CRYSTAL
INSTRUMENTS

EDM MODAL
SOFTWARE SPECIFICATIONS (v8.0)

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EDM MODAL (EMA) SOFTWARE

Engineering Data Management (EDM) is a PC-based software program designed for real-time data management and processing. It contains EDM Testing, EDM Machinery and EDM Utility installation packages.

EDM Modal software is contained in the EDM Testing installation package. It is a complete Modal Testing and Modal Analysis suite for Experimental Modal Analysis (EMA). EDM Modal was developed based upon the sophisticated technologies of modern modal analysis theory and technique. With its intuitive controls and powerful features, EDM Modal is the ultimate tool for modal analysis applications.

Test Management

Tests are managed through a MSSQL Server database. Signal files, test setup, and Unit Under Test (UUT) information are stored in the database. The user can search for previous tests using keywords, time, or date information. The database may be installed on local computer or on a server via Local Area Network (LAN).

Spider Hardware System Management

A Spider system consists of one or more Spider front-ends. The user constructs the system by combining Spider front-ends on the same LAN. The software validates and displays hardware attributes of each Spider front-end.

EDM Modal Software License Control

The EDM Modal software license requires activation. This license activation feature allows users to use EDM Modal analysis software without connecting the Spider hardware. For computers without an internet connection, offline or mobile activation options are available. The license can be deactivated on one computer and activated on another computer.

User Management and Access Code Control

The administrator can edit access privileges of other users. Each Spider front-end has its own access control code to prevent unauthorized access.

Measurement Quantities

The user has the option to select from a wide range of measurement quantities. Typical measurement quantities include acceleration, velocity, displacement, force, strain, torque, temperature, voltage, angle, phase, resistance, tacho speed, pressure, voltage, time, frequency, angular velocity, current, sound pressure, and mass.

Measurement Data Storage

- **Data Format:** compliant with ASAM-ODS hierarchy and structure
- **Signal Data Structure:** all signals are combined and saved into one file per each save command executed

Export Data File Formats

- ASAM-ODS XML, UFF ASCII, UFF Binary, ASCII, Excel, CSV, Matlab, .Wav

Import Data File Formats

- ASAM-ODS XML, UFF ASCII, UFF Binary, ASCII, Excel CSV, SIG

Languages

English, Russian, Japanese, Simplified and Traditional Chinese are available. Languages can be switched without reinstalling software.

Report

Formats Available: Open XML, MS Word (.doc, .docx), PDF

Input Channels

- **Location ID:** labels the physical point and direction of UUTs. Location ID is used to name signals.
- **Level Display:** bar graph displays the input level of each channel with 4 grids. Automatic IEPE sensor detection.
- **Sensitivity:** user-defined with engineering unit and input sensitivity setting
- **Input Types:** AC/DC, differential or single-ended, IEPE, Charge coupling
- **TEDS:** Read TEDS, Read all TEDS, support TEDS with location DOFs
- **Integration/Differentiation:** when acceleration is selected as the measurement physical quantity, integration or double integration can be applied to obtain velocity or displacement quantity. When velocity is selected as the measurement quantity, integration or differentiation can be applied to obtain displacement or acceleration.
- **Digital High-Pass Filter:** user-defined cutoff frequency

Output Channels

The output channels provide signal sources and generate user determined waveforms. Multiple output channels may generate signals independently but simultaneously. The Spider-80X/80Xi is equipped with two output channels but only one is enabled as default. An option (S80-P09) is available to enable the second output. The Spider-81 is equipped with up to 4 output channels. The Spider-80M supports from 2 to 8 output channels.

Review Mode

Review Mode is used to recall multiple saved signals in a user-defined format. When signals are saved to a PC, the parameters (such as level, RMS, elapsed time) of the test are also saved to the same file. The signals, along with the test parameters and run log values, are viewable under Review Mode. Reports including selected runs may be generated in Review Mode.

Geometry/ODS/Animation (EMA-01)

EDM Modal Geometry/ODS/Animation is the primary software module required for every EDM Modal system. This option provides fast and efficient structural model generation and full 3D visualization of test and analysis results.

The base elements (points, lines, and surfaces) can be added/deleted graphically, or through the typed Model Editor entry. Components can be specified for each part of the structure. Each component can have its own origin as well as its own directions and Euler angles. The basic component library includes: line, plane, cube, cylinder and sphere. Any of these can be added to the geometry model by specifying origin, direction, dimensions, and the number of cells of the component.

The geometry model can be saved and later recalled by other tests.

