS)
1.0000E+001	6.9769E-005	8.3740E-005	1.2857E-004	5.3250E-005	7.7018E-005	8.8052E-005	1.2833E-004	8.0374E-005
1.2500E+001	7.1571E-005	8.4793E-005	7.9915E-005	9.8765E-005	9.9772E-005	8.0579E-005	1.0239E-004	1.0655E-004
1.6000E+001	7.8875E-005	6.3278E-005	9.4665E-005	8.1185E-005	8.6545E-005	8.7863E-005	8.6236E-005	9.1559E-005
2.0000E+001	6.7992E-005	6.9317E-005	1.3044E-004	8.5704E-005	8.0008E-005	1.0030E-004	7.6000E-005	7.5440E-005
2.5000E+001	8.1437E-005	8.0335E-005	1.0324E-004	9.0098E-005	8.8843E-005	7.1335E-005	9.0805E-005	1.1561E-004
3.1500E+001	8.5949E-005	1.0534E-004	9.7519E-005	1.1277E-004	1.3213E-004	9.6525E-005	1.0815E-004	1.0016E-004
4.0000E+001	7.6134E-005	1.0011E-004	8.7693E-005	8.5186E-005	9.5179E-005	9.4383E-005	1.0553E-004	1.0753E-004
5.0000E+001	1.1617E-004	1.0581E-004	1.1950E-004	1.1981E-004	1.0767E-004	1.2049E-004	1.0091E-004	1.1027E-004
6.3000E+001	4.3070E-004	4.2256E-004	4.1593E-004	3.5091E-004	2.8844E-004	2.8028E-004	2.4400E-004	3.3043E-004
8.0000E+001	1.0164E-004	1.0491E-004	1.1543E-004	1.1322E-004	1.0601E-004	8.9435E-005	1.0678E-004	8.8418E-005
1.0000E+002	1.0857E-004	1.0976E-004	1.1859E-004	1.2524E-004	1.2958E-004	1.0270E-004	1.1018E-004	1.0128E-004
1.2500E+002	1.2343E-004	1.0987E-004	1.1591E-004	1.3109E-004	1.1316E-004	9.8287E-005	1.3443E-004	1.1958E-004
1.6000E+002	4.9558E-004	1.1488E-004	1.2502E-004	1.2254E-004	1.2819E-004	1.2487E-004	1.3003E-004	1.2044E-004
2.0000E+002	7.5609E-004	1.2390E-004	1.3864E-004	1.4025E-004	1.2331E-004	1.2377E-004	1.3239E-004	1.1944E-004
2.5000E+002	3.0644E-004	1.3975E-004	1.4454E-004	1.5586E-004	1.4627E-004	1.5320E-004	1.3969E-004	1.4325E-004
3.1500E+002	1.2966E-003	1.4696E-004	1.6357E-004	1.6735E-004	1.5123E-004	1.6193E-004	1.6064E-004	1.5208E-004
4.0000E+002	1.3692E-003	1.6230E-004	1.7475E-004	1.7399E-004	1.6562E-004	1.6858E-004	1.7204E-004	1.7417E-004
5.0000E+002	1.1566E-003	1.7372E-004	1.8578E-004	1.8414E-004	1.9952E-004	1.8755E-004	1.8414E-004	1.8685E-004
6.3000E+002	8.7960E-004	1.9438E-004	2.0643E-004	2.0561E-004	2.0340E-004	2.0837E-004	2.1058E-004	2.0671E-004
8.0000E+002	4.5974E-004	2.1835E-004	2.2879E-004	2.3447E-004	2.2874E-004	2.3516E-004	2.2880E-004	2.3381E-004
1.0000E+003	9.0615E-004	2.5085E-004	2.6574E-004	2.5768E-004	2.5312E-004	2.6750E-004	2.4995E-004	2.4709E-004
1.2500E+003	9.1835E-004	1.4696E-004	3.0804E-004	2.8169E-004	2.8002E-004	2.8391E-004	2.9297E-004	2.7916E-004
1.6000E+003	7.4060E-004	3.1963E-004	3.4011E-004	2.9852E-004	3.1469E-004	3.1120E-004	3.0495E-004	3.0375E-004
2.0000E+003	7.2891E-004	3.6026E-004	3.5775E-004	3.3581E-004	3.4697E-004	3.7333E-004	3.3461E-004	3.6180E-004
2.5000E+003	7.6283E-004	3.9627E-004	4.0532E-004	3.8454E-004	3.8721E-004	4.2125E-004	4.1139E-004	3.6804E-004

For signals such as SRS or octave, it is convenient to print the report in the text format for easier reading and to run automated scripts when needed.

### Introducing the Enhanced Peak Marker Functionality

The EDM 9.1 release significantly upgrades the Peak Marker function.

