DEWETRON

MODAL TEST

SOFTWARE MANUAL

EN ISO 14001

ISO 9001

MODAL TEST - OXYGEN R7.4
Software Manual - V1.3

Preface

The information contained in this document is subject to change without notice.

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14.01.2025	T. Klug	- added video export - added SDOF Circle Fit	1.3

Contents

1 Getting started

OXYGEN OPT-MODAL (OXYGEN MODAL) is the brand new modal test software option of DEWETRON's OXYGEN measurement software that you can use with most DEWETRON hardware devices.
In addition to the list of general features, this chapter describes how to perform the following tasks:

- OXYEN Basics
- Setting up data channels
- Creating a Modal Test setup
- Navigating the Modal Test screen

INFORMATION

DEWETRON offers tailor-made product and application training to support you with your measurement and analysis. Please contact us for more information.

1.1 General Features

The following features enable a flexible and quick setup of a modal test for an arbitrary object:

- **Model Editor:** Quick setup of a test object with excitation nodes and response nodes
  - Define measurement objects - Set the number of excitation/response points and general measurement axes and direction. This can be adjusted later in the "Measured Nodes".
  - Define vertices - Set the position of excitation/response points in the coordinate system.
  - Define contour - Connect points by line, triangle, or quad operations in the 3D model.
  - Define measured nodes - Adjust measurement axes and directions including rotation.
- **Input Channels & Groups:** Assignment of data channels to excitation nodes and response groups.
  - Drag and Drop response and excitation signals from the channel list
  - Automatically assign response signals from the channel list
- **Trigger & FRF:** Setup of Triggers, FFT and FRF
  - Preview Excitation Amplitude and set trigger level
  - Define FFT sample size and maximum frequency
  - Set calculation type for frequency response function (H, H1, H2, H3, and Hv)
- **Modal Test Screen:** Intuitive visualization of excitation events
  - Amplitude - Response/Excitation (e.g. g/N or m/s^2/N)

- ☐ FRF Single - Data of single trigger event in amplitude plot
- ☐ Phase shift - Response/Excitation [°]
- ☐ Coherence - Response/Excitation [1..0]
- ☐ MIF - Mode indicator function in coherence plot
- ☐ Warnings - Custom range limit, measurement range exceeded, double hit

In addition to the great measurement functions of OXYGEN, the MODAL-Option enables the recording of the following excitation and response characteristics.

- **Excitation**
  - ☐ Input Raw (Raw input values for each excitation point)
  - ☐ Spectra (Spectrum of each excitation)
- **Responses**
  - ☐ Input Raw (Raw input values for each measurement point per excitation)
  - ☐ Spectra (Spectrum of each measurement point per excitation)
  - ☐ FRF Single (Frequency response function for each triggered measurement)
  - ☐ FRF Average (Frequency response function for the average of triggered measurements)
  - ☐ Coherence (Similarity of each excitation and response)
- **MIF** (Mode indicator function)

INFORMATION

The requirements for full functionality and maximum speed are:

- CPU: Intel Core i5 3rd Generation or better
- RAM: 8 GB or greater
- DAQ: TRION
- OS: Windows 7 64 Bit or newer (Linux Version on request)
- Preinstalled DAQ driver (TRION API)

1.2 OXYGEN Basics

1. Switch on your DEWETRON measurement device
2. Use the provided DEWETRON OXYGEN (R7.0 or higher) Installer if not installed already.
3. Start the OXYGEN measurement software (if not launched automatically)

Startup Screen

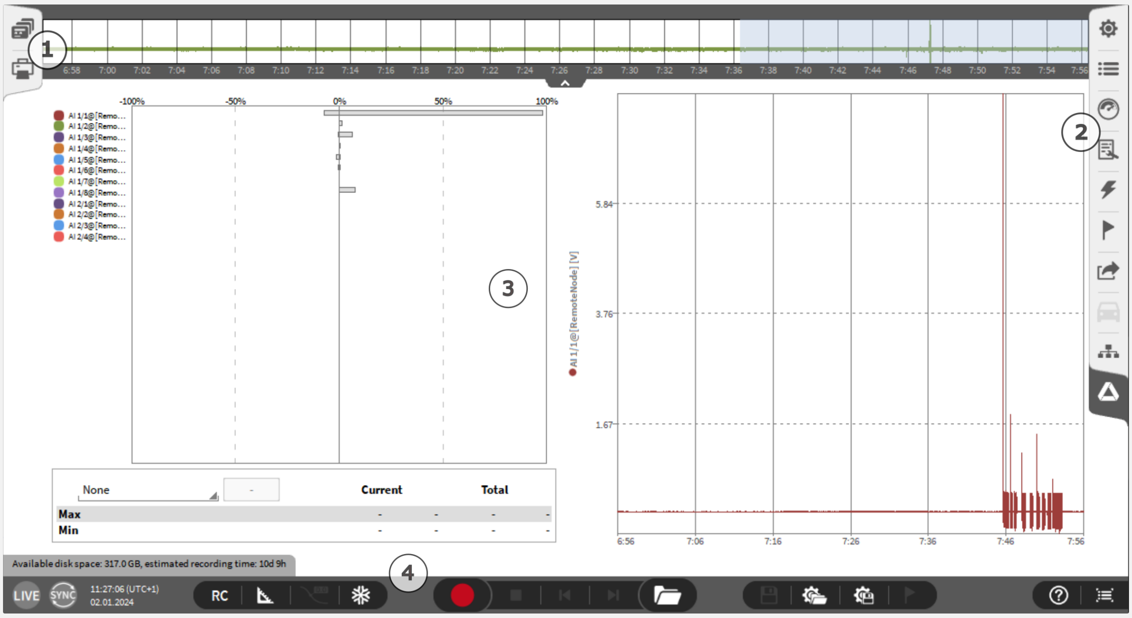

Figure 1.1: Startup Screen

(1) Screens and Reporting (2) Menu Bar (3) Instrument area (4) Action bar

The startup screen contains four main areas, the (1) "Screens and Reporting" tabs, where additional screens can be added and reports can be created. The (2) "Menu bar" contains a variety of functionalities including the measurement settings, the data channel list, and the measurement instruments, which can be added to the instrument area (3) by drag and drop. By default, a saturation meter on the left and a chart recorder on the right are placed in the instrument area. The fourth area (4) is the "Action bar", where the measurement can be controlled and the setup saved or loaded.

Action Bar

Figure 1.2: Action Bar

(5) Instrument state indicator

(6) Screen lock

(7) Design mode

(8) Activate/Deactivate cursor for active instrument

(9) Freeze screen content

(10) Start recording / arm trigger

(11) Stop recording

(12) Jump backward

(13) Jump forward

(14) Open data file for analysis (.dmd)

(15) Save changes in data file (Play Mode)

(16) Open configuration setup (.dms)

(17) Save configuration setup (.dms)

(18) Insert marker during recording

(19) GUI tutorial

(20) Open/Close channel list

Menu Bar

Figure 1.3: Menu Bar

(21) Open measurement settings

(22) Open channel list

(23) Open instruments panel

(24) Open instrument properties

(25) Open trigger events

(26) Open event list

(27) Open export settings

(28) Open network and sync menu

(29) Open birds eye

(30) Open OXYGEN setup

For further information, please see the latest OXYGEN manual in our Customer Care Center:
https://ccc.dewetron.com/pl/oxygen.

1.3 Setting up data channels

The first step after switching on your DEWETRON measurement device is to set up your data channels in the channel list.

- Switch to the channel list (1)
- Click on the channel setup (2) (gear icon)

Channel list

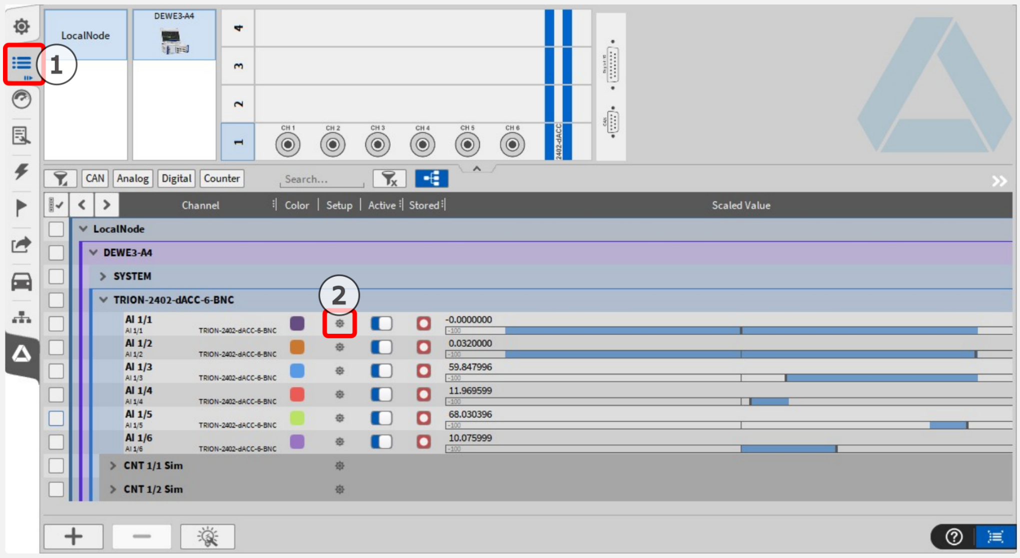

Figure 1.4: Channel setup in channel list

Proper measurements require correct sensor scaling. In most cases, the sensor label gives information about the input/output scaling. This value is often known as the "transducer factor", "ratio" or "sensitivity". Important is the unit of the scaling, e.g. 100.59 mV/g or 10.257 mV/(m/s²).

