CRYSTAL
INSTRUMENTS

EDM Modal 9.0
Engineering Data Management Software Release Notes

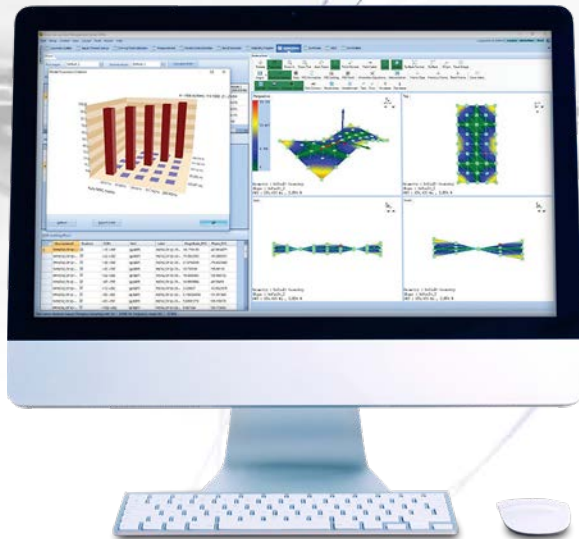EXPERIMENTAL MODAL ANALYSIS (EMA)

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RELEASE HIGHLIGHTS
Introducing Spider Systems Featuring 256 kHz Sampling Rate (Spider-80Hi and Spider-80Ci)

The Spider-80Hi and Spider-80Ci are the newest and the most powerful front-end cards of the Spider 80Xi platform. These cards are equipped with sampling rates of up to 256 kHz.

The Spider-80Hi is similarly equipped as the Spider-80Xi system with dual ADC technology which provides a dynamic range of 160 dB and 58 stages of a sampling rate selection ranging from as low as 0.48 Hz to as high as 256 kHz.

Raw time data can record continuously at the 256 kHz sampling rate for all channels. The Spider-80Hi has the same form factor as the Spider-80Xi platform and can be used with a Spider-80Xi chassis or Spider-80M chassis.

Vibration Control System or Dynamic Signal Analysis
The Spider-80Hi and Spider-80Ci are equipped with synchronized output channels that enable these devices to be used as vibration control systems or for dynamic signal analysis applications.

Spider-80Ci (Integrated Charge Amplifiers)
The Spider-80Ci has integrated charge amplifiers in addition to all the features supported by the Spider-80Hi.

High Channel Count System
Multiple Spider-80Hi and Spider-80Ci front-ends can combine to create a high channel count system with up to 1024 channels. Up to 8 front-ends can fit within one chassis and multiple chassis can connect through Ethernet using a Spider-HUB industrial network switch.

The high channel count system can also include the Spider-80SGi or Spider-80Ti modules when data from strain, strain gage based sensors, RTDs, thermocouples or any other special sensors need to be acquired with Spider-80Hi system.

Time Synchronization
The integration of the IEEE 1588v2 protocol for time synchronization results in accuracy better than 100 ns. This technology provides an excellent phase match even when front-ends are used at their highest sampling rates.

New Hardware Introductions and Improvements to Existing Front-Ends					
Front-end Types	Spider-80Hi	Spider-80Ci	Spider-80Xi	Spider-80SGi	Spider-80Ti
Max Sampling Rate	256 kHz	256 kHz	102.4 kHz	102.4 kHz	2 kHz
Bandwidth	115.2 kHz	115.2 kHz	46 kHz	46 kHz	-
Max Sampling rate for Raw Time Data Recording (Max Channels)	256 kHz (8 Channels /front-end)	256 kHz (8 Channels /front-end)	102.4 kHz (8 Channels /front-end)	102.4 kHz (8 Channels /front-end)	2 kHz (16 Channels/ front-end)
Number of Inputs Per Front-end	8	8	8	8	16
Connector Type	BNC	BNC	BNC	LEMO	3-pin screwed terminal
Input Type	IEPE Voltage TEDS	IEPE Voltage TEDS Charge Inputs	IEPE Voltage TEDS	Voltage Strain gage Strain gage-based sensors MEMS DC-based sensors	3-wire RTD K type thermocouple
Max Input Range	±20Vpk	±20Vpk	±20Vpk	±10V	-------
Dynamic Range	160 dB	160 dB	160 dB	120 dB	
Input Protection Voltage	±220V	±220V	±220V	±40V	-------
Analog to Digital Converter Per Channel	Dual 24-bit ADC	Dual 24-bit ADC	Dual 24-bit ADC	24-bit ADC	-------
Phase Match	< 1° up to 20 kHz	< 1° up to 20 kHz	< 1° up to 20 kHz	< 1° up to 20 kHz	-------

Introducing the Ultra-Compact Spider-20H, Spider-HE & Spider-20i with 256 kHz Sampling Rate
Crystal Instruments' smallest form-factor portable DAQ device received an upgrade in the 9.0 release. The new generation of Spider-20 systems supports sampling rates of up to 256 kHz for data acquisition and recording.

The newest generation of Spider-20 systems are now available in three unique forms:

Spider-20H (Wi-Fi)
The Wi-Fi version of Spider-20 supports a 256 kHz sampling rate, includes 4 GB of built-in flash memory and a battery.