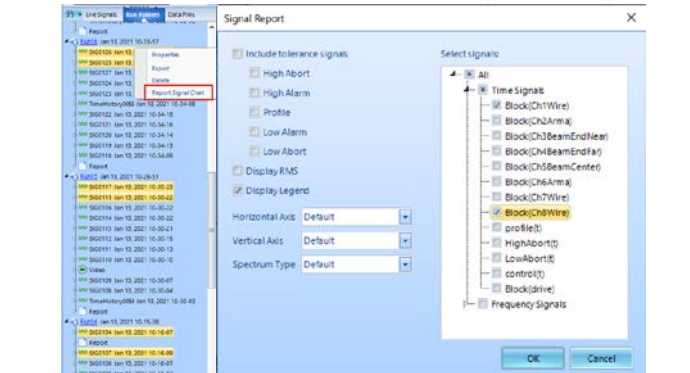


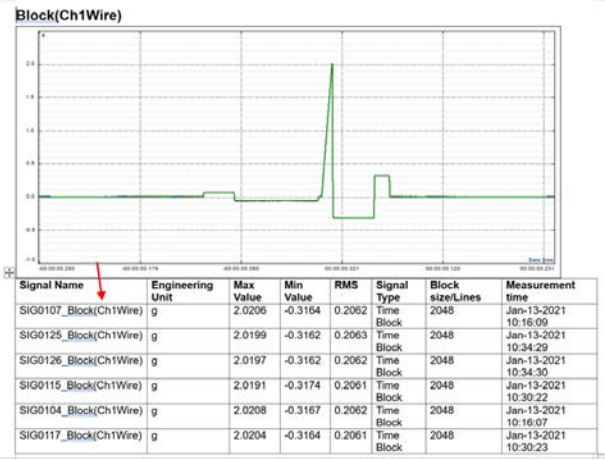
Options are available to pick peak markers with the amplitudes or time/frequency axis. This feature greatly customizes the selection of peaks, especially on a spectrum, where either the peaks of amplitude or the peaks in the low frequency zone are of interest.

In addition, an option is also available to define a delta f between the detection of peaks. This successfully avoids the detection of peaks caused by noise and points to peaks of interest.

### Introducing Overlay & Comparison of Same Signal from Different Run Folders to a Report

EDM 9.1 introduces a convenient way to overlay the same signal of the same channel from multiple run folders and allows users to create a report.





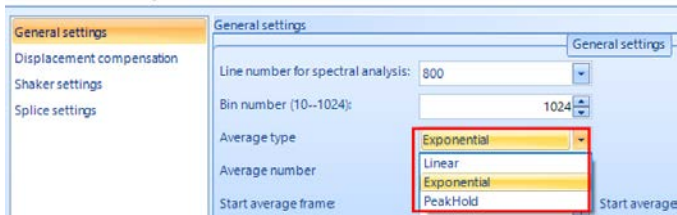
This feature is primarily helpful in the VCS tests to conveniently view the difference between the same signal during multiple runs.

It is also helpful in DSA to create a report for the changes in the signal from different runs on different products.

### Introducing Peak Hold Average Type in Waveform Editor

Peak hold average type is introduced in the Waveform Editor.

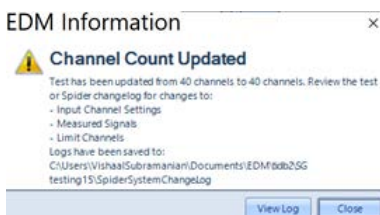
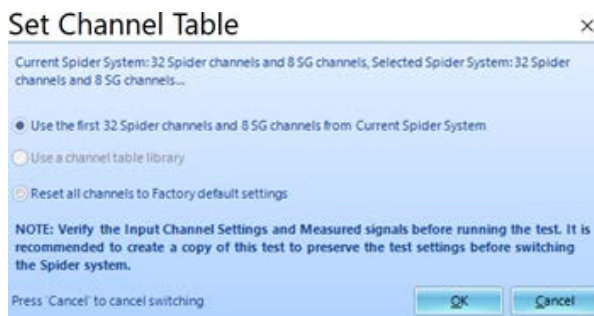
Waveform Editor Configuration



This feature allows users to compute the spectrum of a given time stream using the peak hold average.

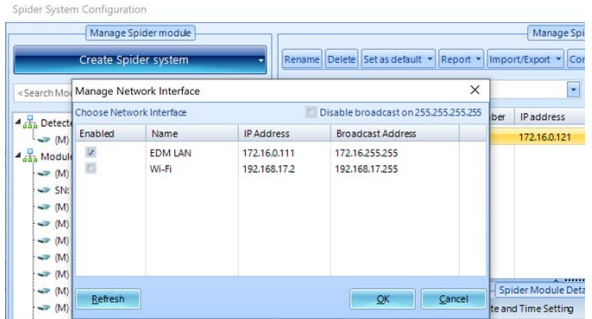
### Switch Spider Systems with Spider-80SG, Spider-80SGi & Spider-80Ti Front-ends

The introduction of the new Spider-80Ti and the current Spider-80Xi and Spider-80SGi modules allow various combinations of systems to use. The new EDM 9.1 software allows users to seamlessly transition between Spider systems with ease and automatically updates the input channel settings. This helps users run old or existing tests with new capabilities such as temperature measurements.