IEPE sensor scaling

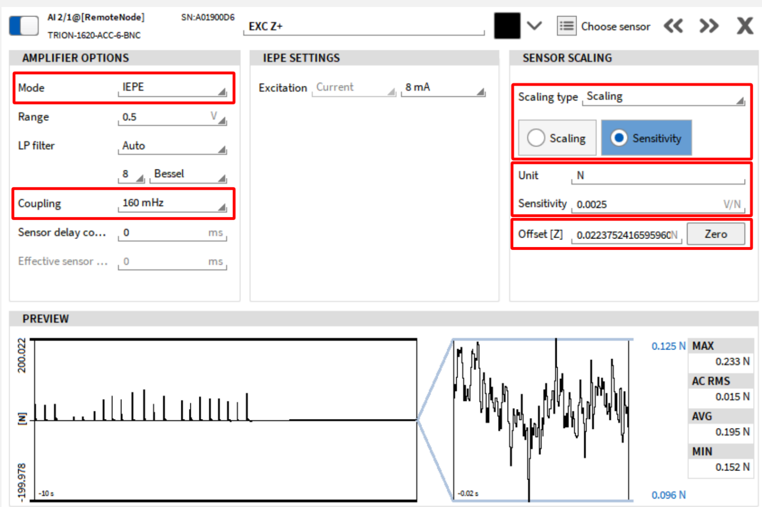

Figure 1.5: IEPE Sensor scaling

- Select the mode fitting your sensor (e.g. IEPE).
- Select the type of scaling/sensitivity.
- Define your unit and the scaling/sensitivity.
- Select coupling mode (high-pass filter) to reduce noise and drift.
- Optionally zero your offset.

1.4 Creating a Modal Test

To create a Modal Test, go to the channel list and use the (+) button (1) on the bottom left of the channel list to add "Modal Test", found in the "Advanced Math" category. This adds the Modal Test Channel (2) in the channel list and the Modal Test tab (3) right above the OXYGEN setup tab and forwards you to the Model Editor. (Figure 1.9)

Set up modal test channel

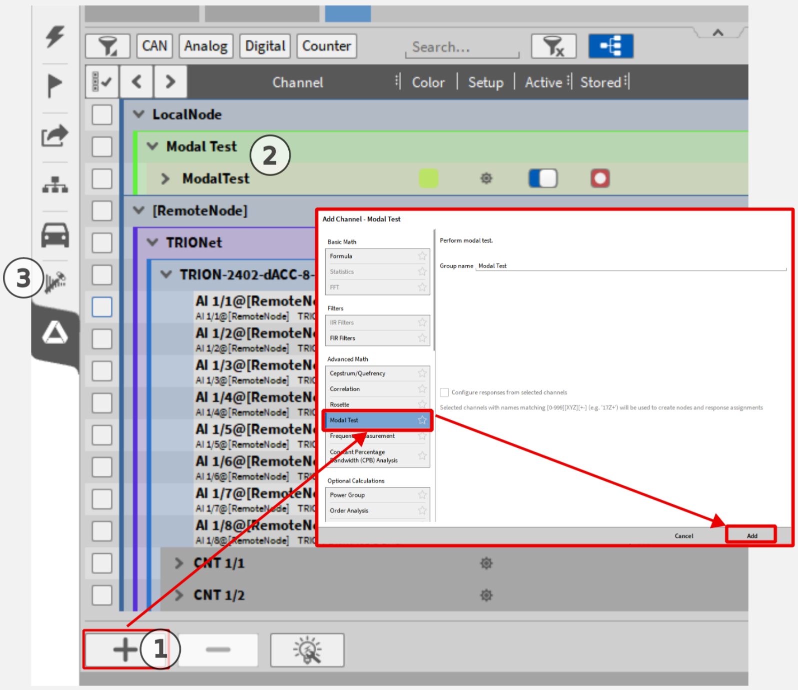

Figure 1.6: Set up modal test channel

(1) Add Modal Test Group

(2) Modal Test Channel

(3) Modal Test Tab

The next page describes an alternative method, which utilizes selected channels to create a test object. In case you didn't select channels for the Modal Test setup, skip to the definition of the test object in the Model Editor in Figure 1.9.

Alternatively, if the respective channels match the naming convention "[0-999][XYZ][+-]", they can be used to create a test object. The tick in the checkbox indicates if the naming is correct. After clicking "Add" the "Model Editor" is opened, which can also be accessed by clicking/swiping the Modal Test tab.

Use channels for test object setup

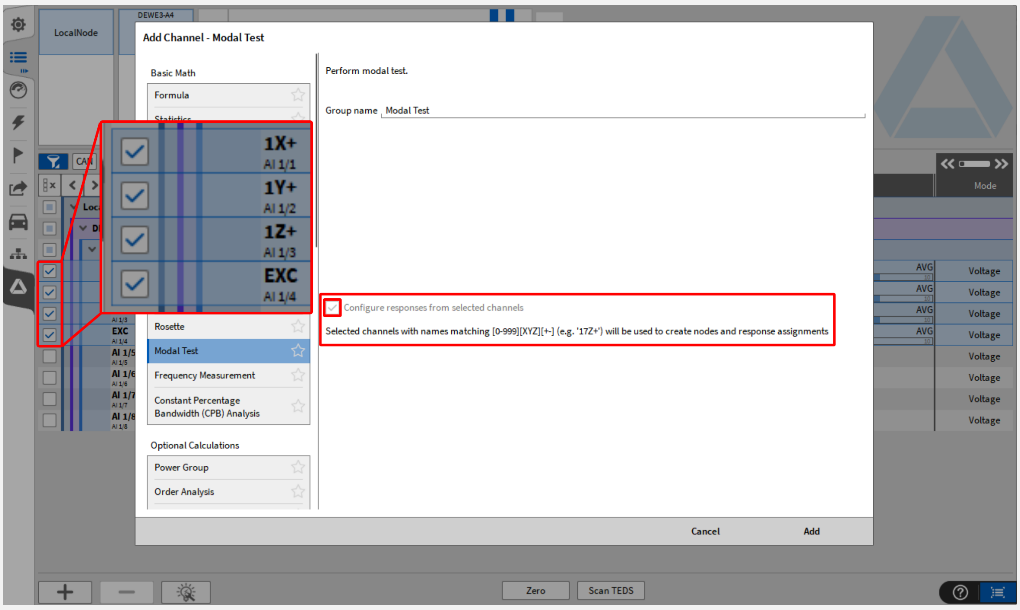

Figure 1.7: Use channels for test object setup

Figure 1.7 shows the Model Editor already populated with a generated test object, based on the selected channels for excitation and response nodes. The test object can be further edited as described in the next pages.

Predefined Model Editor

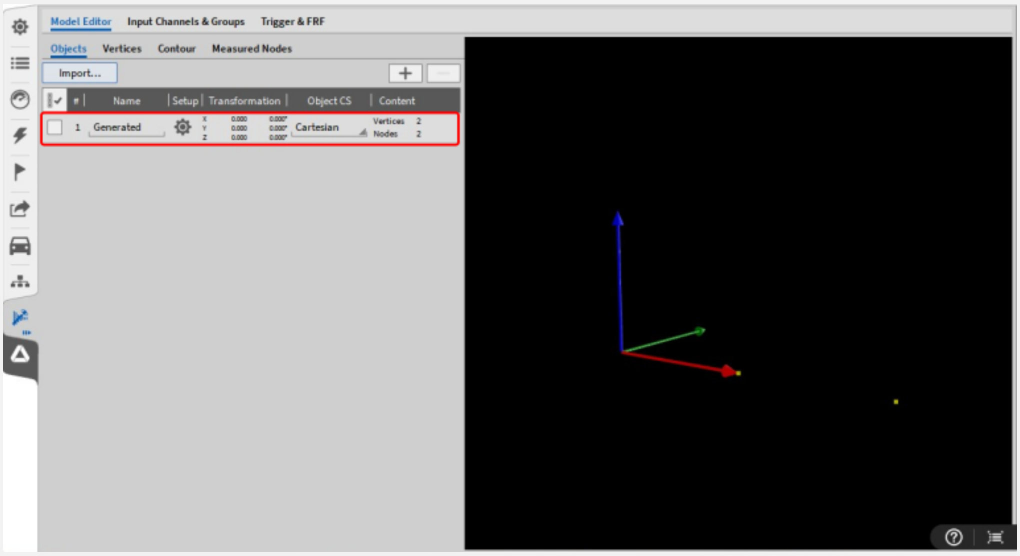

Figure 1.8: Predefined Model Editor

When creating a Modal Test without selected channels, the Model Editor tab is empty. It can also be opened by clicking or swiping the modal test tab 1. The Model Editor 2 is the first of three tabs to define the Modal Test setup. First, you need to set the number of excitation points and response nodes with the respective direction. This can be done by adding a test object with the (+) button 3. Further settings for the test object can be changed in the sub-tabs of the Model Editor Vertices, Contour, and Measured Nodes 4.