Also, the model can be cleared when the user wants to start over with a new geometry model for the structure under a current test. Several types of formats from 3rd party applications are supported for the geometry model import. The Universal File Format (UFF) format of point and line models is widely used and may be imported to EDM Modal Geometry.

One of the most used features of EDM Geometry is mode shape animation. Several types can be selected, such as 'point and arrow', wireframe, or surface contour. The animation's view mode can be set to single Perspective View or Quad-view (Perspective/Top/Side/Front). One cycle of the mode's animation can be saved to an .avi file.

EDM Modal Operational Deflection Shape (ODS) is a feature that allows users to better visualize the deformation of the structure under test. Time domain data and spectrum data can be animated using the animation feature of the geometry model. This feature is integrated with EDM Modal Geometry and works for all types of EDM Modal testing.

The database structure of EDM simplifies navigation and data selection. The selected data set can be animated using the geometry model. The vibration pattern, either in time domain, or frequency domain, can be saved to .avi video files as well.

Geometry Editor
- **View:** Perspective, Perspective/Top/Side/Front quad view
- **Coordinate Systems:** Cartesian, Cylindrical, Spherical
- **Objects:** Point, Line, Surface (triangle)
- **Operation:** Add, Remove
- **Decimate Model:** Tolerance or Scale mode
- **Component:** Select, Move
- **Component Move**: translation, rotation
- **Edit Model:** tabular form, Component, Point, Line, Surface
- **Undo/Redo:** Previous, Next
- **Built in Elements:** Line, Panel, Cube, Sphere, Cylinder and Circle by defining origin, orientation, size, number of sections, etc.
- **Geometry Model:** Import, Export, Clear
- **Geometry Import:** .xml, UFF type 15, 2411, 82, .dxf, .stl, .obj, .3ds, .nas
- **Geometry Export:** .xml
- **Display Control:** Rotate, Translate, Zoom in, Zoom out, Auto Scale
- **Point Display Control**: Show/Hide Point, Point normal, Point label
- **Line Display Control:** Show/Hide Line
- **Surface Display Control:** Show/Hide Model, Surface normal, Surface
- **Image Save:** Save Image to .png, .jpg, .bmp

Animation (Mode Shape)
- **View:** Perspective, Perspective/Top/Side/Front quad view
- **Display Control:** Rotate, Translate, Zoom in, Zoom out, Auto Scale

- **Point Display Control:** Show/Hide Point, Point normal, Point label
- **Line Display Control:** Show/Hide Line (deformed, un-deformed)
- **Surface Display Control:** Show/Hide Model, Surface normal, Surface
- **Animation Window:** Single, Left/Right, or Upper/Lower
- **Animation Control:** Animation point, Animation stop, Animation FFD, Contour
- **Animation Smooth:** Smooth
- **Animation Contour:** Contour Values, Edit Contour
- **Node Lines:** Node Lines
- **Un-deformed Elements:** Point, Line, Surface, Label and Model
- **Animation Equation Editor:** Interpolate unmeasured DOF per user entered Animation Equation of each DOF
- **Animation with Interpolation:** Animation with interpolation or not
- **Animation Speed Control:** Fast, Slow
- **Animation Amplitude Control:** Increase, Decrease
- **Animation One Step Control:** One frame step (On/Off), previous frame, next frame
- **FFD Control:** Show/Hide FFD point, FFD settings (X, Y, Z frame count setting)
- **Origin:** plot Origin of the geometry model
- **Video Save:** Save animation to .avi, or .gif
- **Image Save:** Save Image to .png, .jpg, .bmp

ODS and Time Animation
- **View:** Perspective, Perspective/Top/Side/Front quad view
- **Source Type:** Time or FRF with total signal number count
- **Reference Channel:** pulldown list for reference channel selection
- **Signal List:** Enabled (check or uncheck)
- **Switch Enabled DOF:** switch DOF of reference and excitation Roving hammer test data
- **Animation Window:** Single, Left/Right, or Upper/Lower
- **Animation Control:** Move back, Play/Pause, Stop Animation, Move forward
- **Animation Smooth:** Smooth
- **Animation Contour:** Contour Values, Edit Contour
- **Node Lines:** Node Lines
- **Undeformed Elements:** Point, Line, Surface, Label and Model
- **Animation Equation Editor:** Interpolate unmeasured DOF per user entered Animation Equation of each DOF
- **Animation with Interpolation:** Animation with interpolation or not
- **Display Control:** Rotate, Translate, Zoom in, Zoom out, Auto Scale
- **Point Display Control:** Show/Hide Point, Point normal, Point label