### Specify the Network Adapter for Communication with Spider

EDM 9.1 introduces a new feature that allows users to specify the network adapter at which a Spider is located.

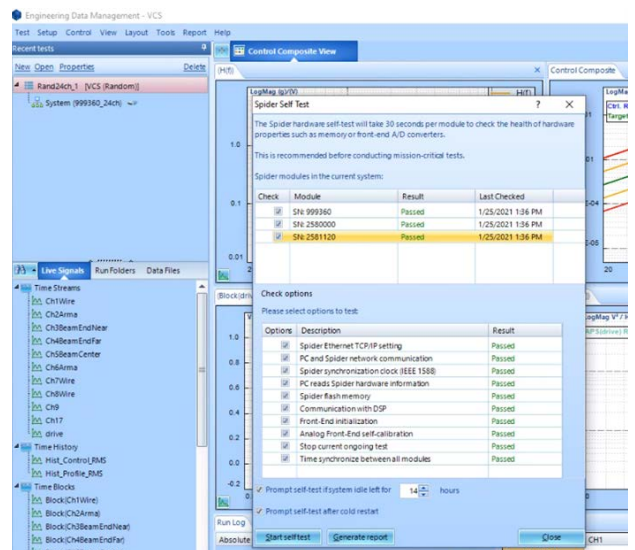
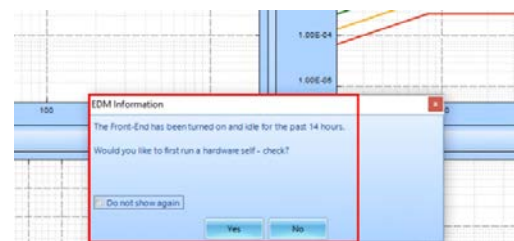


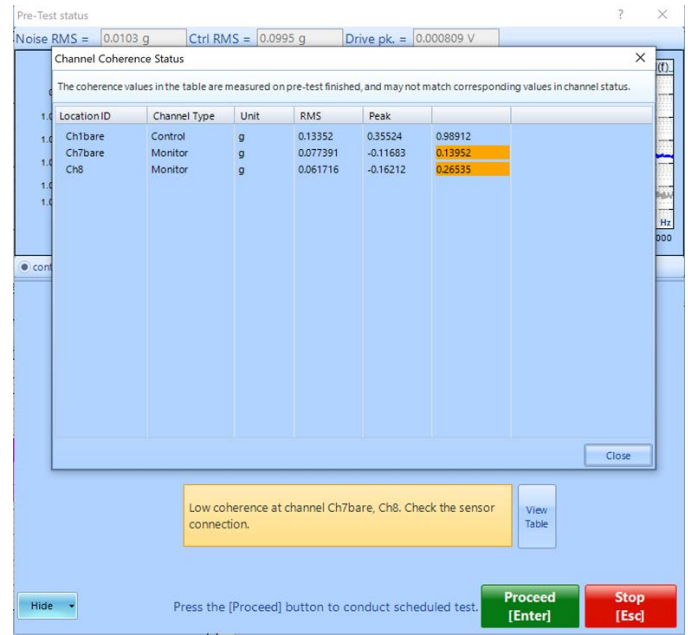
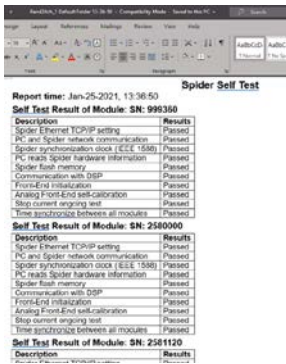
This selection allows network traffic to be routed using the selected adapter. When multiple adapters are present on a computer, EDM typically selects the default adapter or the adapter with the highest priority metric.

With this introduction, users can select a non-default network adapter while other apps on the PC use the default network adapter for communication, which allows internet applications and EDM to run seamlessly.

### Introducing Hardware Self-Test Reminders Feature

Users should ideally perform a hardware self-test on a Spider unit after it has been idle for a very long time. There are also times when it is important to perform a hardware self-test on a Spider after a cold start.





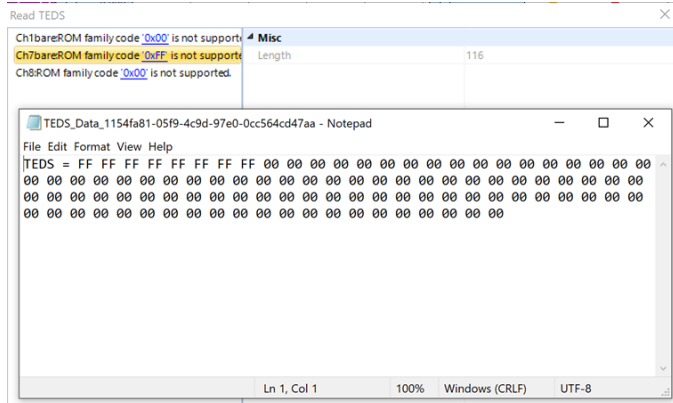
A hardware self-test ensures that all components of the hardware are working well and ensures the accuracy of the measurements. Minor drifts in the ADCs are also corrected to ensure highly accurate measurements.