Model Editor

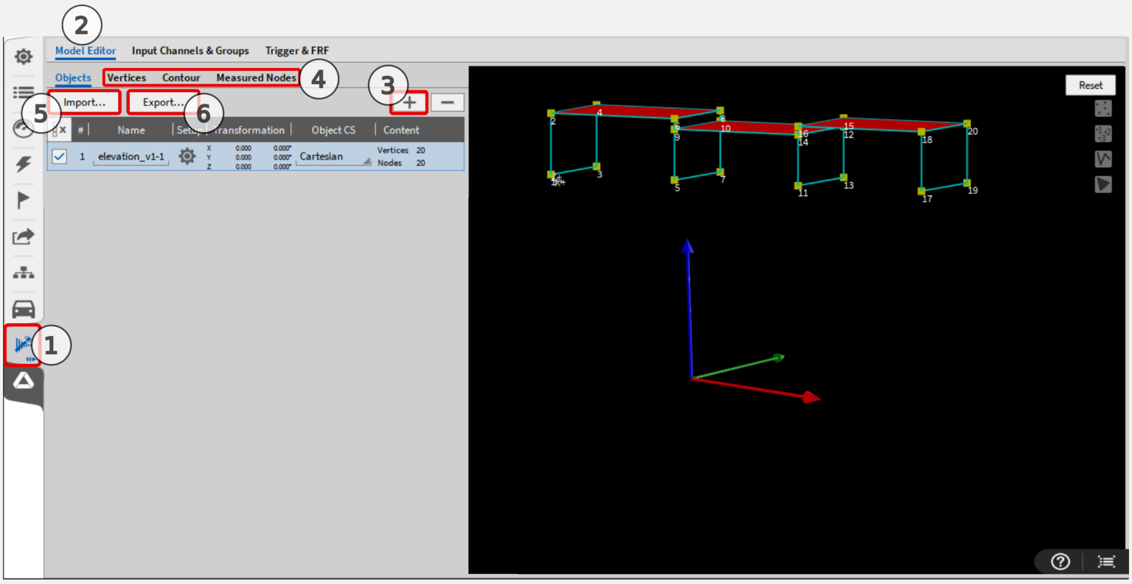

Figure 1.9: Model Editor

INFORMATION

The current implementation supports the import 5 and export 6 of a test object via a geometry file in the *.unv or *.uff format.

After pressing the (+) button in the Model Editor to add a test object, the following window pops up. Here the number of excitation nodes (usually up to 12) and the number of response nodes (usually up to 12) are defined in addition to the overall response directions. The axes of excitation/s and response nodes can be edited in the "Measured Nodes" tab. Note that the number of response nodes stands for the number of points at which a response is measured and not for the number of total response signals. For example, one response node can have 3 axes that are measured and provide 3 data channels, since all are measured at one point they count as one response node.

Add Test Object

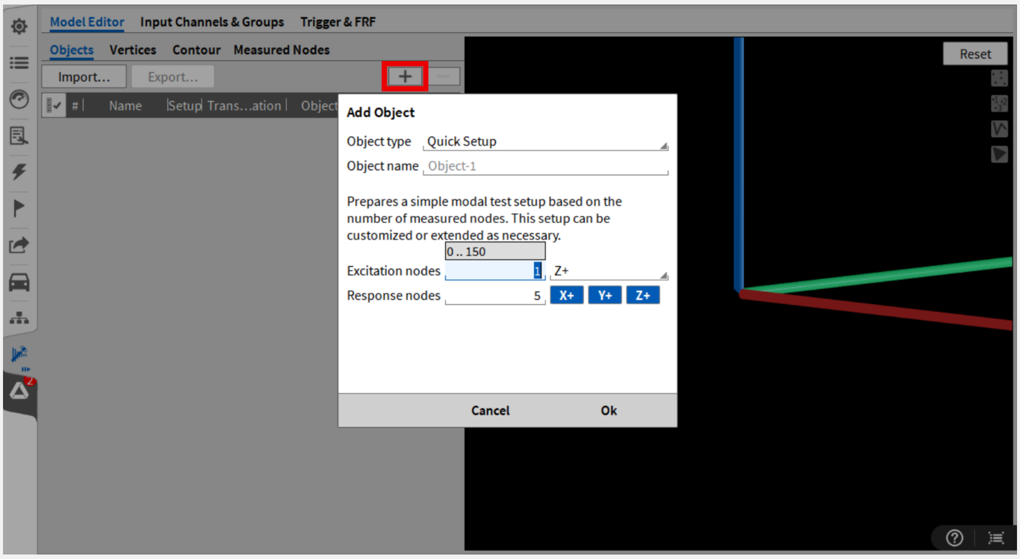

Figure 1.10: Add Test Object

If needed, the excitation and response axes can be modified in the "Measured Nodes" tab. In figure 1.11, two excitation points and one response positions with three directions is defined. The response nodes can be set to mono, bi, or triaxial in the positive or negative direction.

Model Editor - Measured Nodes

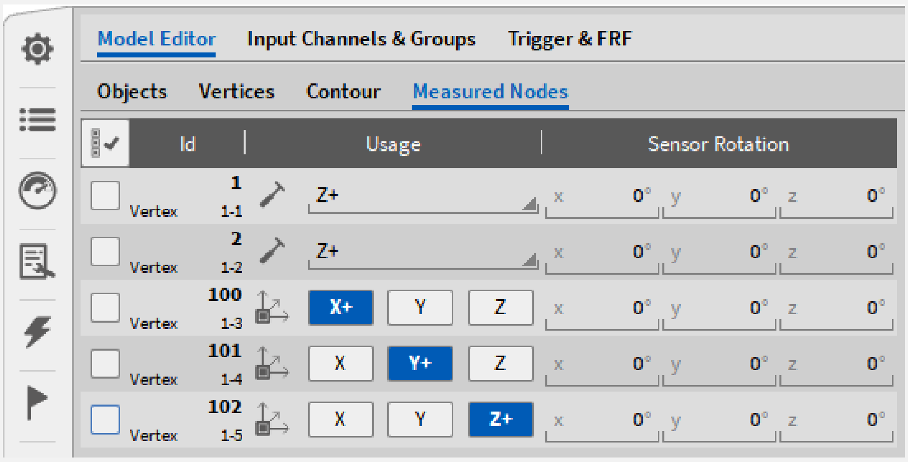

Figure 1.11: Model Editor - Measured Nodes

To add/remove nodes of the test object, switch to the "Vertices" tab and use the (+) or (-) buttons (1). When a new node is created (2) (node 1-4), the type (excitation or response) can be defined by selecting the hammer icon (excitation) (3) or the axes icon (response nodes) (4).

Add/Remove nodes

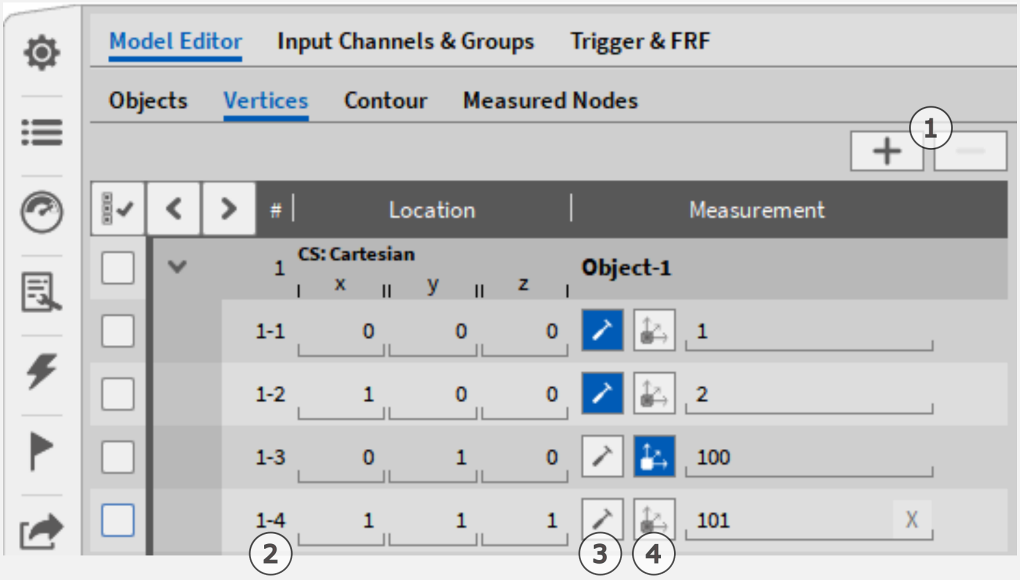

Figure 1.12: Add/Remove nodes

In the next figure 1.13, the new node was defined as a response node. To change the type of coordinates from Cartesian to Cylindrical, switch to the "Objects" tab.