- **Line Display Control:** Show/Hide Line
- **Surface Display Control:** Show/Hide Model, Surface normal, Surface
- **Animation Control:** Animation point, Animation stop, Contour
- **Animation One Step Control:** One frame step (On/Off), previous frame, next frame
- **Origin:** plot Origin of the geometry model
- **Video Save:** Save animation to .avi or .gif
- **Image Save:** Save Image to .png, .jpg, .bmp

Hammer Impact Modal Testing (EMA-02-C16 and EMA-02-CHC)

EDM Modal Hammer Impact Testing provides the necessary features for a single-operator experimental modal test. The Hammer Impact GUI features an intuitive step-by-step process, allowing users to easily go through the setup and testing.

The testing process has been designed to help users quickly define acquisition parameters, so that more time can be spent on analysis. Users can define trigger behavior through the Trigger Setup; a Trigger-Preview window allows control over the trigger level and pre-trigger delay. For users that may need to review their measurements after each acquired frame, the 'Manual-Arm' trigger mode can be used. When this trigger mode is selected, acquired signals will be displayed for review and will prompt the user to accept/reject the signal. The auto-arm mode simply auto-accepts acquired measurements and automatically re-arms the trigger, helping to speed up the whole test process.

Driving Point Selection will help users decide where to place the fixed excitation or response reference. The idea here is to survey several candidate driving-points, measure their FRFs – this allows you to choose the best available DOF for the driving point. The FRF at the trial driving-point which best excites most of modes can be selected as the driving-point. EDM simplifies the data management for this important pre-test survey.

When taking measurements, the status of the DOFs are indicated in a Table window. The status of every measurement point is available from this table, which is updated as the test progresses. The Trigger Preview window is optimized for your viewing experiences – featuring a resizable window and adjustable font size. The font size increases when the window itself is dragged to be enlarged. With this added flexibility of the trigger window, EDM Modal supports users with various display types- users can be far removed from their display and still be able to take measurements. Users have total control of their testing, regardless of how far they are from the computer.

One common problem associated with hammer testing is the "double hit". EDM Modal Hammer Impact software can automatically detect a double hit and give the user the choice to automatically or manually reject the double strike. Hammer impact testing is seamlessly integrated with the necessary post modal analysis inside the EDM software.

Frequency Signal Analyzer Functions
- **Transient Time Block Size:** up to 256,000 points for 1 channel per Spider front-end, up to 16,000 points for all channels.

- **FFT Block Sizes:** 256 - 32,768 for up to 128 channels, 256 - 65,536 for 1 channel per Spider front-end, up to 16384 for 512 channels
- **FFT Spectral Lines:** 100 - 14,400 for all input channels, 100 - 28,800 for 1 channel per Spider front-end
- **Data Window Functions:** Hanning, Hamming, Flattop, Uniform, Kaiser-Bessel, Blackman, Force, Exponential, Force-Exponential
- **Averaging:** exponential, linear, peak hold
- **Time Trace:** RMS, Peak, RPM (if enabled) vs. Time
- **Spectrum Types:** linear spectrum, auto power spectrum, frequency response function, coherence, cross power spectrum, phase spectrum
- **PC FRF Estimators:** H1, H2, H3 and Hv
- **Auto Spectrum Type and Scaling:** linear spectrum with peak or RMS scaling, power spectrum or power spectrum density with RMS scaling (Spectrum Units: EU_{pk}, EU_{rms}, EU_{rms}^2, EU^2/Hz, $EU^2 \cdot s/Hz$), sqrt($EU^2 \cdot s/Hz$))
- **APS View:** as FFT or Octave of 1/1, 1/3, 1/6, 1/12, 1/24
- **Overlap:** no overlap, 25%, 50%, 75%, 87.5%, 95%
- **Display of Complex Spectrum:** bode plot

EMA Settings
- **Roving Mode:** Excitation or Response
- **Auto Increment to Next Point:** check box
- **Save at Completion of Averaging:** Auto-save or Prompt to save

Double Hit Detection
- **Enable Double Hit Detection:** check box
- **Auto Reject Double Hit:** check box

Acquisition Mode
- **Mode Selection:** free-run, continuous after trigger, single shot with trigger, single shot without trigger, auto-arm trigger, manual-arm trigger
- **Trigger Conditions:** trigger source > high level (rising edge); trigger source < low level (falling edge); low level < trigger source < high level; trigger source > high level OR trigger source < low level (bi-polar)
- **Trigger Delay:** ±100% of block size
- **Trigger Setup Display:** a special display view is created for trigger setup. User selects the acquisition mode, trigger source, trigger level, trigger delay, and trigger condition
- **Trigger Run-Time Display:** in manual arm-mode, a smaller window will pop up for the user to accept or reject the transient captured signals. Only accepted signals are averaged into the spectra.