This new feature helps users identify scenarios where a hardware self-test is needed and performs the hardware self-test upon a user's input.

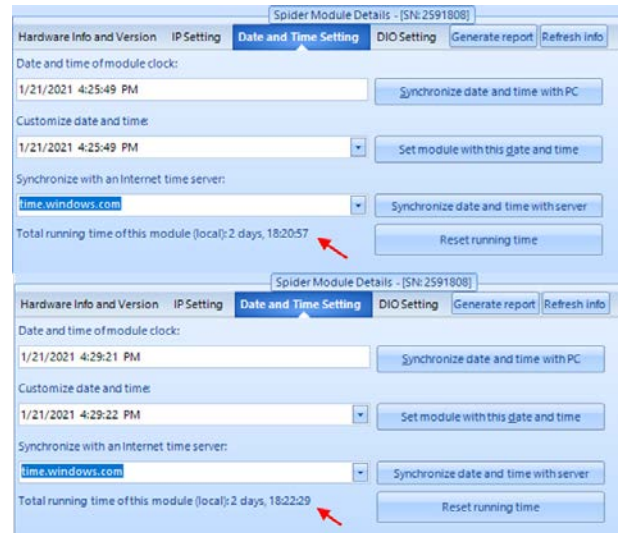
### Automatically Save Error Code When TEDS Detection Fails

The TEDS feature in EDM is provided for sensors with TEDS capabilities. The automatic detection of sensitivity reduces the user's time to configure the input channel setup.

TEDS detection can fail due to a variety of reasons. This new feature in EDM automatically creates a text log to represent the channels that failed along with the error code.



### Record of Spider module running time



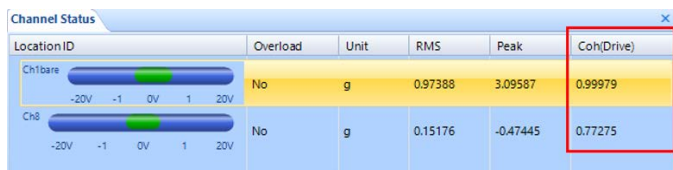
In a high channel count system setup, this convenient feature helps users identify the failed channels and take necessary actions.

## MAJOR IMPROVEMENTS

### EDM Vibration Control Software

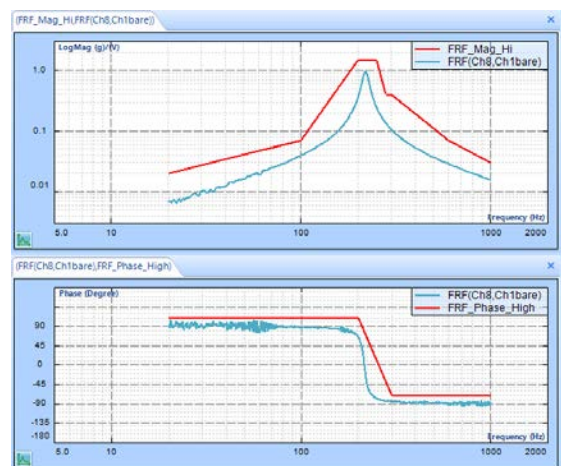
#### Improvements in Random

Coherence indicators for all input channels in Random/MIMO Random tests are displayed in the channel status from pre-test to the end of the test. A summary is shown at the end of pre-test to ensure the user has a clear picture of each channel status.



### Improvements in Sine/RSTD/Multi-sine

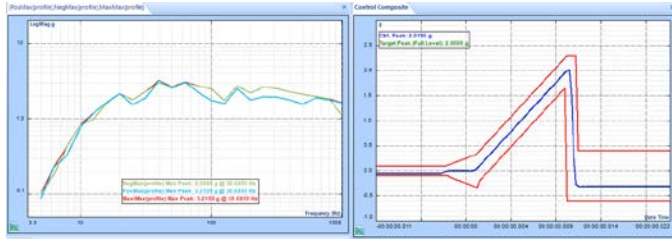
User defined signals in Sine. Now supports spectrum, coherence, and FRF signal types. Allows customizable limits for visual comparison.