New response node

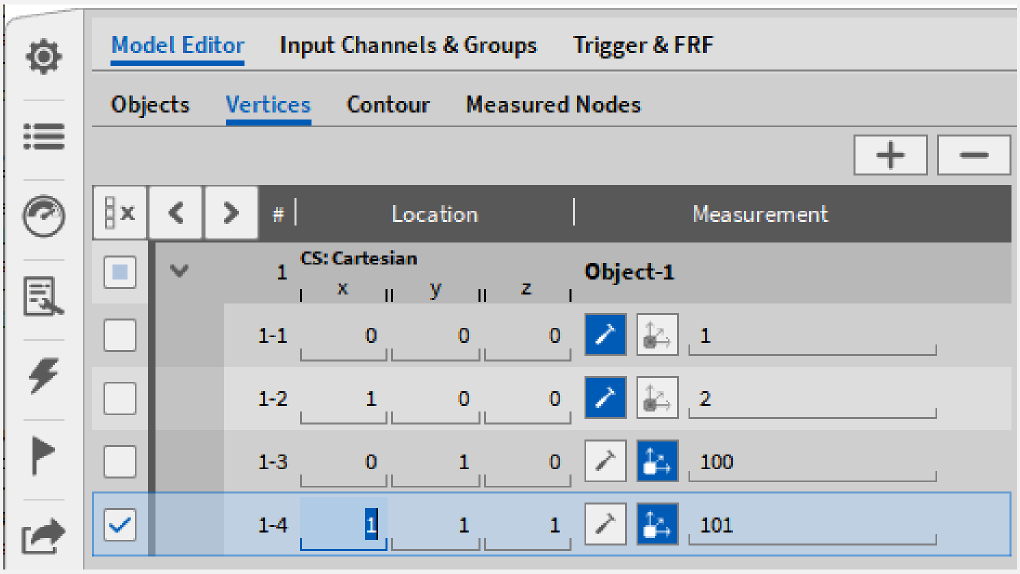

Figure 1.13: New response node

The defined response nodes can be connected by a custom contour, which can be set in the "Contour" tab. Simply use the naming (1-4, number of test object - number of signal channel), as defined in the "Vertices" tab, and choose the type of connection (line (1), triangle (2) or quad (3)).

Test Object Contour

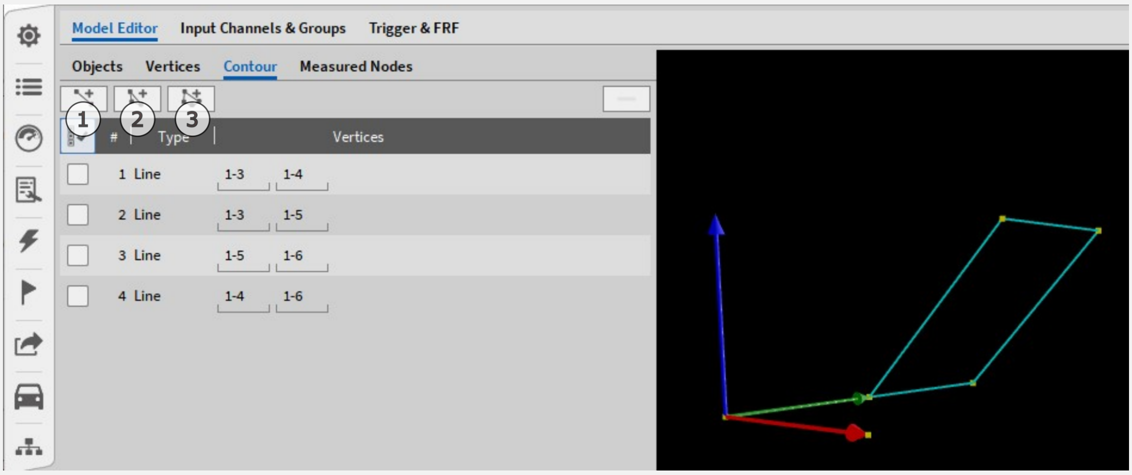

Figure 1.14: Test Object Contour

The next step after setting up a test object, is to define the input channels in the second tab "Input Channels & Groups". Here the excitation channel can be added by drag and drop (1), while the response channels can be drag and dropped (2) or "Auto assigned" (3), which automatically adds them to the selection sequence to undefined response groups. The channel list shows all available data channels regardless of their type.

Input Channel & Groups

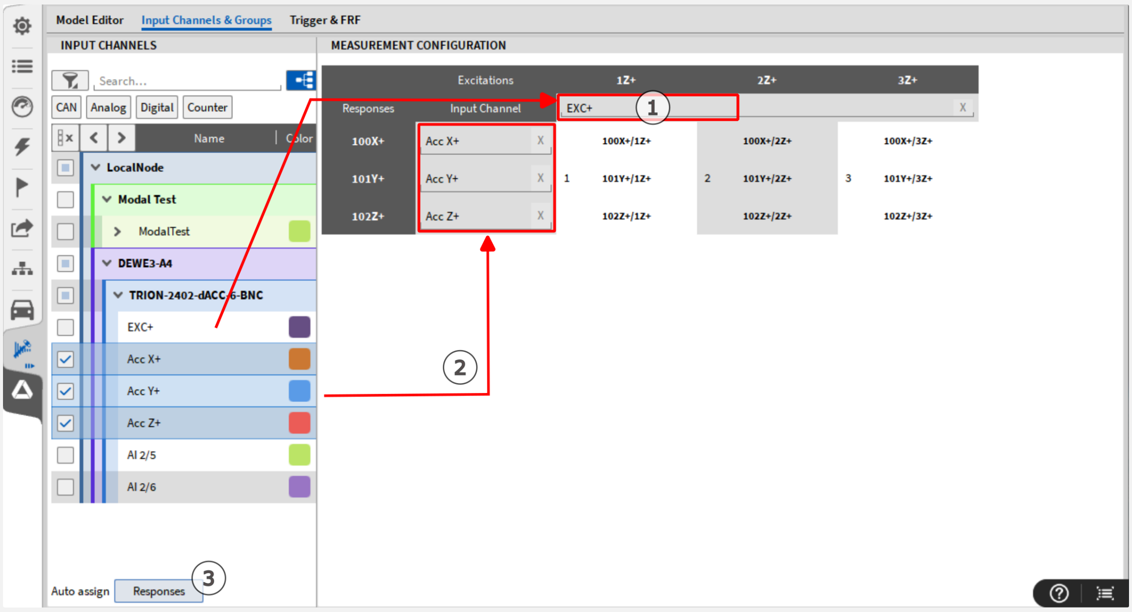

Figure 1.15: Input Channel & Groups

The third and last tab to define the Modal Test setup is the "Trigger & FRF" menu, where the trigger level can be set based on an excitation and response preview. In the Trigger section, the "Required triggers per group" (1) is used to define how many excitation events are averaged for one excitation point. The correct "Trigger level" (2) can be set by using the preview window (2), which can be auto-scaled by a click on its label. If the check box "Second hit level" (3) is ticked, signals higher than x% of the trigger peak lead to a warning in the form pink color and an exclamation mark of the respective excitation bar. The "Warning level" (4) can be set to detect excitation events that exceed a percentage of the range. For recording the spectrum, the "Pretrigger" (5) sets the percentage of samples to include, before the trigger level is reached. The configuration for the FFT calculation is done in the FFT section (6), which enables to setting of a data size, a line resolution, and a maximum frequency. For further information on the FFT calculation see the OXYGEN manual: https://ccc.dewetron.com/pl/oxygen. The maximum frequency should be set to 1/10th of the sample rate, for example to a maximum frequency of 1000 Hz for a sample rate of 10 kHz. The last setting of this tab is the FRF (frequency response function) "Type" (7) which is used to set the calculation type. The formulas for the FRF are described from formula 2.1 to formula 2.5. The two preview windows on the left (8) show the live signal of the excitation and response nodes, while the two windows on the right (9) display the last recorded trigger event.

Trigger & FRF

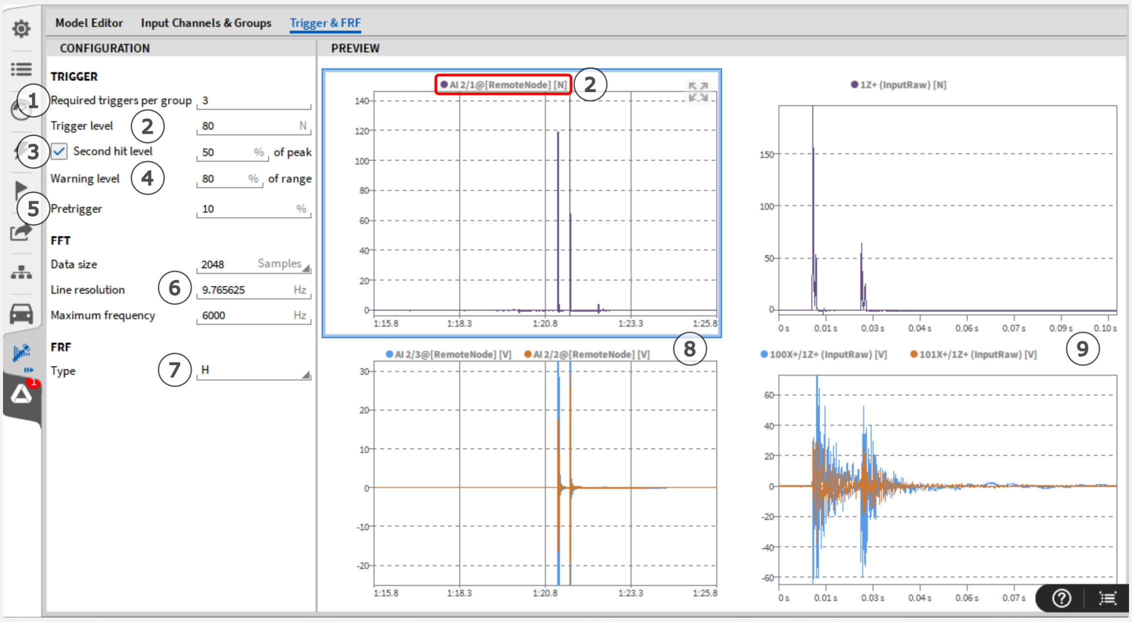

Figure 1.16: Trigger & FRF

If clicking on the label to auto-scale, has no effect, the design mode might be still enabled. To deactivate, simply double-click on the instrument and disable the blue triangle button.

