

EDM Modal Software Specifications

Includes the following:

- Geometry/ODS/Animation
- 3D Model Reconstruction
- Hammer Impact Modal Testing
- SIMO/MIMO FRF Modal Testing
- SIMO/MIMO Sine Modal Testing & Stepped Sine
- SIMO/MIMO Sine Modal Testing & Swept Sine
- Operational Modal Testing
- Standard/Advanced/Premium Modal Analysis
- Premium Operational Modal Analysis
- Correlation Analysis



A complete Modal Testing and Modal Analysis suite for Experimental Modal Analysis (EMA).

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EDM Modal (EMA) Software

EDM Modal software is a complete Modal Testing and Modal Analysis suite for Experimental Modal Analysis (EMA). Hammer Impact testing, modal shaker(s) testing or operational modal testing can be executed to acquire FRF or CSD signals.

Data File Formats and Reporting

- **Export:** ASAM-ODS XML, UFF ASCII, UFF Binary, ASCII, Excel, CSV, Matlab, .Wav
- **Import:** ASAM-ODS XML, UFF ASCII, UFF Binary, ASCII, Excel CSV, SIG
- **Report:** 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.
- **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:** can be applied to acceleration, velocity, and displacement plots
- **Digital High-Pass Filter:** user-defined cutoff frequency

Output Channels

The output channels provide signal sources and generate user determined waveforms (up to 8 outputs).

Testing Plan

This feature provides information about the measurement acquisition status and helps to customize and control the testing process flow with a quick glance of the roving mode and the measurement points.

Recording & Playback Analysis (EMA-10)

This feature allows users to take the recorded time signals and process these modal measurements to obtain the related frequency domain signals. This function is available in Hammer Impact, SIMO/MIMO FRF and OMA.

CoCo Testing Plan (C80X-24 or C90X-24)

This feature combines the powerful Coco hardware system platform with the strong functionalities of EDM Modal software to provide a seamless integration of the modal analysis process.

Factory Acceptance Test

The test sequence feature in EMA software can be used to run lined up tests.

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.

Geometry Editor

- **Draw:** Point, Line, Surface
- **Structure Library:** Add Line, Panel, Cube, Sphere, Cylinder, Circle, Cone
- **Model Editor:** Modify Components, Point, Line, Surface (triangle)
- **Operations:** Undo, Redo, Decimate Model, Edit Coordinates
- **View:** Auto Scale, Rotate, Translate, Rotate (CCW, CW), Zoom (In, Out)
- **Display Settings:** Point, Line, Surface – Show/Hide, Normal Indicator, Labels
- **Geometry Import/Export:** Import (.xml, UFF type 15, 2411, 82, .dxf, .stl, .obj, .3ds, .nas), Export (.xml)
- **Image Save:** Save Image to .png, .jpg, .bmp

Animation (Mode Shape)

- **View:** Auto Scale, Rotate, Translate, Rotate (CCW, CW), Zoom (In, Out)
- **Display Settings:** Point, Line, Surface – Show/Hide, Normal Indicator, Labels, Undeformed Model, Origin
- **Animation Control:** Play, Pause, Stop, Frame (Previous, Next), Speed (Slow, Fast), Amplitude (Increase, Decrease)
- **Animation Settings:** View (Single, Double, Quad), Contour (Values, Edit), Interpolation, Node Lines, Smooth
- **Save:** Video (.avi, .gif), Image (.png, .jpg, .bmp)

ODS (Time and Spectrum Signals Animation)

- **View:** Auto Scale, Rotate, Translate, Rotate (CCW, CW), Zoom (In, Out)
- **Display Settings:** Point, Line, Surface – Show/Hide, Normal Indicator, Labels, Undeformed Model, Origin
- **Animation Control:** Play, Pause, Stop, Frame (Previous, Next), Speed (Slow, Fast), Amplitude (Increase, Decrease)
- **Animation Settings:** View (Single, Double, Quad), Contour (Values, Edit), Interpolation, Node Lines, Orbit, Smooth
- **Save:** Video (.avi, .gif), Image (.png, .jpg, .bmp)

3D Model Reconstruction (EMA-01-01)

The 3D Model Reconstruction software produces 3D geometric models of complex test structures using a group of 2D photos.