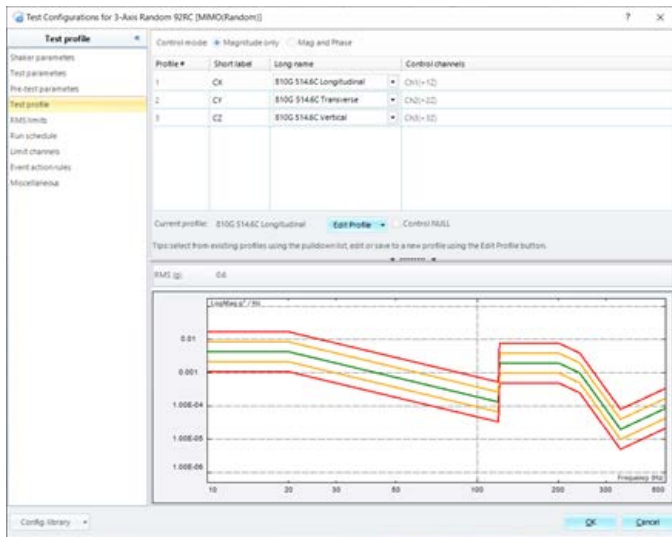
## Improvements in Shock/TTH/SRS/Earthquake Testing/ Transient Random

The EDM 9.1 release includes the SRS analysis of shock profiles



## EDM MIMO Vibration Control Software MIMO VCS Profile - Short Label & Long Name

The use of short label and long name (profile name) simplifies the assignment of a profile to the control channel. The short label defines one of the control labels, while the long name shows the profile name selected for this control. The control channel illustrates its assigned physical channel.

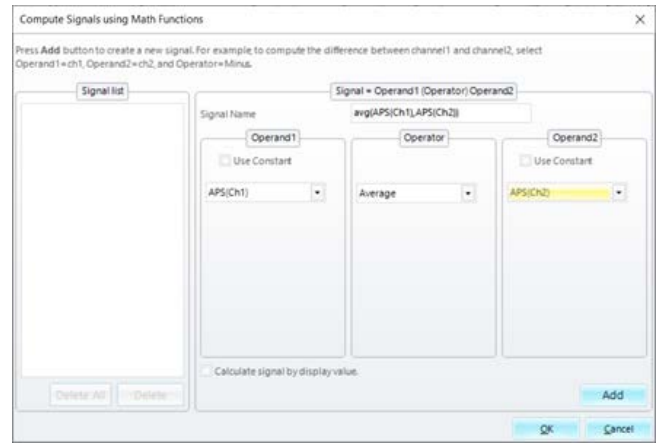


The assignment of the control label and profile is simple and straightforward, text is entered into the "Profile" column of the input channel table.

Ch/Dr	Location ID	Profile	Measurement quantity	Engineer unit	Channel type	Sensitivity	Max. sensor range	Input mode	Sensor	High-Pass Blue Fc (Hz)	SDR	Measurement Axis	Control
18A	SS Dr	CX \$10G S148C Longitudinal	Acceleration	g	Control	100,000,000	20,000.00	SR	User Defs...	0Hz	1:2	1	I:2
18B	SS Dr	CY \$10G S148C Transverse	Acceleration	g	Control	100,000,000	20,000.00	SR	User Defs...	0Hz	+12	1	I:2
18C	SS Dr	CZ \$10G S148C Vertical	Acceleration	g	Monitor	100,000,000	20,000.00	AC Single End	User Defs...	0Hz	+12	1	I:2

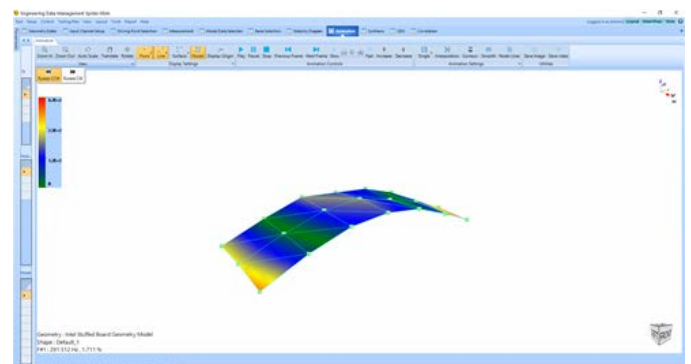
## Added Average to the PC Math Signals in MIMO VCS

PC math signals in EDM MIMO VCS now includes average. Users can select the operands of either time or spectrum and select the average as the operator when the averaged signal is required.



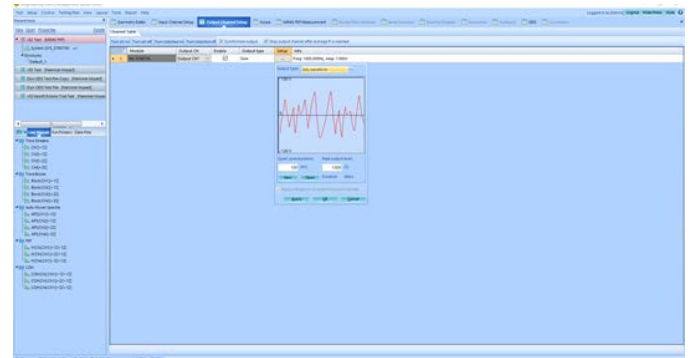
## EDM Modal Auto Rotate 3D View

The 3D geometry can automatically rotate in clockwise or counterclockwise directions to provide views of mode shapes in different orientations.