Spider-20HE
The Ethernet based version of Spider-20 supports a 256 kHz sampling rate, includes 4 GB of built-in flash memory and a battery.

Spider-20i
A new addition to the traditional Spider-20 series is the Spider-20i. The Spider-20i is an Ethernet based Spider-20 system supporting

a 256 kHz sampling rate with an industrial enclosure. Without any buttons or a battery, this device is suitable to be deployed in rough industrial environments for momentary or permanent data acquisition, recording or monitoring.

Extended Input Range
The new generation of Spider-20 products also received an upgrade to the input range. An input range of up to 20V is now available for these devices compared to the 10V input range of the previous generation.

High Channel Count Synchronized Data Acquisition
The Ethernet versions of the Spider-20 (Spider-20HE or Spider-20i) can combine into a high channel count system for synchronous data acquisition. The high precision IEEE 1588v2 protocol provides excellent phase match between the channels of different front-ends, even at the highest sampling rate of 256 kHz.

Synchronized Data Acquisition Between Spider-20E and Spider-80X/Spider-80Xi Systems
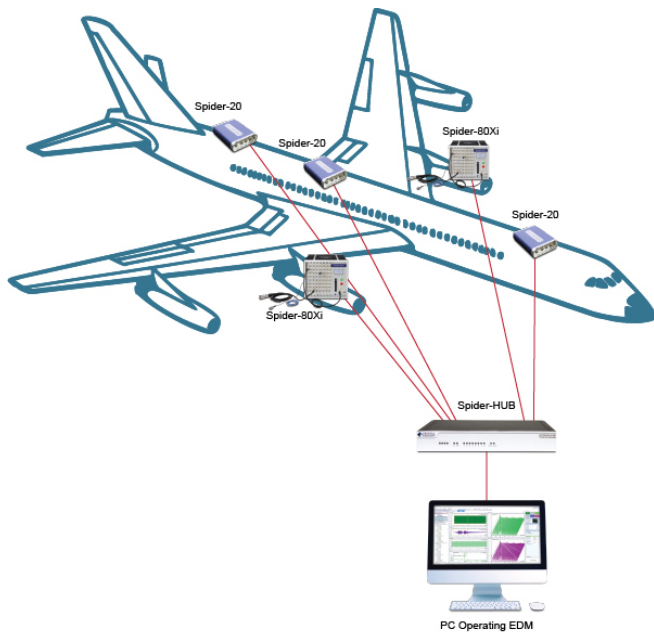
The Spider-20 series of products are ultra-portable and can be mounted at even remote locations. The Spider-80X and Spider-80Xi on the other hand are powerful front-ends that can chain together to obtain simultaneous data acquisition for up to 1024 channels.

There are times when sensor cable lengths cannot easily reach the extreme corners where data needs to be acquired. A typical example is an airplane where multiple sensors are needed near the engine, but a few sensors are also placed all along the aircraft.