Input Channel
- **Number of Input Channel:** up to 16, EMA-02-C16; from 17, up to 512, EMA-02-CHC
- **Exci./Resp. type:** Excitation, Response
- **DOFs:** Measurement point ID + Coordinate
- **Measurement Point ID:** User specified point ID on the structure

under test

- **Coordinate:** User selected coordinate from Cartesian, Cylindrical, or Spherical coordinate system
- **Increment Point By:** user specified value per input channels available to rove

Driving Point Selection
- **Driving Point Setup:** Input point, Direction, Response channel, Excitation channel, Driving point switch (On or Off)

Measurement
- **Initial Operation Buttons:** Run, Save, Config,
- **Trigger:** Setup trigger, Preview trigger
- **Setup:** Roving Setup
- **Switch:** Trigger switch
- **Operation Buttons:** Hold/Cont. Stop, Rec, Next point, Previous point, Reset avg
- **Acquisition Status Panel:** List of points, with status (Not Acquired, In Progress, Acquired)

SIMO/MIMO FRF Modal Testing (EMA-03/04-C16 and EMA-03/04-CHC)

EDM Modal Single Input Multiple Output (SIMO) and Multiple-Input Multiple-Output (MIMO) FRF Testing includes a dedicated test setup and operation process flow using single or multiple shakers to acquire FRF signals. Using a large channel count Spider data acquisition system (up to 512 channels) this shaker excitation method provides much higher test execution efficiency for the FRF measurements

The Source Output type supports pure random (white noise), burst random, Chirp/Burst Chirp, pseudo random, and periodic random. For periodical random types (pseudo random and periodical random), the delay block and cyclic block numbers can be set for the purpose of bringing the structure to steady state response prior to each data acquisition. This will result in leakage-free measurements that do not require the use of a tapering window function.

When using multiple shaker random excitation applications, the shaker-driving source signals are guaranteed to be uncorrelated with one another. The source output type supports pure random (white noise), burst random, chirp/burst chirp, pseudo random, and periodic random.

Multiple shaker excitation is useful to separate and clearly identify repeated roots and frequency-proximate modes. With more than one reference shaker, multiple columns of the Frequency Response Matrix can be measured simultaneously. Combined with the poly reference curve fitting algorithm, the modal participation factor will help to isolate the repeated and highly coupled modes.

Frequency Signal Analyzer Functions
- **Transient Time Block Size:** up to 256,000 points for 1 channel per Spider front-end, up to 16,000 points for all channels.
- **FFT Block Sizes:** 256 –32,768 for up to 128 channels, 256 –65,536 for 1 channel per Spider front-end, up to 16384 for 512 channels

- **FFT Spectral Lines:** 100–14,400 for all input channels, 100 –28,800 for 1 channel per Spider front-end
- **Data Window Functions:** Hann, Hamming, Flattop, Uniform, Kaiser-Bessel, Blackman, Force, Exponential, Force-Exponential
- **Averaging:** exponential, linear, peak hold
- **Time Trace:** RMS, Peak, RPM (if enabled) vs. Time
- **Spectrum Types:** linear spectrum, auto power spectrum, frequency response function, coherence, cross power spectrum, phase spectrum, multiple coherence (only for MIMO FRF EMA-04)
- **PC FRF Function:** H1, H2, H3 and Hv
- **Auto Spectrum Type and Scaling:** linear spectrum with peak or RMS scaling, power spectrum or power spectrum density with RMS scaling (Spectrum Units: EUpk, EUrms, EUrms2, EU2/Hz, EU2·s/Hz), sqrt(EU2·s/Hz))
- **APS View:** as FFT or Octave of 1/1, 1/3, 1/6, 1/12, 1/24
- **Overlap:** free-run, 25%, 50%, 75% or 90%
- **Display of Complex Spectrum:** bode plot

EMA Settings
- **Auto Increment to Next Point:** check box
- **Save at the completion of averaging:** Auto-save, or Prompt to save

Input Channel
- **Number of Input Channel:** up to 16, EMA-03/04-C16; from 17, up to 512, EMA-03/04-CHC
- **Exci./Resp. Type:** Excitation, Response; 1 Excitation for EMA-03; up to 8 Excitation for EMA-04
- **DOFs:** point and Coordinate
- **Measurement Point ID:** user defined
- **Coordinate:** user selectable from all type of coordinates
- **Increment Point By:** user defined channel increment value used for Auto increment/Next point/Previous point