## Output Waveform Display

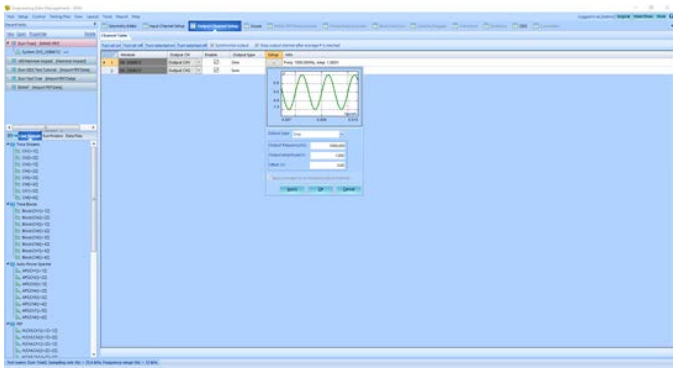
The MIMO FRF and MIMO Sine testing suite uses modal shaker excitation to execute the modal analysis of a unit under test. The output waveform display guides the user in visualizing the output excitation type chosen for the experimental modal test.



## Safety Feature for Shaker Output

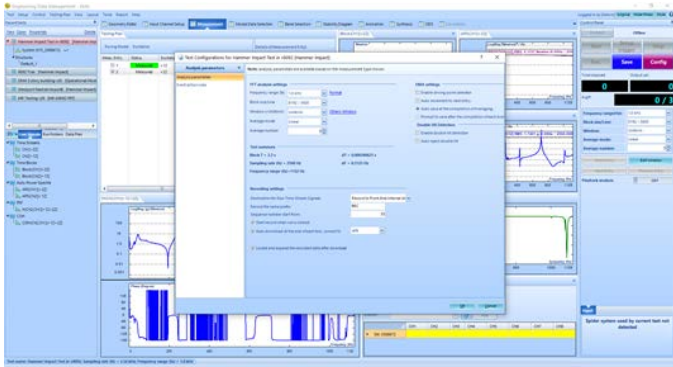
This safety feature is available in the MIMO FRF and MIMO Sine testing suites to ensure that the output excitation does not exceed the drive limit during a modal test.





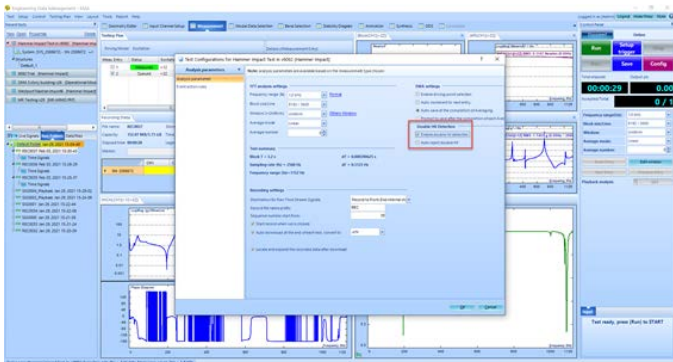
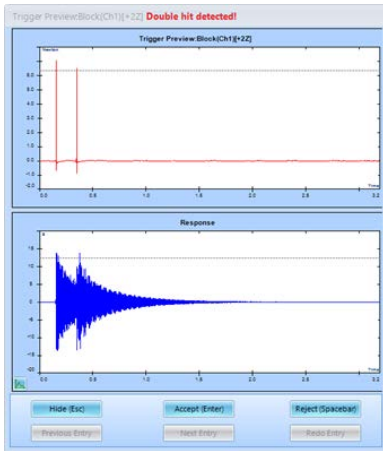
**Recording Enhancement**

The user can automatically record, download, and view recorded signals at the completion of a modal test. These recorded signals can be opened for playback analysis in post-processing.



**Double Hit Detection Optimization**

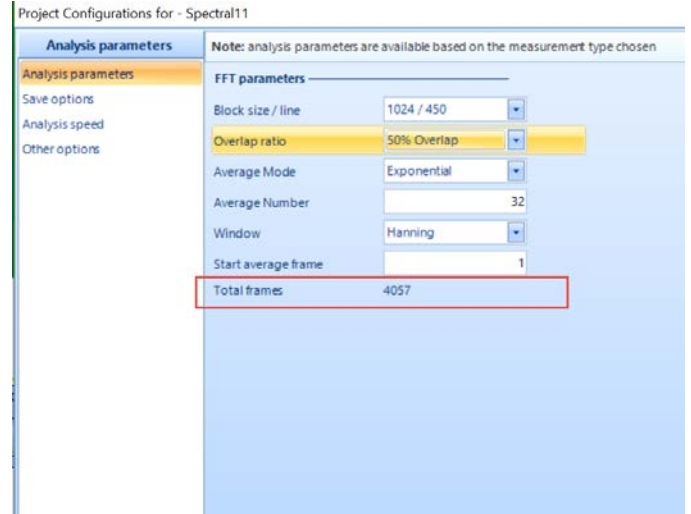
The detection and auto-rejection for double hits with modal impact hammers is enhanced to optimize the modal measurement process.