With EDM 9.0, multiple Spider-20s can be combine with the Spider-80X or Spider-80Xi front-ends to create a high channel count system. A Spider-80Xi with tens or hundreds of channels can be placed to monitor the vibrations on an engine while portable Spider-20 units can be placed far from the engine at different locations within the airplane to ensure synchronized data acquisition at all locations.
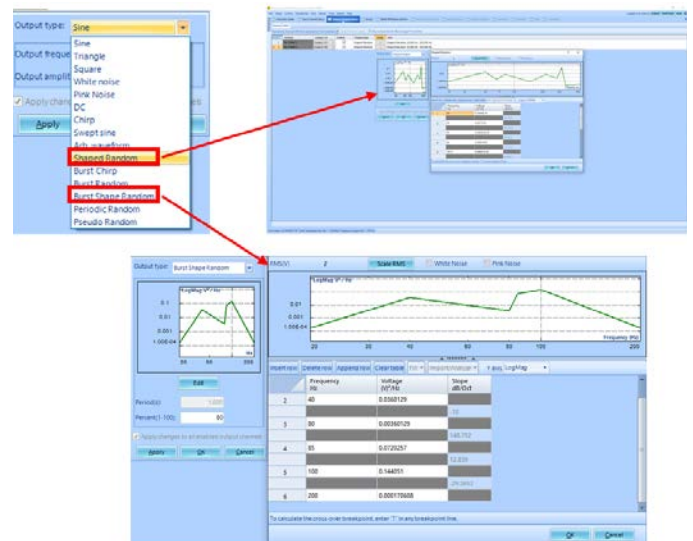
Introducing EMA Testing Plan
In EDM 9.0, a testing plan feature is added to provide information about the measurement acquisition status and to helps users customize and control the flow o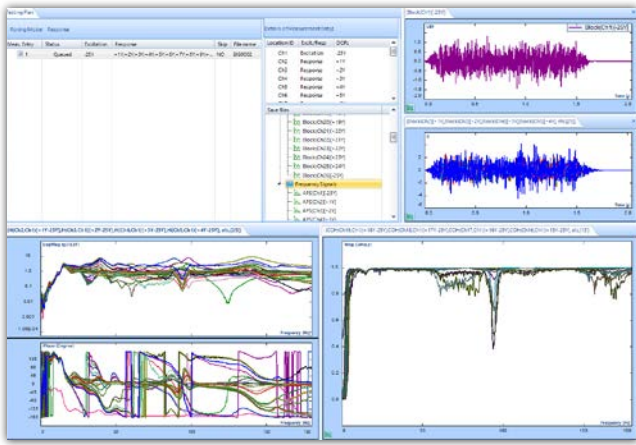f the testing process. A quick glance of the testing plan provides information about the roving mode implemented for the modal test and the number of measurement points on the 3D geometry model. It also provides power capabilities to randomize and modify the test plan using the skip, reset, recalculate, edit and other associated options in the measurement entry list to optimize the test control and measurement procedure. Corresponding to the user operation, the status of the measurement runs is measured, queued, skipped and in process accordingly. The testing plan is docked onto the measurement tab as shown in the following screenshot.
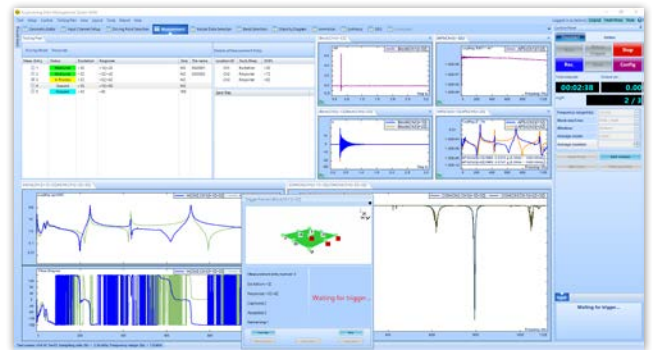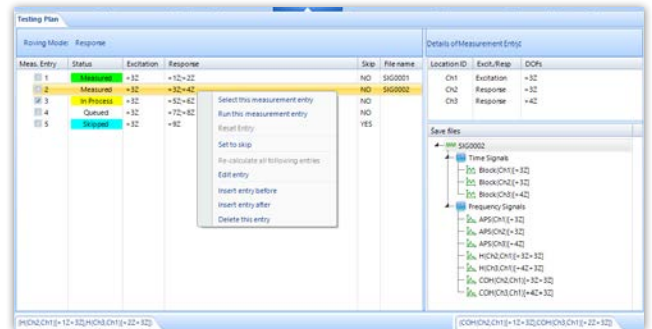
Added Shaped Random/Burst Shaped Random Output Excitation in MIMO FRF Modal Analysis
Shaped random and burst shaped random excitation is added to the MIMO FRF Modal Analysis suite. These output excitations help increase the response level at certain desired frequencies by allowing the user to input a profile in the frequency domain. Adding a burst percentage also provides an opportunity to control the time duration of no output.

Patented Multi-Resolution Spectrum Technology in Modal Analysis Extended to High Channel Count System

Crystal Instruments' was granted a patent for the unique Multi-Resolution Spectrum technology which provides 8 times higher spectral resolution in the low frequency region compared to the high frequency region without having to use enormous block sizes or enormous computational resources.

The multi-resolution spectrum technology available in the MIMO FRF test of the EDM Modal Analysis suite has been optimized and extended for use in multiple module systems. The FRF is much sharper and more accurate with the implementation of multi-resolution technology compared to those acquired using the conventional FFT approach, which results in a better estimation of the FRF amplitude and damping.

With these improvements, the advantages of multi-resolution spectrum technology can be utilized across all testing types of modal analysis and for any number of channels within the system.

Support for Microsoft SQL Server 2017 and 2019

EDM 9.0 has received significant upgrades in all areas including support for the latest version of Microsoft SQL Server.


Support for SQL Server 2017 and 2019 is included to allow users to take advantage of the powerful features provided by this software.