3D Reconstruction

- **Load Images:** .jpg, .jpeg
- **Feature Extraction:** CCD Width, Image Scale, Match Ratio (0-1)
- **Spare Reconstruction:** Fast In Spare Reconstruction, Auto-Select Initial Image Pairs, Initial Pair
- **Dense Reconstruction:** Re-Extracting Features in Dense Reconstruction
- **Surface Reconstruction:** automatically reduce model size

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

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

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 (128 ch), 256 - 65,536 for 1 channel per Spider front-end, up to 16384 for (512 ch)
- **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
- **Averaging:** exponential, linear, peak hold
- **Time Trace:** RMS, Peak, RPM (if enabled) vs. Time
- **Spectrum Types:** FFT, APS, CPS, FRF, COH
- **PC FRF Estimators:** H1, H2, H3 and Hv
- **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%

EMA Settings

- **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:** 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:** $\pm 100\%$ of block size
- **Trigger Setup Display:** acquisition mode, trigger source, trigger level, trigger delay, and trigger condition
- **Trigger Run-Time Display:** pop up for the user to accept or reject the transient captured signals
- **Auxiliary Set:** suggested trigger level and block size

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
- **Roving mode:** Response, Excitation
- **Increment:** user defined global integer number
- **Auto Increment:** check box

Driving Point Selection

- **Driving Point Setup:** input point, direction, response channel, excitation channel, driving point switch (on or off)

Measurement

- **Testing Plan:** Select, Run, Reset, Skip, Edit, Insert entry before/after, Delete, Re-calculate all measurement entries
- **Initial Operation Buttons:** Run, Save, Config
- **Trigger:** setup trigger
- **Operation buttons:** Hold/Cont., Stop, Rec, Save, Next Entry, Previous Entry, Redo Entry

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.

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 (128 ch), 256 –65,536 for 1 channel per Spider front-end, up to 16384 (512 ch)
- **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
- **Averaging:** exponential, linear, peak hold
- **Time Trace:** RMS, Peak, RPM (if enabled) vs. Time
- **Spectrum Types:** Spectrum Types: FFT, APS, CPS, FRF, COH, MCOH (only for MIMO FRF EMA-04)
- **PC FRF Function:** H1, H2, H3 and Hv
- **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%
- **Multi-Resolution Spectrum:** drop-down for choosing cut-off frequencies

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
- 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

- **Testing Plan:** Select, Run, Reset, Skip, Edit, Insert entry before/after, Delete, Re-calculate all measurement entries
- **Initial Operation Buttons:** Run, Save, Config
- **Trigger:** Setup Trigger, Preview Trigger
- **Operation Buttons:** Hold/Cont. Stop, Rec, Next Point, Previous Point, Reset Avg

SIMO/MIMO Sine Modal Testing (EMA-25/26-C16 and EMA-25/26-CHC): Swept & Stepped Sine

EDM Modal SIMO/MIMO Swept & Stepped Sine Modal Testing includes a dedicated test setup and operation process flow using single or multiple shakers outputting swept or stepped sine wave to acquire FRF signals.

Frequency Signal Analyzer Functions

- **Supported Input Channel:** up to 16, EMA-06-C16; from 17, up to 512, EMA-06-CHC
- **Spectrum Types:** FFT, APS, CPS, FRF, COH, MCOH

EMA Settings

- **Auto Increment to Next Point:** check box
- **Save at Completion of Averaging:** auto-save or prompt to save

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
- **Step Sine Entry:** Start Frequency, End Frequency, Level in %, # of Points, Delta-F(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 “?” automatically calculates the crossover frequency and amplitude
- **Profile Maximum:** 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:** 1 for SIMO (EMA-25); 2 channels or more for MIMO (EMA-26) 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
- **Testing Plan:** Select, Run, Reset, Skip, Edit, Insert entry before/after, Delete, Re-calculate all measurement entries

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.