Output Channel
- **Max Number of Output Channel:** 1, SIMO FRF EMA-03); up to 8, MIMO FRF EMA-04
- **On/Off:** On, Off
- User editable when Spider hardware is connected or disconnected
- **Output Waveform Type:** White noise (Random), Burst random, Chirp, Burst Chirp, Pseudo random, Periodic random
- **Synchronized Output:** check, or uncheck
- **Stop output channel after average # is reached:** check, or uncheck

Trigger Setup
- **Mode:** Source trigger

Scope
- **Initial Operation Buttons:** Run, Save, Config

- **Operation Buttons:** Hold/Cont. Stop, Rec

Measurement
- **Initial Operation Buttons:** Run, Save, Config
- **Trigger:** Setup trigger, Preview trigger
- **Operation Buttons:** Hold/Cont. Stop, Rec, Next point, Previous point, Reset avg

SIMO Stepped Sine Modal Testing (EMA-05-C16 and EMA-05-CHC)

EDM Modal SIMO Stepped Sine Modal Testing includes a dedicated test setup and operation process flow using a single shaker outputting a stepped sine wave to acquire FRF signals. Using a large channel count data acquisition system (i.e., Spider-80X or Spider-80Xi), this shaker excitation method provides much higher test execution efficiency for FRF measurements.

The Source Output type is Sine tone. From the name of Stepped Sine, data at one frequency will be measured at a time. Stepping through the defined points, either linear or logarithmic spaced, the FRF signals of each measurement DOFs with respect to the defined reference channel will be constructed.

Frequency Signal Analyzer Functions
- **Supported Input Channel:** up to 16, EMA-05-C16; from 17, up to 512, EMA-05-CHC
- **Spectrum Types:** linear spectrum, frequency response function, coherence
- **Display of Complex Spectrum:** bode plot

Test Parameters
- **Control Strategy:** No control, Amplitude
- **Sweep Type:** Linear, Logarithmic
- **Measurement Strategy:** Filter, RMS, Mean, Peak
- **Filter Type:** Fixed (bandwidth in Hz), Proportional (bandwidth in %)
- **Step Sine Entry:** Start frequency, End Frequency, Level in %, # of Points, DeltaF(Hz) (Linear), Points/Oct (Log)
- **Transition Speed:** Fast, Medium, Slow
- **Settling Time:** user specified
- **Step Duration:** time, cycle
- **Initial Drive:** user specified
- **Drive Limit:** user specified
- **Drive:** user specified (No control strategy)
- **Auto Increment to Next Point:** check box

Reference Profile
- **Profile Definition:** defined by breakpoints table
- **Operation:** Insert row, Delete row, Append row, Clear table; Import/Export profile
- **Breakpoints:** defined as frequency, level, and segment type
- **Segment Type:** Const. Ampl, Log-Log Const Slope, Linear-Linear Const Slope

- **Crossover Calculation:** by entering "?" the crossover frequency and amplitude automatically calculated.
- **Profile Maximum:** calculation of maximum expected acceleration, velocity and displacement, checked against shaker limits
- **Profile Library:** load from or save to

Input Channel
- **Channel Type:** Control, Monitor
- **Location ID:** User specified
- **Reference:** 1 channel set as reference for cross channel signals
- **DOFs:** Measurement point ID and Coordinate
- **Measurement Point ID:** user defined
- **Coordinate:** user selectable from all type of coordinates
- **Increment Point By:** user defined channel increment value used for Auto increment/Next point/Previous point

Measurement
- **Initial Operation Buttons:** Run, Save, Config
- **Trigger:** Setup trigger, Preview trigger
- **Operation Buttons:** Hold/Cont. Stop, Rec, Next point, Previous point, Reset avg

SIMO Swept Sine Modal Testing (EMA-35-C16 and EMA-35-CHC)

EDM Modal SIMO Swept Sine Modal Testing includes a dedicated test setup and operation process flow using a single shaker outputting a swept sine wave to acquire FRF signals or to test the device under test. Using a large channel count data acquisition system (i.e., Spider-80X or Spider-80Xi), this shaker excitation method provides much higher test execution efficiency for FRF measurements and minimizes the crest factor of applied forces.

The Source Output is Sine tone. From the name of Swept Sine, the frequency of the sine tone is sweeping from the start frequency to the end frequency defined. Sweeping through the defined frequency range at the level defined, either linear or log spaced, the FRF signals of each measurement points with respect to the defined reference channel will be constructed.