New Features in EDM-Modal
Improvised 3D Model Reconstruction

The 3D model reconstruction software is revamped with a progress bar and guided texts to make the 2D photo to 3D model conversion process faster, simpler, and more efficient. The help texts for each process helps users understand each of the setup parameters which improves the feature extraction, point generation and surface generation for 3D model reconstruction. The progress bars provide a visual of the progression of each stage completion which further aids users to fine tune the whole process.
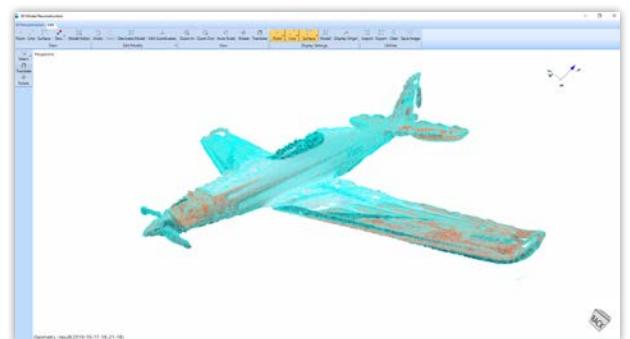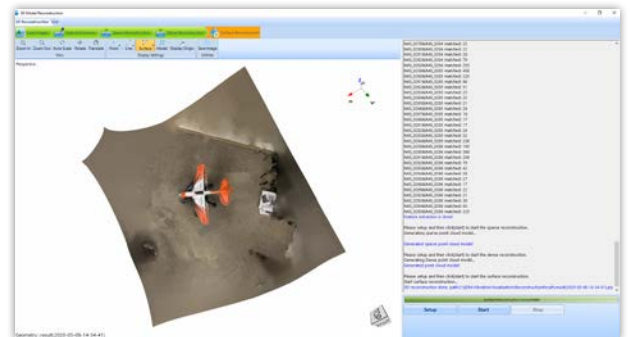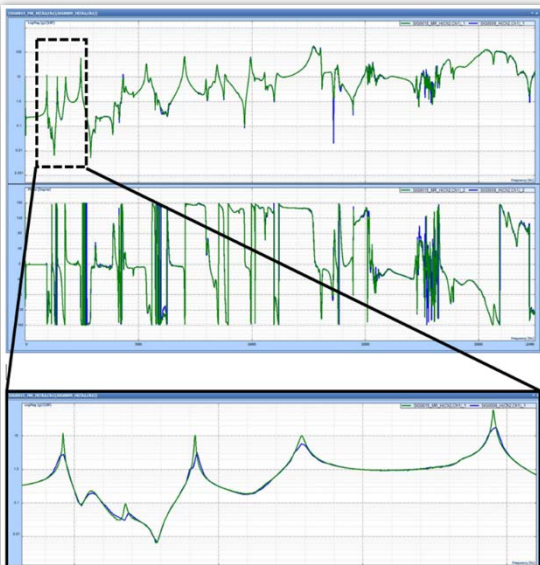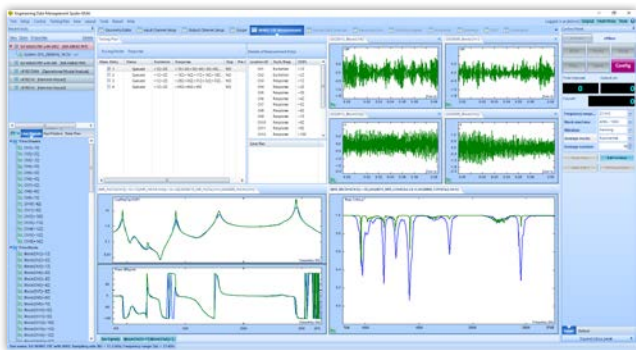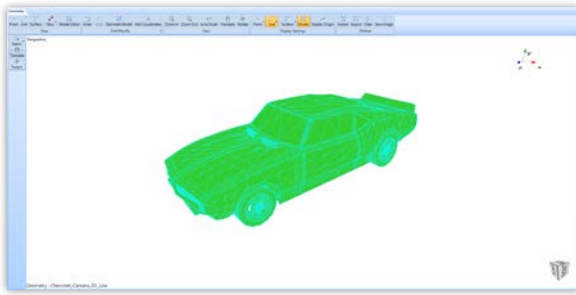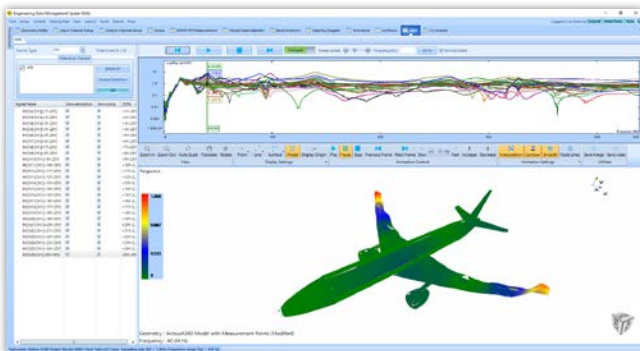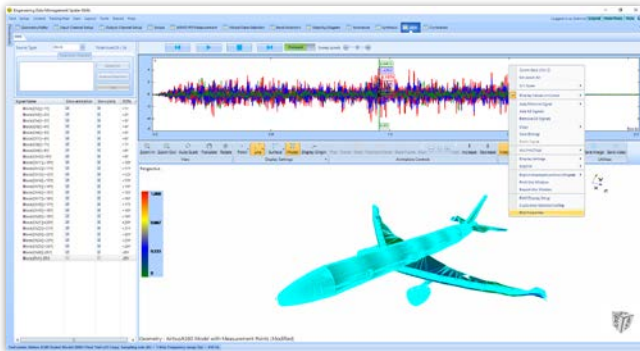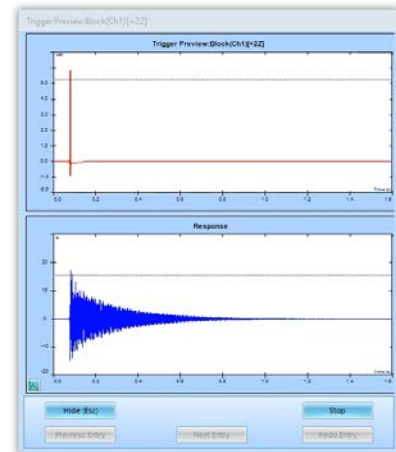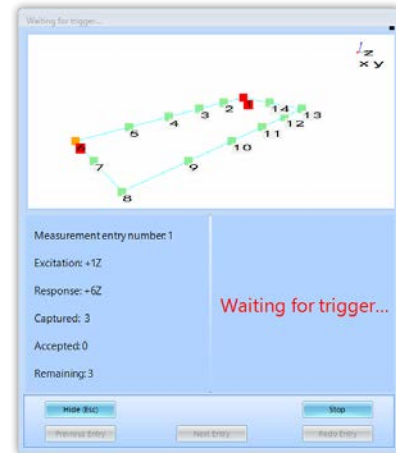