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
- **Averaging:** exponential, linear, peak hold
- **Spectrum Types:** APS, CPS
- **Overlap:** free-run, 25%, 50%, 75% or 90%

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

- **Testing Plan:** Select, Run, Reset, Skip, Edit, Insert entry before/after, Delete, Re-calculate all measurement entries
- **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 return to the original spectrum

Standard Modal Analysis (EMA-11)

EDM Standard Modal Analysis provides users with

complete features, from FRF data selection and parameter identification to results validation and mode shape animation.

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
- **Multi-reference:** select signals by DOF
- **Switch DOFs:** only available for Hammer Impact test with roving hammer case
- **FRF Data Directions:** X, Y, Z, R, T, P, S
- **FRF Signal List:** save or recall signal list (to or from .xml file)
- **FRF Signal Display Mode:** display select signal only, or multiple signals
- **Check Missing FRFs:** FRFs not collected for measurement points
- **Geometry Display:** selected FRF point indication
- **Validate:** FRF Compatibility Check

Band Selection

- **Range Cursor:** movable using mouse
- **Start/End Frequency:** user entered, or from Range cursor
- **Display Style:** MIF, Sum, Selected Function
- **MIF Functions:** Multivariate MIF, Complex MIF, Real MIF, Imaginary Sum
- **Automatic Pole Selection:** auto select stable poles

Stability Diagram

- **Max Modal Order:** user defined number of max modes for iteration
- **Estimation Method:** Time Domain, Poly-X
- **Action Button:** Calculate Stabilization
- **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, Save to Existing Shape
- **Delete Pole**
- **Speed:** user selectable from 1 to 10 seconds

Advanced Modal Analysis (EMA-15)

EDM Modal Advance Modal Analysis requires EMA-11 Standard Modal Analysis. As an added bonus, it also provides the Poly-Reference modal analysis (PTD) algorithm to curve fit the FRF matrix from the MIMO FRF testing results.

Premium Modal Analysis (EMA-16)

EDM Modal Premium Modal Analysis requires EMA-11 Standard Modal Analysis. As an added bonus, it also provides the Poly-X modal analysis algorithm (p-LSCF) to curve fit the FRF matrix from the MIMO FRF testing results.

Premium Operational Modal Analysis (EMA-14)

EDM Modal Premium Operational Modal Analysis requires EMA-11 Standard Modal Analysis. As a dedicated curve fitting method for OMA analysis, the Stochastic Subspace Identification (SSI) is available as well.

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.

Import

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

Modal Mapping

- **Match:** pair 3 points from each model
- **Auto Match**
- **Calculate MAC**
- **Display MAC Chart (colour coded)**
- **Animation Comparison:** Left/Right, Upper/Lower

Supported Hardware Systems

- Spider-80X/80Xi
- Spider-80M
- Spider-20/20E
- CoCo-80X/90X

| Hardware Platform | Spider-20 | Spider-80X | Spider-80Xi | Spider-80M | CoCo-80X/90X |
|----------------------------------|--|--|---|---|--------------------------------------|
| Number of Front-ends Per Chassis | 1 | 1 | 8 | 1 | 1 |
| Number of Inputs per Front-end | 4 | 8 | 8 | 8 | 8/16 |
| Max Number of Inputs Per Chassis | 4 | 8 | 64 | 56 | 8/16 |
| Max Number of Inputs Per System | 4 | 512 | 512 | 504 | 8/16 |
| Number of Outputs Per System | 1 | 2 | 2 | 2 | 1 |
| Input Mode | Charge TEDS IEPE Voltage | Charge (optional) TEDS IEPE Voltage | Charge TEDS IEPE Voltage Strain gage MEMS RTD Thermocouple | Charge TEDS IEPE Voltage Strain gage MEMS RTD Thermocouple | Charge TEDS IEPE Voltage |
| Digital I/O | N/A | 4 in/out, isolated | 4 in/out, isolated | 4 in/out, isolated | N/A |
| Front Panel LCD | No | No | Yes | Yes | Yes |
| Notes | Can be used for: 1. Hammer Impact 2. Shaker Excitation 3. OMA | Can be used for: 1. Hammer Impact 2. Shaker Excitation 3. OMA | Can be used for: 1. Hammer Impact 2. Shaker Excitation 3. OMA | Can be used for: 1. Hammer Impact 2. Shaker Excitation 3. OMA | Can be used for: 1. Hammer Impact |

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

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