Frequency Signal Analyzer Functions
- **Supported Input Channel:** up to 16, EMA-35-C16; from 17, up to 512, EMA-35-CHC
- **Spectrum Types:** linear spectrum, frequency response function, coherence
- **Display of Complex Spectrum:** bode plot

Test Parameters
- **Control Strategy:** No control, Amplitude
- **Sweep Type:** Linear, Logarithmic
- **Measurement Strategy:** Filter, RMS, Mean, Peak
- **Filter Type:** Fixed (bandwidth in Hz), Proportional (bandwidth in %)
- **Sweep Sine Entry:** Left frequency, Start frequency, Right Frequency, Initial sweep direction, Level in %, Sweep speed (Hz/s,

Linear; Oct/Min, Log), Sweep #, Total time, Total sine cycles

- **Hold Sweep after target level reached:** check box
- **Initial Drive:** user specified
- **Drive Limit:** user specified
- **Drive:** user specified (No control strategy)
- **Auto increment to next point:** check box

Reference Profile
- **Profile Definition:** defined by breakpoints table
- **Operation:** Insert row, Delete row, Append row, Clear table; Import/Export profile
- **Breakpoints:** defined as frequency, level, and segment type
- **Segment Type:** Const. Ampl, Log-Log Const Slope, Linear-Linear Const Slope
- **Crossover Calculation:** by entering "?" the crossover frequency and amplitude automatically calculated.
- **Profile Maximum:** calculation of maximum expected acceleration, velocity and displacement, checked against shaker limits
- **Profile Library:** load from or save to

Input Channel
- **Channel Type:** Control, Monitor
- **Location ID:** User specified
- **Reference:** 1 channel set as reference for cross channel signals
- **DOFs:** Measurement point ID and Coordinate
- **Measurement Point ID:** user defined
- **Coordinate:** user selectable from all type of coordinates
- **Increment Point By:** user defined channel increment value used for Auto increment/Next point/Previous point

Measurement
- **Initial Operation Buttons:** Run, Save, Config
- **Trigger:** Setup trigger, Preview trigger
- **Operation Buttons:** Hold/Cont. Stop, Rec, Next point, Previous point, Reset avg

MIMO Stepped Sine Modal Testing (EMA-06-C16 and EMA-06-CHC)

EDM Modal MIMO Stepped Sine Modal Testing includes a dedicated test setup and operation process flow using multiple shakers outputting a stepped sine wave to acquire FRF signals. Using a large channel count data acquisition system (i.e., Spider-80X or Spider-80Xi), this shaker excitation method provides much higher test execution efficiency for FRF measurements.

The Source Output type is Sine tone. From the name of Stepped Sine, data at one frequency will be measured at a time. Stepping through defined points that are either linear or logarithmic spaced, the FRF signals of each measurement DOFs with respect to the defined reference channels will be constructed.

Frequency Signal Analyzer Functions
- **Supported Input Channel:** up to 16, EMA-06-C16; from 17, up to 512, EMA-06-CHC
- **Spectrum Types:** linear spectrum, frequency response function, coherence
- **Display of Complex Spectrum:** bode plot

Test Parameters
- **Control Strategy:** No control, Amplitude
- **Sweep Type:** Linear, Logarithmic
- **Measurement Strategy:** Filter, RMS, Mean, Peak
- **Filter Type:** Fixed (bandwidth in Hz), Proportional (bandwidth in %)
- **Step Sine Entry:** Start frequency, End Frequency, Level in %, # of Points, DeltaF(Hz) (Linear), Points/Oct (Log)
- **Transition Speed:** Fast, Medium, Slow
- **Settling Time:** user specified
- **Step Duration:** time, cycle
- **Initial Drive:** user specified
- **Drive Limit:** user specified
- **Drive:** user specified (No control strategy)
- **Auto Increment to Next Point:** check box

Reference Profile
- **Profile Definition:** defined by breakpoints table
- **Operation:** Insert row, Delete row, Append row, Clear table; Import/Export profile
- **Breakpoints:** defined as frequency, level, and segment type
- **Segment Type:** Const. Ampl, Log-Log Const Slope, Linear-Linear Const Slope
- **Crossover Calculation:** by entering "?" the crossover frequency and amplitude automatically calculated.
- **Profile Maximum:** calculation of maximum expected acceleration, velocity and displacement, checked against shaker limits
- **Profile Library:** load from or save to
- **Number of Sweeps:** user defined
- **Initial Phases:** +/-, or random