Design mode

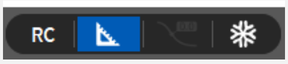

Figure 1.17: Design mode

1.5 The Modal Test screen

On the measurement screen, the modal test screen can be added for visualization, recording and navigation of the modal test. To create this screen click on the "Create Modal Test Screen" button (1), see Figure 1.18. This screen always displays the data of the active excitation group (6). The following items (1) - (17) can be found in Figure 1.18.

(1) Create Modal Test Screen: Creates a new screen based on a Modal Test template.

(2) Active: Deactivates FRF calculation i.e. in case sensors are changed.

(3) Reject: Deletes the last hit(s) successively.

(4) Single: Shows data of actual hit in Amplitude FRF and Bode Plot.

(5) MIF: Display the mode indicator function in the coherence banner.

(6) Select/show the currently active group to measure/view/discard.

(7) Shows the saturation and progress of the latest measurement group. Switch between single hits of the currently selected group.

(8) Live data of excitation channel.

(9) Recorded signal of excitation channel

(10) Spectra of excitation channel (FFT)

(11) Live data of response channels

(12) Recorded signal of response channels

(13) Spectra of response channels (FFT)

(14) Amplitude response: Spectrum of amplitude ratio between response and excitation

(15) Phase shift response: Spectrum of phase shift between response and excitation [°]

(16) Coherence function: Similarity between excitation and response of recorded events

(17) Modal Shape animation: Animation of the modal test object for a specific frequency. See Figure 1.18 for detailed useage.

Modal Test Screen Overview

Figure 1.18: Modal Test Screen Overview

A standard measurement procedure proceeds as follows: The trigger button (2) is active by default. If not, set the button to active and excite the test object. As a result, the bar indicator (7) should be filled, in this case, three times with a green color. To repeat an excitation event and discard the last one, the (Reject last) button (3) can be used. To switch to previous excitation groups, the desired excitation group (6) can be clicked to set it as the active group and display its data. To further analyze the data, a single FRF can be displayed in the amplitude response (14) by clicking (4). Furthermore, the MIF can be added to the coherence spectrum (16) by clicking (5). For more details about the MIF calculation go to formula 2.8 and for the Coherence calculation, to formula 2.6 and formula 2.7. Each instrument can be modified to change the displayed data, for example, the amplitude response can be set to display the real or imaginary part instead. Just click on the instrument to be edited and click the instrument properties tab seen in the next figure 1.20 (1) to choose the desired data. For more information on the spectrum analyzer, see the OXYGEN manual: https://ccc.dewetron.com/pl/oxygen.

Select displayed response groups

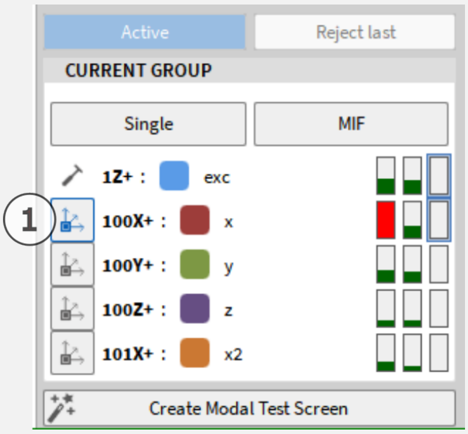

Figure 1.19: Selection of response group

The individual response groups can be hidden, shown in figure 1.19 (1) where a click on the axes symbol toggles the displayed data in the amplitude response, seen in figure 1.18 (14), the phase shift response (15) and the coherence function (16). In the first excitation of this group, the x response bar is displayed as red. This indicates an exceeding of the sensor range. Further details are described in the operation basics chapter.

The data which is displayed in the modal test screen instruments be further customized. For example the bode diagram can be changed to show real part of the vibration instead of the amplitude. To revert to the default template, just click again on the "Create Modal Test Screen" button (1) in figure 1.18, which adds a new screen based on the default modal test screen template. To further edit the modal test screen, the instrument group can be dismantled and changed to the preferred instruments. Click on the modal test group followed by clicking on dismantle (2) in the properties.

Customizing the modal test screen

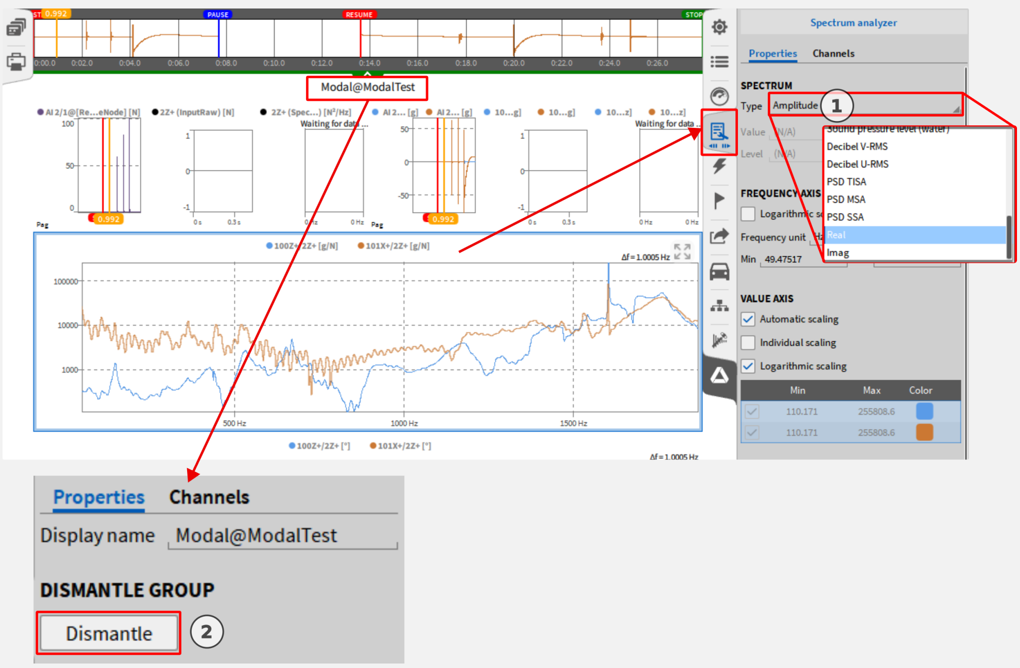

Figure 1.20: Instrument properties and dismantling template

1.5.1 Modal Shape animation

The modal shape animation instrument can be found in the instruments list in the miscellaneous tab and is by default included in the modal test screen. It has following features in the instrument properties:

(1) Set the excitation point, whereas "Auto" selects the first recorded excitation point.

(2) The animated frequency and be selected either manually or based on an adjacent instrument or an instruments on page. To select a frequency based on an adjacent/page instrument, chose the respective mode and click via cross hair into the bode plot. This will make an cursor line appear which specifies the frequency for the modal shape animation. To manually specify the frequency, set the dropdown to "Manually specified" and use the slider or the text box.

(3) Deflection controls the animation speed, the amplitude of the oscillation and the replay of the animation which loops the selected excitation event. With MAX (+) the largest deflection and with (-) the smallest deflection is shown.

(4) View can hide part of the model object and resets the zoom and position of the model object.

(5) Export a video of the instrument (modal shape animation) or entire screen for reporting purposes. The export is only available in PLAY mode and the video format is *.mkv. The number of animation cycles can be defined from 1 to 10.