**Post Analyzer**

**Analysis Parameters Displays the Total Frame Count**

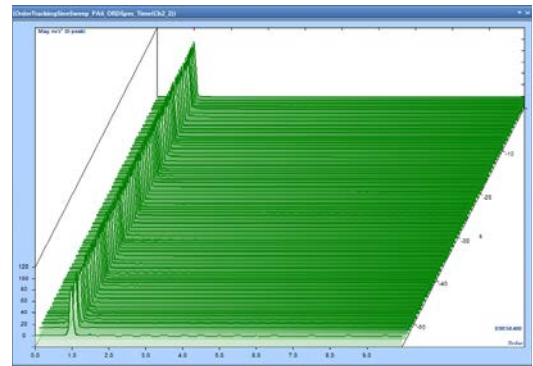
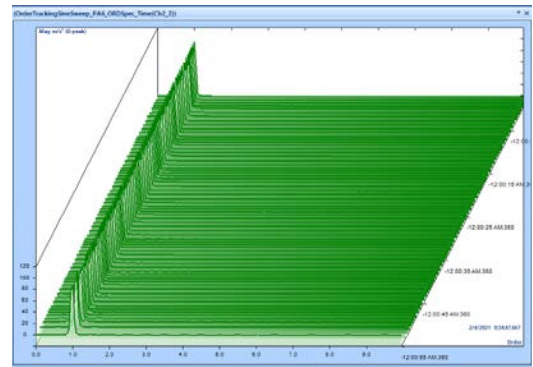
PA now displays the total frame count for a signal that will be processed for the block size and overlap selection.



This enables a convenient adjustment of the Average Number for some applications requiring an averaged spectral analysis for the entire time domain data.

**Display Absolute or Relative Time for Reference Axis of 3D Signals**

In 3D signals with time as the reference axis, the ability to display the absolute time or the relative time is added.



When analyzing data for long time durations, it is easier now to identify the absolute or relative time of the desired event(s).

## General Improvements

### Monitor the Network Traffic

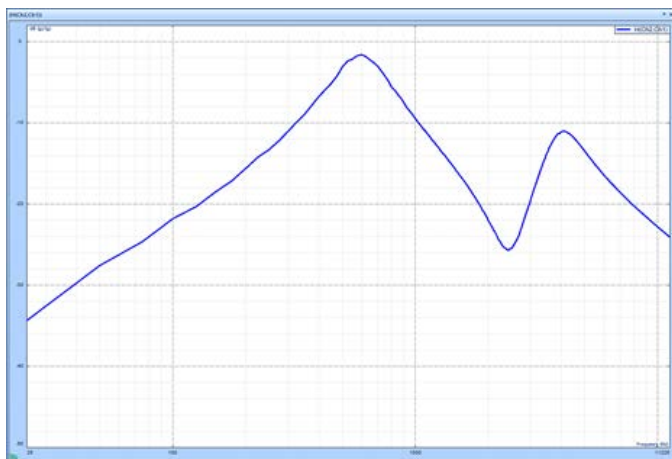
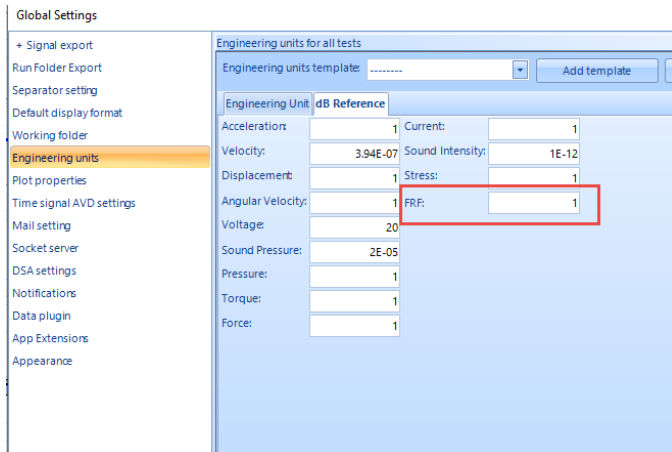
Users can monitor network traffic on EDM 9.1



This feature allows users to monitor the network traffic and ensure that sufficient bandwidth is available for EDM to communicate with the Spiders. When the bandwidth gets low, it is advisable to close other programs to ensure seamless communication and a clear display of data transmitted to EDM.