Input Channel
- **Channel Type:** Control, Monitor
- **Location ID:** User specified
- **Reference:** 2 channels or more set as reference for cross channel signals
- **DOFs:** Measurement point ID and Coordinate
- **Measurement Point ID:** user defined
- **Coordinate:** user selectable from all type of coordinates
- **Increment Point By:** user defined channel increment value used for Auto increment/Next point/Previous point

Measurement
- **Initial Operation Buttons:** Run, Save, Config
- **Trigger:** Setup trigger, Preview trigger

- **Operation Buttons:** Hold/Cont. Stop, Rec, Next point, Previous point, Reset avg

Operational Modal Testing (EMA-08-C16 and EMA-08-CHC)

EDM Modal Operational Modal Testing includes a dedicated test setup and operation process flow to acquire ambient vibration signals. Using a large channel count data acquisition system (i.e., Spider-80X or Spider-80Xi), this shaker excitation method provides much higher test execution efficiency for measurements.

The Operational Modal Analysis (OMA) takes advantage of natural excitations from ambient forces or operational loads, (i.e., wind, traffic, etc.,) which makes possible the dynamic identification of large civil structures or operating machineries. Due to its response-only nature, special processing is carried out to process the vibration data before the modal model is identified. EDM Operational Modal Testing provides response data acquisition, response data processing, and readies data for modal parameter identification.

Frequency Signal Analyzer Functions
- **Supported Input Channel:** up to 16, EMA-08-C16; from 17, up to 512, EMA-08-CHC
- **FFT Block Sizes:** 256 –32,768
- **FFT Spectral Lines:** 100–14,400
- **Data Window Functions:** Hann, Hamming, Flattop, Uniform, Kaiser-Bessel, Blackman, Force, Exponential, Force-Exponential
- **Averaging:** exponential, linear, peak hold
- **Spectrum Types:** auto power spectrum, cross power spectrum
- **Auto Spectrum Type and Scaling:** linear spectrum with peak or RMS scaling, power spectrum or power spectrum density with RMS scaling (Spectrum Units: EU_{pk}, EU_{rms}, EU_{rms}^2, EU^2/Hz, $EU^2{\cdot}s/Hz$), sqrt($EU^2{\cdot}s/Hz$))
- **Overlap:** free-run, 25%, 50%, 75% or 90%
- **Display of Complex Spectrum:** bode plot

EMA Settings
- **Auto Increment to Next Point:** check box
- **Save at Completion of Averaging:** Auto-save, or Prompt to save

Input Channel
- **Reference:** check box
- **DOFs:** point and Coordinate
- **Measurement Point ID**: user defined
- **Coordinate:** user selectable from all type of coordinates
- **Increment Point By:** user defined channel increment value used for Auto increment/Next point/Previous point

Scope
- **Initial Operation Buttons:** Run, Save, Config
- **Operation Buttons:** Hold/Cont. Stop, Rec

Measurement
- **Initial Operation Buttons:** Run, Save, Config

- **Trigger:** Setup trigger, Preview trigger
- **Operation Buttons:** Hold/Cont. Stop, Rec, Next point, Previous point, Reset avg

Modal Data Processing
- **Smooth Signal:** using deconvolution to smooth the spectrum, multiple smoothing allowed
- **Cancel Smooth:** cancel the smoothing process and back to the original spectrum

Standard Modal Analysis (EMA-11)

EDM Standard Modal Analysis provides the user with complete features, from FRF data selection and parameter identification to results validation and mode shape animation.

Upon completion of Modal testing, the resulting set of FRF data is made available for the next step: Modal Analysis. You can also add/replace individual FRF signals. The complete set of FRF test signals can be exported or imported from other sources. These operations are managed by 'Modal Data Selection'. The FRF signals are organized for a rapid comprehensive review, individual review, or multiply in one graph window.

With one click, the Modal Parameter Identification process can be started. With the help of a Mode Indicator Function (MIF), the natural frequencies can be labeled. The Multivariate, Complex, Real, and Imaginary Sum MIFs are available. MIF indicators aide identifying repeated roots (repeated poles) and closely-spaced distinct roots.

A Stability Diagram is employed with modal parameter identification. With the Standard Modal Analysis option, the proven Least Square Complex Exponential (LSCE) fitter is implemented for pole identification. The physical poles sought are stable (as opposed to 'computational poles' sometimes produced by the LSCE) and can be selected from the Stability Diagram for the next step mode shape calculation, using the Least Square Frequency Domain (LSFD) algorithm.