New Geometry Editor Window

The geometry creation capabilities of EDM are optimized for intuitive and user-friendly interactions. The features are categorized according to their functionality which makes it easier to use according to the requirement. The user can have a huge number of points for higher accuracy of the geometry and still carry out measurements on a few points to interpolate the measured data to unmeasured points to observe the mode shapes of the entire model.

Optimization of ODS Capabilities

The user can choose to dwell or sweep through the FRF, Time and CPS signals to view the operational deflection shapes of the unit under test. The sweep can be executed in the forward and backward direction. A slider bar is provided to control the sweep speed as well. Normalization mode helps to observe an amplified motion of the ODS at a lower amplitude of FRF at frequencies other than natural frequencies. This feature also helps in distinguishing the transition between the modes of the structure. Changes can be made to the horizontal and vertical axis to change the display styles, axis scale etc. The text at the bottom left allows alerts to the user when the sweeping cursor is approaching and exiting a mode.
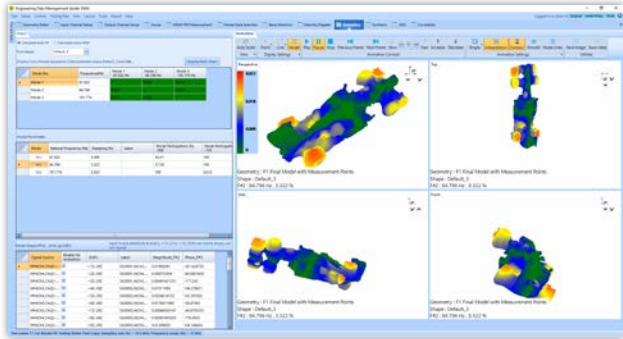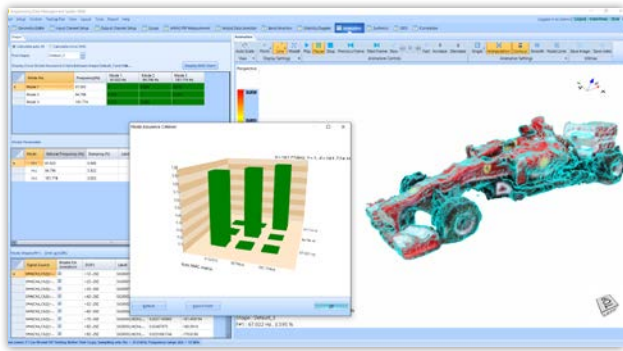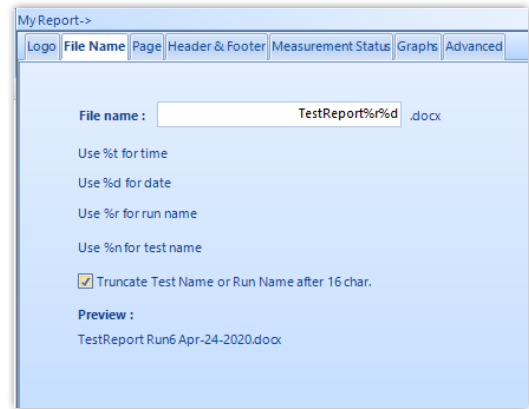

Improved Trigger Window

The improved trigger window guides the user to the location of measurement DOFs on the geometry model for the excitation and response channels. Based on the roving mode setup and the current DOF location of the excitation and response points, the trigger window provides a simple visual of the corresponding measurement points on the geometry model to simplify the testing process. The implemented window is also displayed on the acquired excitation and response signals which helps to optimize the configuration parameters.

Enhanced Modal Data Selection

Features like "Check Missing FRFs" and "Validate" are useful features which make the modal data selection process very simple. The DOFs associated with the missing FRFs are highlighted on the geometry model. "Validate" check allows users to confirm all the measured signals have the same configuration settings and are compatible.

Updated Animation Window

The MAC results and MAC chart display are colorized to provide a quick illustration of the correlation between the mode shapes. The green color signifies that the mode shapes have been uniquely identified and are orthogonal to each other. Major enhancements and regrouping of icons have also been implemented in the animation display window.

New General Features
Ease of Adding Modules to Tests or Switching Tests Between Spider Systems of Different Channel Counts

EDM 9.0 introduces a convenient way to modify the Spider system associated with the test to any other Spider system of a different channel count.

This extends the capabilities of the test templates to be used for any channel count system. In addition, a test using the Spider-NAS can be switched to a system without a Spider-NAS.

Smart algorithms handle the addition or removal of channels without deleting the existing channel configuration.