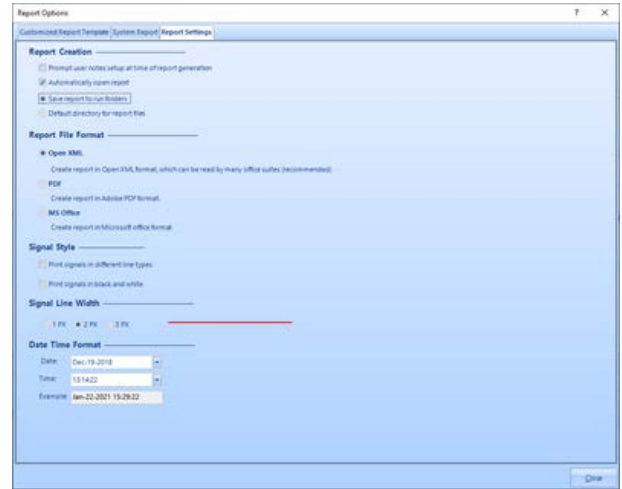
### Display FRF Signals in dB with Customized Reference

Users can now display FRF Signals in dB with a customized dB reference.



### Report Enhancements - Saving Reports to Customized Locations (including Run Folder)

Location to automatically save reports is easily customized and includes option to save report to the Run Folder.



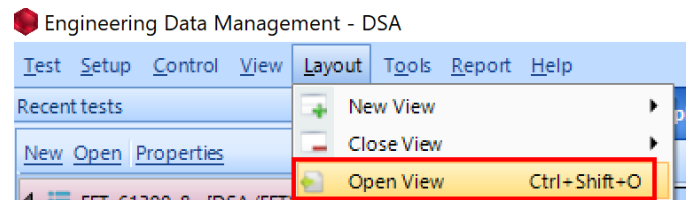
### Auto Download and Auto Export Recordings to Customized Formats



The option to automatically download time stream recordings at the end of a test and to auto export to a user selected format is now available across all EDM software modules.

### “Open View” Supports Multiple Tabs & Files

Open View in EDM now allows users to open multiple files or tabs.



This allows users to conveniently configure and save multiple display tabs and then open them in a different test type.

## SOFTWARE RELEASE HISTORY

Dates of software releases

Type	Release	Exact Version	Release Date
Release	EDM 4.2	CI 4.2.0.3	2/28/2014
Patch	EDM 4.2.0	CI 4.2.0.14	7/2/2014
Release	EDM 5.0	CI 5.0.0.2	11/27/2014
Patch	EDM 5.0.1	CI 5.0.1.3	2/27/2015
Release	EDM 5.1	CI 5.1.0.6	8/12/2015
Release	EDM 6.0	CI 6.0.0.1	5/19/2016
Patch	EDM 6.0.2	CI 6.0.2.9	8/9/2016
Release	EDM 6.1	CI 6.1.0.4	2/7/2017
Patch	EDM 6.1	CI 6.1.0.27	8/22/2017
Release	EDM 7.0	CI 7.0.0.6	2/1/2018
Patch	EDM 7.1	CI 7.1.0.7	7/19/2018
Release	EDM 8.0	CI 8.0.0.1	2/02/2019
Release	EDM 8.1	CI 8.1.0.1	11/13/2019
Release	EDM 9.0	CI 9.0.0.4	06/05/2020
Release	EDM 9.1	CI 9.1.0.0	02/03/2021

## SYSTEM REQUIREMENTS

### Minimum System Requirements:

- Operating System Support: Windows 7 SP1 or higher
- Operating System Type: 32-bit or 64-bit
- Processor Speed: 1.5 GHz Dual-Core x86
- RAM: 4 GB
- Available Storage Space: 10 GB

### Recommended System Requirements (Minimum for Spider Systems Higher than 16 Channels):

- Ethernet Speed: at least 1 Gbps Ethernet port on the computer
- Network Cables: provided by Crystal Instruments
- Operating System: Windows 10, 64-bit
- Processor: Intel Core i7, 2.0 GHz or Higher
- RAM: 8 GB DDR3 1600 or higher
- Available Storage Space: 10 GB or higher
- Spider-HUB Firmware Version: 2.0.5.17 or higher

## VERSION COMPATIBILITY

Product and Software Version	Firmware Versions
<b>Spider-80X/80Xi/80Hi/80Ci</b>	
EDM Testing 9.1.0.x	9.1.0.x
<b>Spider-81 (v7.x)</b>	
EDM Testing 9.1.0.x	9.1.0.x
<b>Spider-81B (v7.x)</b>	
EDM Testing 9.1.0.x	9.1.0.x
<b>Spider-80SG/SGi</b>	
EDM Testing 9.1.0.x	9.1.0.x
<b>Spider-20/20E/20HE/20H/20i</b>	
EDM Testing 9.1.0.x	9.1.0.x

Product and Software Version	Firmware Versions
<b>CoCo-80</b>	
EDM 6.0.2.x	4.0.x
<b>CoCo-70X</b>	
EDM Testing 9.1.0.x (EDM CoCo for DSA)	2.0.x
Vibration Diagnostic System 1.4.2.x	2.0.x
<b>CoCo-80X/90X</b>	
EDM Testing 9.1.0.x (EDM CoCo for DSA)	2.0.x