The resulting mode shape table can be saved and used for mode shape animation. Modal Assurance Criterion (MAC) function and FRF synthesis are also available. These provide means for modal parameter validation.

Modal Data Selection
- **Source of FRF Signals:** Live signals, Run folders, Data files
- **Enable Analysis:** Select all, Inverse selection
- **Signal Removal:** Remove signal, Remove all signals
- **Switch DOFs:** only available for Hammer Impact test with roving hammer case
- **FRF Data Directions:** X, Y, Z, R, T, T, P, S
- **Data Set:** Import, Export (to or from .xml file)
- **FRF Signal Display Mode:** Display select signal only, or multiple signals
- **Geometry Display:** Selected FRF point indication
- **Modal Parameters:** Brings to Band Selection for curve fitting

- **Range Cursor:** movable using mouse
- **Start/End Frequency:** user entered, or from Range cursor
- **Max Modes:** user defined number of max modes for iteration
- **Estimation Method:** Time Domain, Poly-X
- **Display Style:** MIF, Sum, Selected Function
- **MIF Functions:** Multivariate MIF, Complex MIF, Real MIF, Imaginary Sum
- **Action Button**: Calculate Stabilization

Stability Diagram
- **Mode Selection:** Add, Remove, Remove all
- **Mouse Hover Display:** Rank, Frequency, Damping, Type (New poles, Stable frequency, Stable poles)
- **Poles List:** Mode #, Frequency, Damping
- **Calculate Modes:** brings into mode shaper calculation
- **Action Button:** Calculate modes
- **Mode Shape Save Option:** Save to new shape (with Shape name box), Save to existing shape (with Select shape box)
- Delete Pole
- **Speed:** User selectable from 1 to 10 seconds

Advanced Modal Analysis (EMA-12)

EDM Modal Advance Modal Analysis includes all the features of EMA-11 Standard Modal Analysis. As an added bonus, it also provides the Poly-reference modal analysis algorithm to curve fit the FRF matrix from the MIMO FRF testing results. The time domain curve fitting algorithm for the pole identification is the sophisticated and proven Poly reference time domain method (PTD).

The selection of the curve fitting method, PTD or LSCE, is automatically based on the type of FRF signal set selected, whether it is a single reference or multi-reference.

Premium Modal Analysis (EMA-13)

EDM Modal Premium Modal Analysis includes all the features of EMA-12 Advanced Modal Analysis. As an added bonus, it also provides the Poly-X modal analysis algorithm to curve fit the FRF matrix from the MIMO FRF testing results. It is the frequency domain curve fitting algorithm for the pole identification, Poly reference least square frequency domain (p-LSCF), which is more efficient and neat.

The selection of the curve fitting method, Time domain or Poly-X, is available from the Band Selection tab, per software options available.

Correlation Analysis (EMA-21)

EDM Modal Correlation Analysis allows the user to correlate two modal models. The modal models can be EMA model, and/or FEA model. The geometry model and mode shape data from the FEA software or another set of mode shape data from EMA can be imported. A modal mapping procedure is executed to match the EMA and FEA models. After this matching procedure, the new mode shape information from FEA is interpolated and the FEA modal parameters are displayed alongside with EMA results. Finally, to

observe the correlation between the results from two methods, a Cross-MAC matrix is calculated and shown.

Import
- **Model:** .xml, .unv, .nas
- **Mode Shape:** .unv

Modal Mapping
- **Match:** pair 3 points from each model
- Auto Match

- Calculate MAC
- Display MAC Chart
- Animation Comparison: Left/Right, Upper/Lower

PC Requirements for EDM Software

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):
- **Operating System:** Windows 10, 64-bit
- **Processor:** Intel Core i7, 2.0 GHz or Higher
- **RAM:** 8GB DDR3 1600 or higher
- **Available Storage Space:** 10 GB

Software Bundles

Part Number	Function	EMA-10-CHC	EMA-30-CHC	EMA-40-CHC	EMA-50-CHC	EMA-70	EMA-80
S20-P02 or S20E-P02	Spider-20 or -20E two input channels						X
EMA-01	Geometry/ODS/Animation	X	X	X	X	X	x
EMA-02-CHC	Hammer Impact Modal Testing	X			X		X
EMA-03-CHC	SIMO FRF Modal Testing		X				
EMA-04-CHC	MIMO FRF Modal Testing			X	X		
EMA-11	Standard Modal Analysis	X	X	X		X	X
EMA-12	Advanced Modal Analysis				X		