Channel specific configurations including limit channel setup are preserved for the channels that are carried over after the change to the number of input channels.

Introducing Customizable File Names for Report
File names for reports is an important aspect when there is a high quantity of reports generated from several tests.

EDM 9.0 introduces several customization characteristics to generate the file name of reports.

Users can generate a report using customized names combined with macros for test name, run name, date, time or a combination of any test characteristics.

Addition of Measurement Point, Coordinates and DOF to Input Channel Table
The input channel table in DSA and VCS now includes measurement point, coordinate and DOF information.

This information not only acts as a reference for users but also helps during Vibration Visualization for VCS or DSA tests.

This data can also be used with EDM-Modal for Modal Analysis.

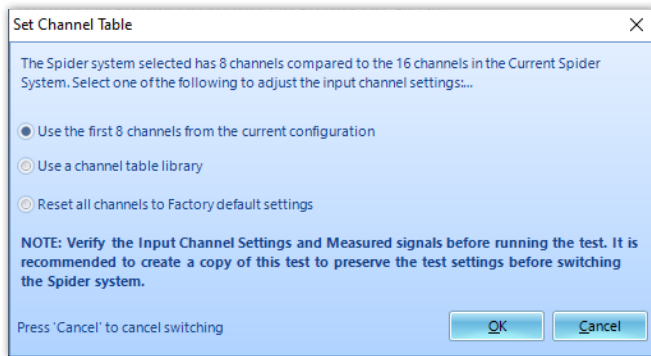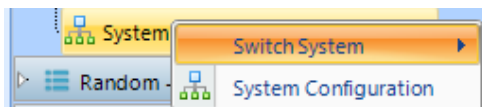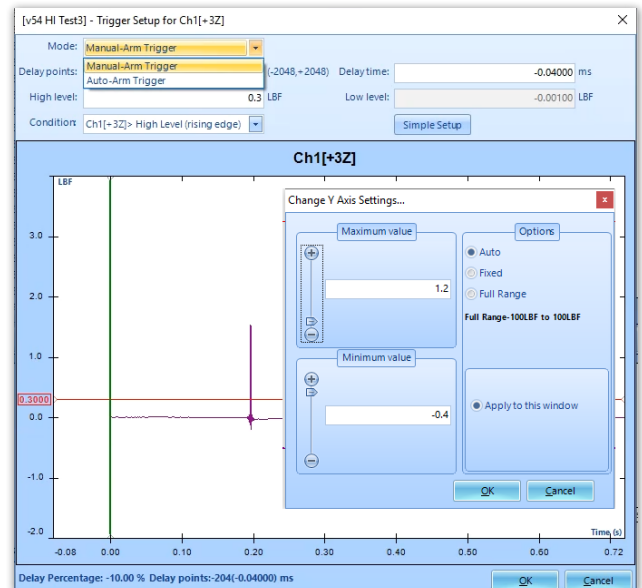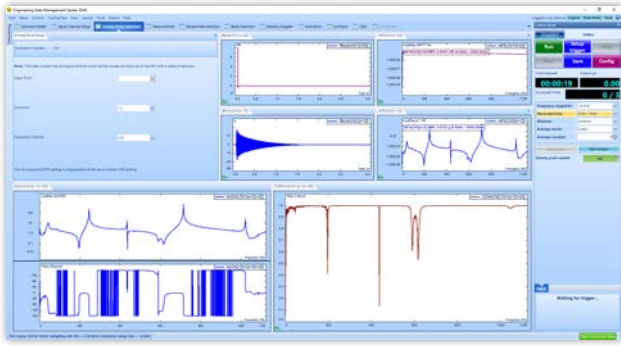## MAJOR IMPROVEMENTS
EDM Modal
Simplified Trigger Setup
Manual-arm and auto-arm trigger mode is available in the hammer impact modal analysis suite with an optimized Y-Axis range.
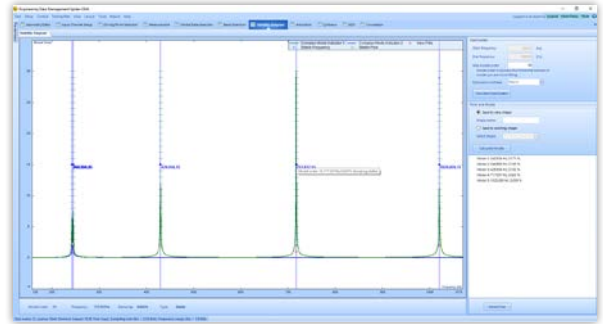
Improved Driving Point Selection

Driving point selection is updated and simplified to optimize the setup before executing the hammer impact modal test.

Added DOF Information to the Live Signal List

The DOF information is also displayed with each signal in the live signal list.