Modal Shape animation instrument

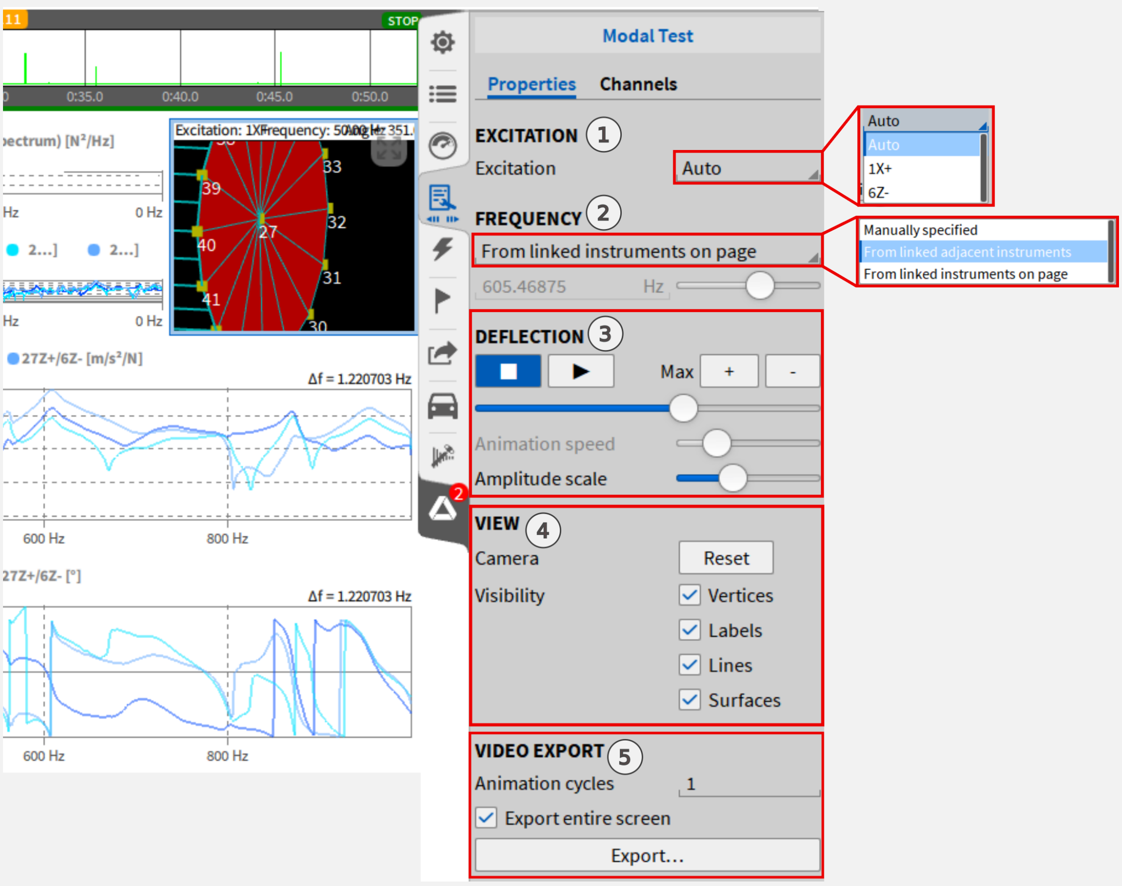

Figure 1.21: Modal Shape animation instrument

1.5.2 SDOF circle fit

The SDOF Circle Fit can estimate the damping in simple structural systems, characterized by well-separated, non-overlapping modes. These systems can be effectively analyzed as individual Single Degree Of Freedom (SDOF) systems, enabling accurate damping estimation. The application of this method is illustrated in the example Frequency Response Function (FRF) graph provided below, which demonstrates the distinct modal characteristics of such simple structures.
First choose the Nyquist instrument from the instruments panel or open the nyquist template, in the bottom of the sceens menue, which is available after creating a modal test.

Nyquist instrument

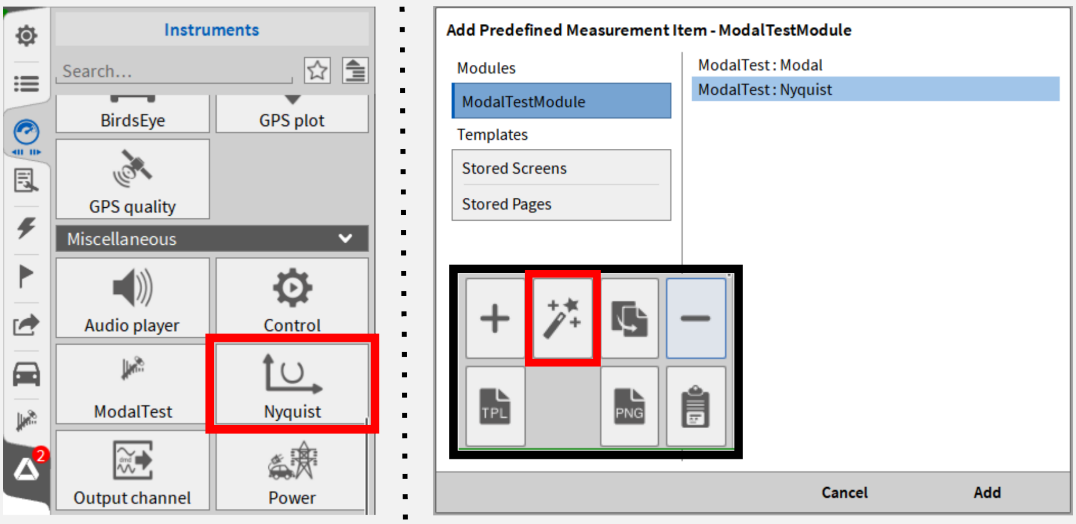

Figure 1.22: Nyquist instrument

When choosing the Nyquist template, the FRF averages of the first excitation event are automatically assigned to a spectrum analyzer instrument and the Nyquist instrument. The first step is to determine if a manual frequency range or a frequency range based on another instrument on the page or nearby should be used for the circle fit. To choose the frequency bandwidth with another instrument, the spectrum analyzer, three options are available.

- Single cursor - Select the center frequency with on cursor, whereas 10 bins below and above the chosen frequency are used as default for the circle fit. This is also the case if the frequency is chosen manually.
- Dual cursor - Select the frequency range of interest with upper and lower cursor. The center frequency is automatically calculated as middle ob the selected band.
- Triple cursor - Select the lower, middle and upper frequency to specify a asymmetrical frequency range.

This means if a Bode plot is linked one, two or three cursors can be set to specify the frequency band of the Nyquist plot. See the example Figure 1.23 which facilitates a single cursor in an amplitude Bode plot.

In this example the frequency range (1) is chosen via the amplitude bode plot (2) on the same page and the fitting parameter is calculated by center and radius (3). There is also the option to only calculate the loss factor via the center or just display the Imaginary and Real part of the signal. In (4) the resulting fitting parameter(Natuaral frequency and Loss factor) as displayed and can be copied to the clipboard.

SDOF circle fit

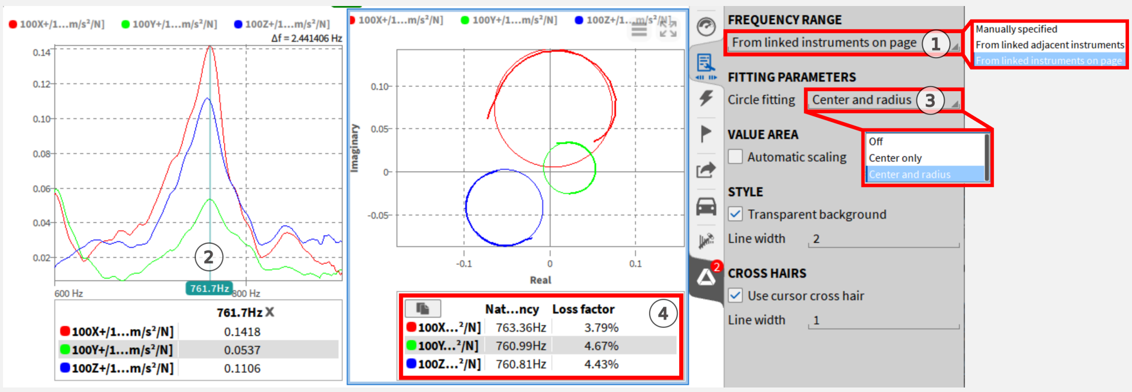

Figure 1.23: SDOF circle fit

More information regarding the calculation basis and theory of the circle fit can be found at chapter 2.1.5.

2 Understanding Modal Test

This chapter contains the calculation basis and recorded data channels.

Signal and data flow: Modal calculation

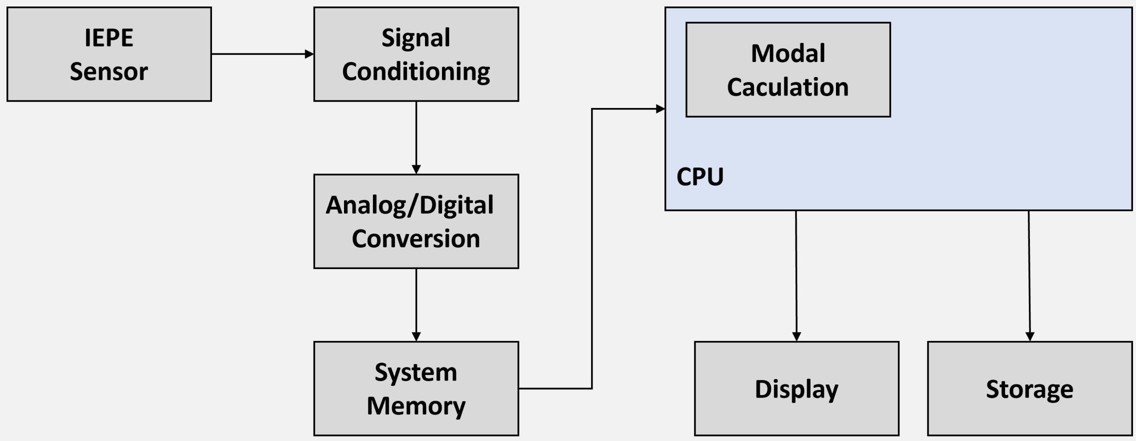

Figure 2.1: Signal and Data flow

2.1 Calculation Modes

In this chapter, the calculation modes for all relevant results will be explained.