Updated Band Selection

Help text highlighted in red has been added on the right to describe the different mode indicator functions and other display styles. This helps optimize the selection of the band for the curve fitting process.
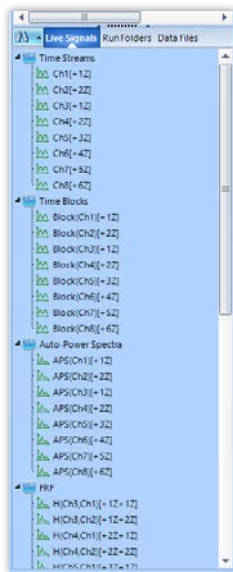

Enhanced Stability Diagram

A guided hovering cursor provides details about the modal order, frequency, damping and the type of pole. This helps in choosing poles with stable frequency and damping.
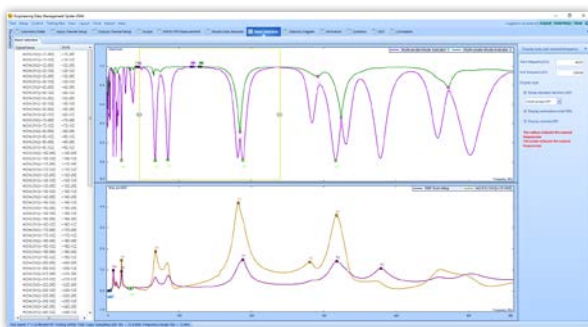

General Improvements

Out of Band Overload Detection on Front-end LEDs

Drop shock tests, pyro shock tests or data acquisition during blast testing may at times have sufficient energy to drive the sensors at their resonance frequency. Piezo resistive sensors are the most suitable for these purposes as they have a higher resonant frequency. However, most IEPE sensors used in these tests have a resonant frequency of less than 100 kHz which may easily saturate the sensor out of its usual band.


Once saturated, the data acquired is corrupted and not usable.

EDM 9.0 added the detection of out of band saturation before any low pass filters to ensure that the data is not corrupted. Hardware indicator LEDs have been programmed to display the out of band saturation.

Introducing Overall RMS Display for All Signals in the Plot

In EDM 9.0, overall RMS for all the signals in a given plot can be computed and displayed.
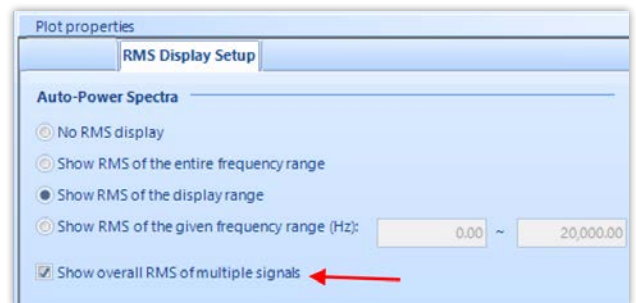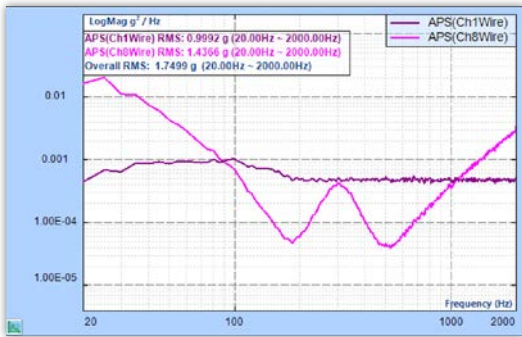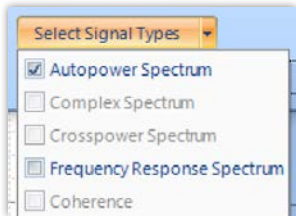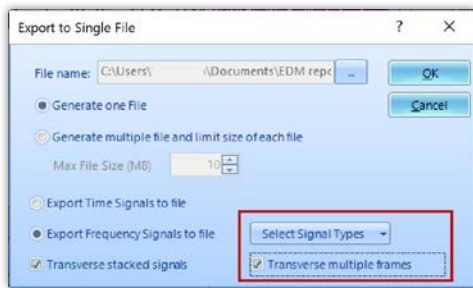
The total energy in signals acquired through sensors specialized for different frequency ranges can be acquired and the overall energy can be estimated.

### Improvements to "Export to Single File"

The Export to Single File feature provides an option to export multiple signals from multiple channels as a single file.

This feature is significantly improved. In addition to more options to select the signal types, the option to export in MAT and UNV file formats is added.

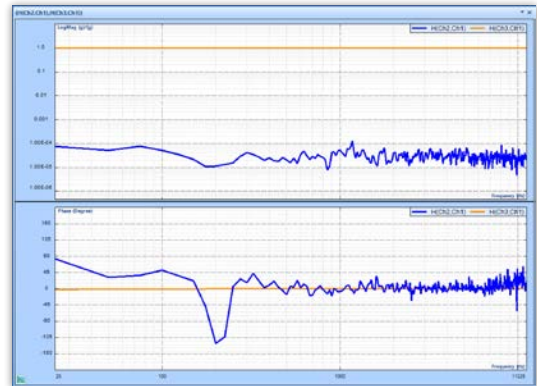### Customizable Line Width for Signals in Report

The line width can be independently adjusted for signals displayed on a report.
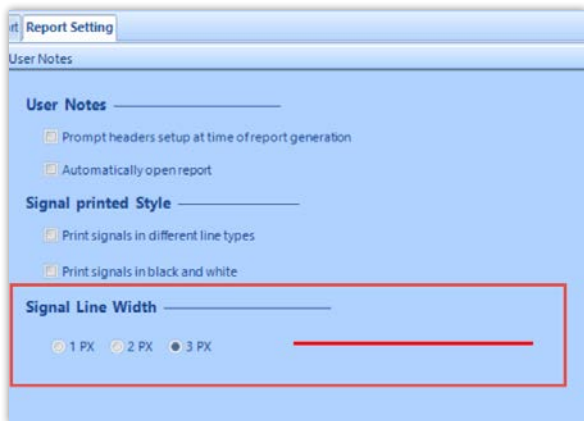
This allows for the optimum selection of the line width in a report without having to modify the displayed line width in EDM.

### Improved Text Display for Signals with Phase (FFT/FRF/CPS)

Users can conveniently display signals consisting of phase information on EDM software. Converting to text format when multiple signals are plotted within the same chart was a limitation in previous versions. Improvements to EDM 9.0 enables users to plot multiple signals on a chart and allows users to display signals in text format.

Customizable Font Size of Marker Text in EDM Display and Report

EDM 9.0 allows customizable font sizes for markers (peak markers, harmonic markers, etc.) on the display as well as on the report.
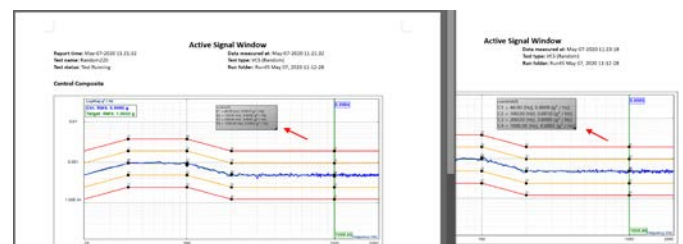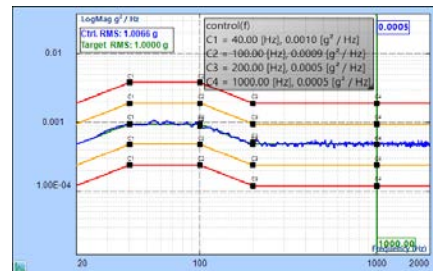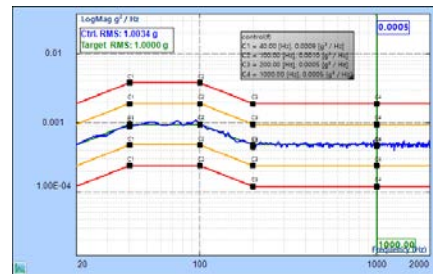
Improved PC Resources Check

EDM 9.0 introduces an advanced PC check to ensure that the available RAM and processor speed meets the minimum requirements to efficiently run EDM software.

Share Global Settings with Systems on LAN

EDM installed on multiple computers on the same LAN can share the same global settings stored in a central place. Requires editing the global config file.

Improved Signal Color Setting for Saved Signals and Live Signals

Different applications or different users require different display requirements. In certain applications, reviewing the same signal over the course of time is essential while in other applications comparing the signals from two different channels is more essential and requires the same coloring scheme used for live signals.
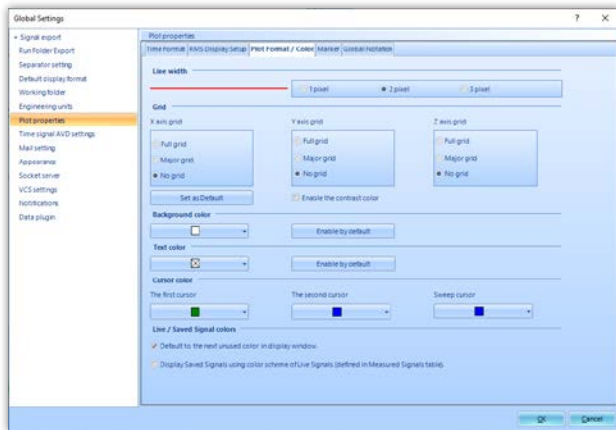
To accommodate all cases, users can select the signal coloring scheme for saved and live signals.

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	2/2/2019
Release	EDM 8.1	CI 8.1.0.1	11/13/2019
Release	EDM 9.0	CI 9.0.0.4	6/5/2020

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
Spider-80X/80Xi/80Hi/80Ci	
EDM Testing 9.0.0.x	9.0.0.x
Spider-81 (v7.x)	
EDM Testing 9.0.0.x	9.0.0.x
Spider-81B (v7.x)	
EDM Testing 9.0.0.x	9.0.0.x
Spider-80SG/SGi	
EDM Testing 9.0.0.x	9.0.0.x
Spider-20/20E/20HE/20H/20i	
EDM Testing 9.0.0.x	9.0.0.x

Product and Software Version	Firmware Versions
CoCo-80	
EDM 6.0.2.x	4.0.x
CoCo-70X	
EDM Testing 9.0.0.x (EDM CoCo for DSA)	1.8.x
Vibration Diagnostic System 1.4.2.x	1.8.x
CoCo-80X/90X	
EDM Testing 9.0.0.x (EDM CoCo for DSA)	1.8.x