2.1.1 FRF - Frequency Response Function

The FRF is calculated between each excitation/response pair in mono or triaxial mode, depending on the sensor. These calculations are available as actual transfer functions and averaged transfer functions for each excitation/response pair of the same direction. The data can be displayed as amplitude spectrum, phase spectrum, real part, and imaginary part in the instrument properties tab of the modal test screen. The information is stored as a complex frequency spectrum and can be exported in various formats see chapter 3.2.

2.1.2 FRF Calculation - Transfer function & bode plot

In the "Trigger & FRF" 1.16 tab, one calculation type has to be chosen, to define a modal test setup. The variables A and B stand for the complex spectra of the input (excitation) and output (response). Additionally, A' and B' stand for the conjugate complex spectra of the input and output channels.

$$H(f) = \frac{B(\omega)}{A(\omega)} \tag{2.1}$$

$A(\omega)$... Complex spectra of input channel
$B(\omega)$... Complex spectra of output channel

In case the output signal is noisy, the H_1 algorithm can be used:

$$H_1(\omega) = \frac{B(\omega)}{A(\omega)} * \frac{A'(\omega)}{A'(\omega)} = \frac{S_{AB}(\omega)}{S_{AA}(\omega)} = \frac{G_{AB}(\omega)}{G_{AA}(\omega)} \tag{2.2}$$

$A'(\omega)$... Conjugate complex spectra of input channel
$B'(\omega)$... Conjugate complex spectra of output channel

In case the input signal is noisy, the H_2 algorithm can be used:

$$H_2(\omega) = \frac{B(\omega)}{A(\omega)} * \frac{B'(f)}{B'(f)} = \frac{S_{BB}(\omega)}{S_{AB}(\omega)} = \frac{G_{BB}(\omega)}{G_{AB}(\omega)} \tag{2.3}$$

In case both input and output signal are noisy, H_3 or H_v can be used:

$$H_3(\omega) = \frac{H_1(\omega) + H_2(\omega)}{2} \tag{2.4}$$

$$H_v(\omega) = \sqrt{H_1(\omega)} * \sqrt{H_2(\omega)} \tag{2.5}$$

2.1.3 Coherence

The Coherence function compares the response function of the active group (excitation and response) with prior response functions between the values of 0 and 1, whereas 1 would indicate an identical response function. Typically values below a coherence of 0.8 are rejected and the measurement must be repeated.

Coherence calculation for two signals:

$$\gamma^2_{XY}(f) = \frac{|\langle G_{XY}(f)\rangle|^2}{\langle G_{XX}(f)\rangle * \langle G_{YY}(f)\rangle} \tag{2.6}$$

$G_{XY}(f)$... cross-spectral density $G_{XX}(f)$ & $G_{YY}(f)$... auto spectral density

Coherence calculation of a signal group and another signal:

$$\gamma^2_{[A]B}(f) = \frac{G^H_{[A]B}(f) * G^{-1}_{[A][A]}(f) * G_{[A]B}(f)}{G_{BB}(f)} \tag{2.7}$$

The following applies to this formula: $\gamma^2_{[A]B}(f) \in [0,1]$

A value of 1 indicates a linear relationship between all signals in the selected group $[a_1(t);...a_n(t)]$ and the signal $b(t)$. Whereas a value of 0 indicates no correlation between the signals $a_1(t);...a_n(t)$ and $b(t)$.

2.1.4 MIF - Mode Indicator Functions

The Mode Indicator Function (MIF) evaluates the Frequency Response Function (FRF) of all excitation pathways. It indicates the presence of modes with a value of 0 (indicating an apparent mode) and the absence of modes with a value of 1 (indicating no modes).

$$MIF(f) = \frac{\sum_{i=1}^{N} Re\left\{H(F)\right\}^2}{\sum_{i=1}^{N} |H(F)|^2} \tag{2.8}$$

In the current implementation of the modal test, no model validation is realized.

2.1.5 SDOF circle fit

The SDOF (Single Degree of freedom) circle fit is a numerical method to estimate the natural frequency and loss factor. To calculate the loss factor a spectral region, see Figure 2.2, is chosen where on natural frequency is assumed and transferred into a Nyquist plot, see Figure 2.3. In the Nyquist diagram, the point at which the circle crosses the Y-axis represents the exact natural frequency.

SDOF cicle fit theory

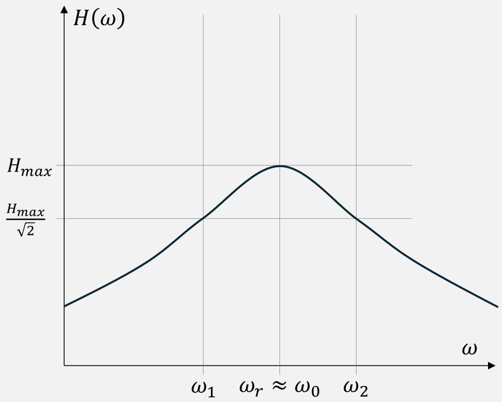

Figure 2.2: Frequencies with the amplitude fit method using the amplitude response of an ideal single-mass oscillator

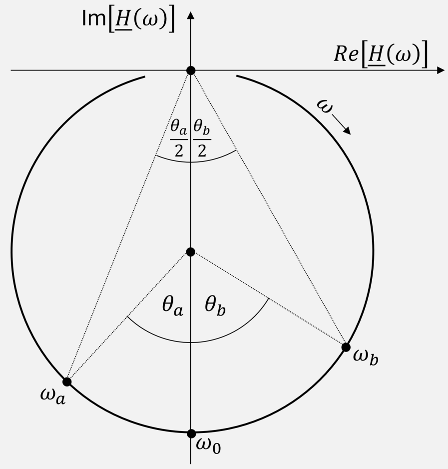

Figure 2.3: Nyquist plot for SDOF with the locations of the natural frequency ω_0 and other frequencies ω_a and ω_b

Subsequently, two known frequencies and their angle can be used to calculate the loss factor. The spectral region of interest must only contain one natural frequency.

$$\eta = \frac{\omega_a^2 - \omega_b^2}{\omega_0^2[tan(\frac{\theta_a}{2}) + tan(\frac{\theta_b}{2})]} \approx \frac{2(\omega_a - \omega_b)}{\omega_0[tan(\frac{\theta_a}{2}) + tan(\frac{\theta_b}{2})]} \tag{2.9}$$

η ... Loss factor ω_0... Natural frequency (Eigenfrequenz)
ω_a... Frequency, above the Eigefrequenz ω_0
ω_b... Selected frequency, bewlow the Eigefrequenz ω_0
$H(\omega)$... Frequency response
The OXYGEN implementation and application example is shown in chapter 1.5.2.

2.2 Modal Test channel list - Recorded channels

In the current implementation of the modal test, the results of the Modal Test are split up into Excitation, Responses, and MIF.

1. Excitation - grouping channel
2. Input Raw of excitation and response nodes
3. Spectra of input raw channels
4. Responses - grouping channel
5. Input raw of excitation and response nodes
6. Spectra of input raw response channels
7. FRF Single - FRF of single excitation event
8. FRF AVG - Average of single FRFs
9. Coherence of excitation events
10. MIF (Mode indicator function)

Modal Test channel list

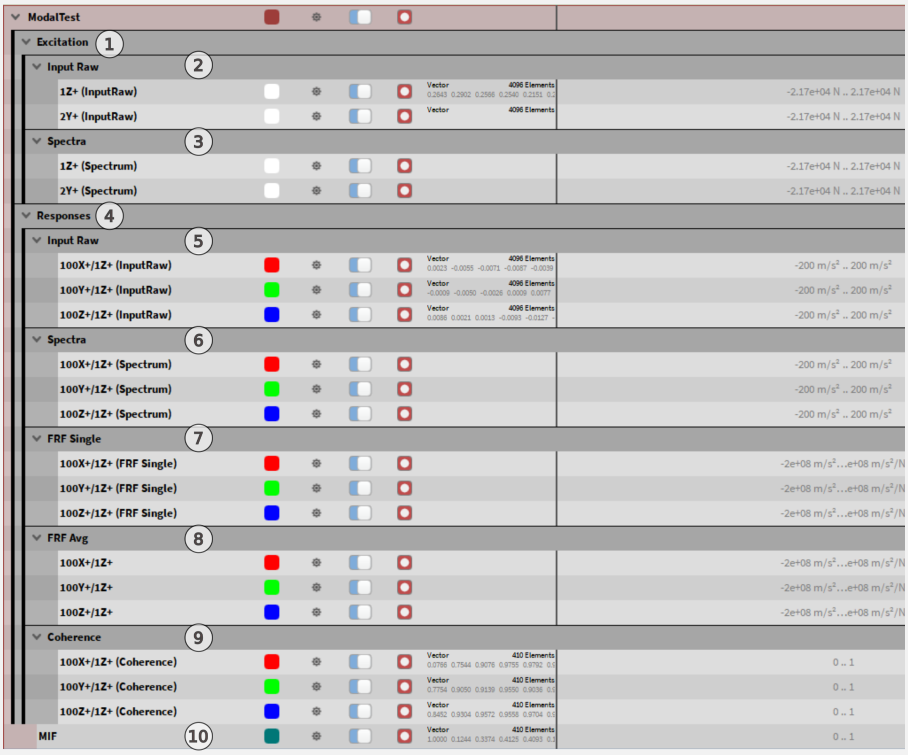

Figure 2.4: Modal Test channel list

3 Operation Basics

In this chapter, the steps to carry out a modal test are described. This requires a sound setup of sensors see chapter 1.3, and the definition of a test object, assignment of channels, and trigger settings, see chapter 1.4.

Workflow

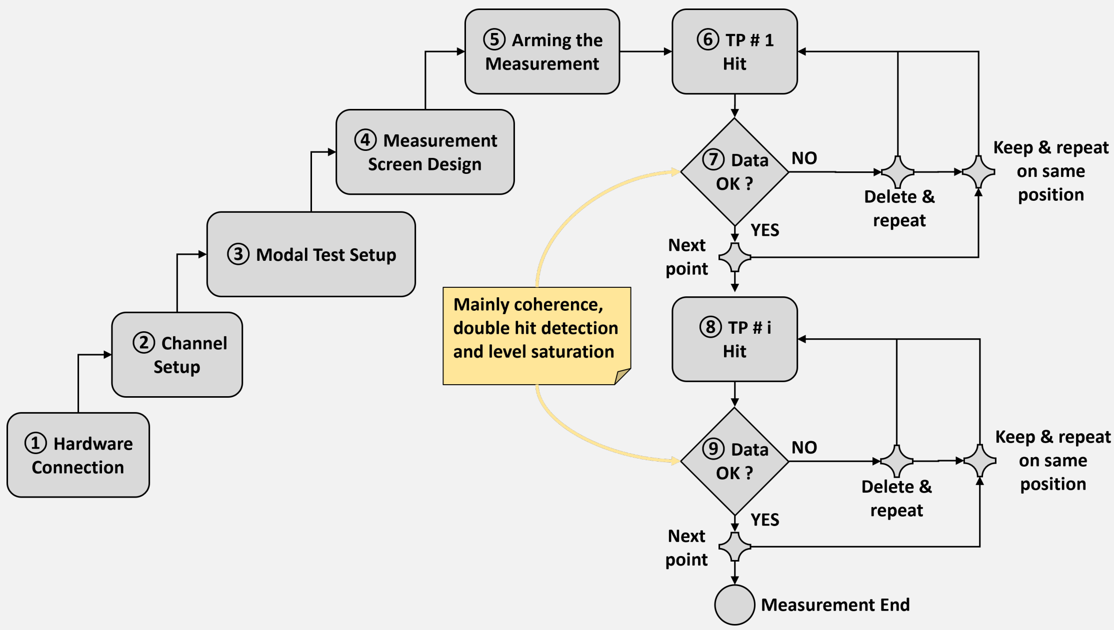

Figure 3.1: Workflow

① Connect an excitation device (hammer) and mono/triaxial accelerometers to the hardware.

② Configure the input/response channels depending on sensors (see chapter 1.3 setting up data channels).

③ Modal Test Setup (Create a test object, define input channels, configure Trigger & FRF).

④ Measurement screen design (Load Modal Test Screen template and optionally edit).

⑤ Arming the measurement and start recording (Make sure the "Active" button is enabled).

⑥ Carry out an excitation at the first excitation point.

⑦ Check after each hit/excitation if the data is valid (depending on the test setup multiple hits per point have to be made and individually evaluated). Repeat hits until all excitation events for this position are completed correctly.

⑧ Continue to the next excitation point and carry out an excitation.

⑨ Evaluate the data and repeat until the test is complete, stop the recording.

As shown by figure 3.1 above, the acceptance or rejection of an excitation event is a central step in the recording of modal data. OXYGEN MODAL Test includes several options to warn the user of potentially flawed measurements. Based on the settings in the "Trigger & FRF" tab following flaws are marked:

- Double hit warning (% of triggered peak): pink
- Range warning (% of range): orange
- Range exceeded (> signal range, this is always active): red

If no excitation is recorded whatsoever, check the trigger level in the "Trigger & FRF" tab and the "active" button in the modal test screen.

3.1 Trigger warning

In case of an successful measurement, each recorded excitation results in green bars for all sensors as well as the excitation hammer. In the figure below, the first excitation hit (1) had a double peak which surpassed the defined threshold in regards to the trigger level and thus shows a pink color with an exclamation mark in the bar. This is also displayed in the excitation group (2) by a pink color for all three events. If a measurement exceeds the previously defined limits for the sensor range, a warning in the form of an orange bar is displayed seen in (3) for the excitation and the $x+$ response. If the measurement range of the channel is exceeded, the bar will turn red instead.

Modal Test Screen: Double hit and Range warning

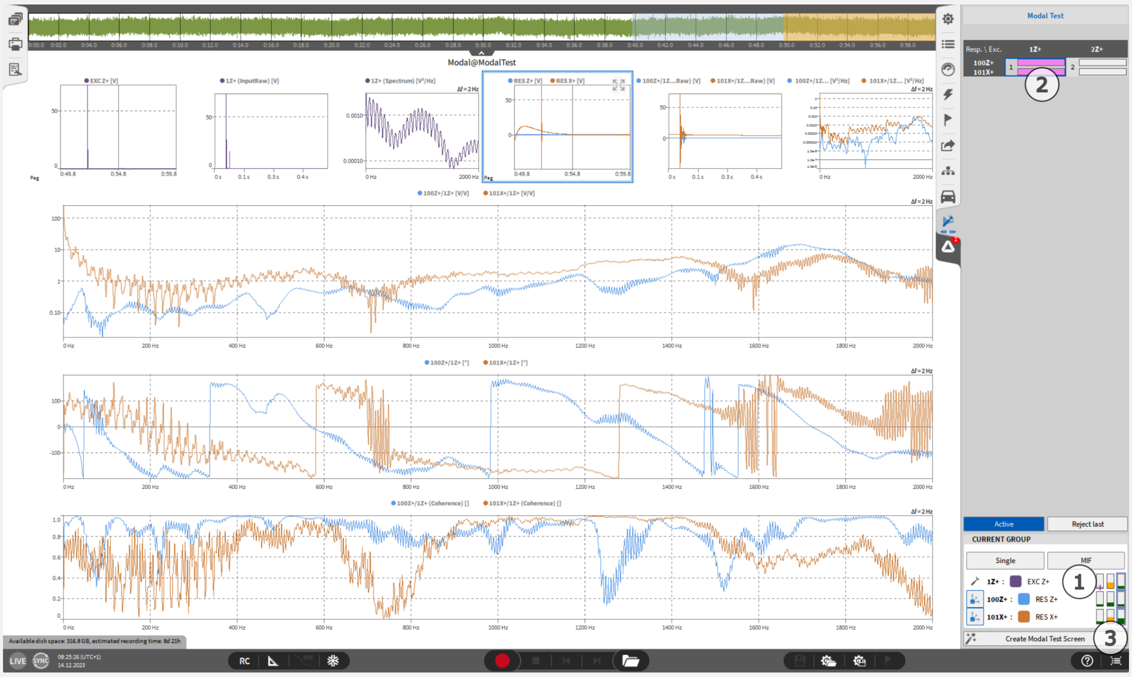

Figure 3.2: Modal Test Screen: Double hit and Range warning

Warnings

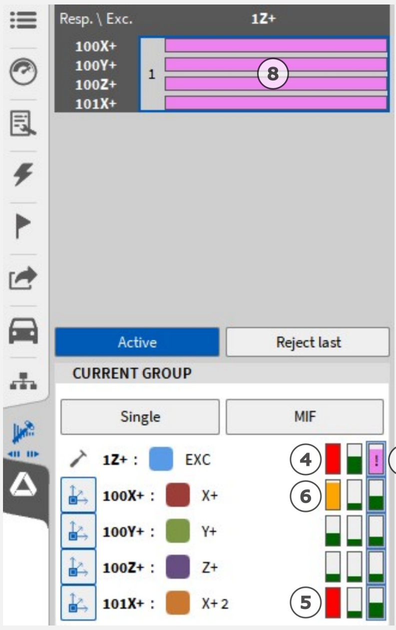

Figure 3.3: Warnings

(4) Exceeding of measurement range for excitation channel.

(5) Exceeding of measurement range for X+2 response channel.

(6) Exceeding of the defined measurement range (Trigger & FRF tab).

(7) Double hit excitation warning.

(8) Double hit warning, marked for whole measurement group.

3.2 Recording and exporting data

When a recording is started, all previously collected data is discarded. While pausing a recording no data is saved, even though a trigger event can be recognized. Mind this when pausing a recording between changing the excitation point for example.

Recording

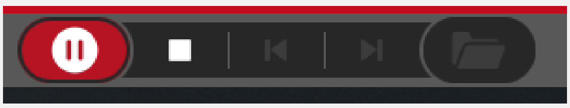

Figure 3.4: Recording Active

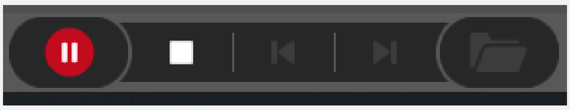

Figure 3.5: Recording Paused

To export data, save a recording and open the .dmd file. Then switch to the export settings in the "Menu Bar" on the right of the start screen. The predestined export format is .uff (universal file format), but a variety of other data types are available.

INFORMATION

Only single-value vector channels can be exported. This means only the MIF, Coherence, and FRF AVG channels can be exported!

For further information, please see the latest OXYGEN manual in our Customer Care Center: https://ccc.dewetron.com/pl/oxygen.