



EconTest

User Manual

Version: 2.1

2025-10



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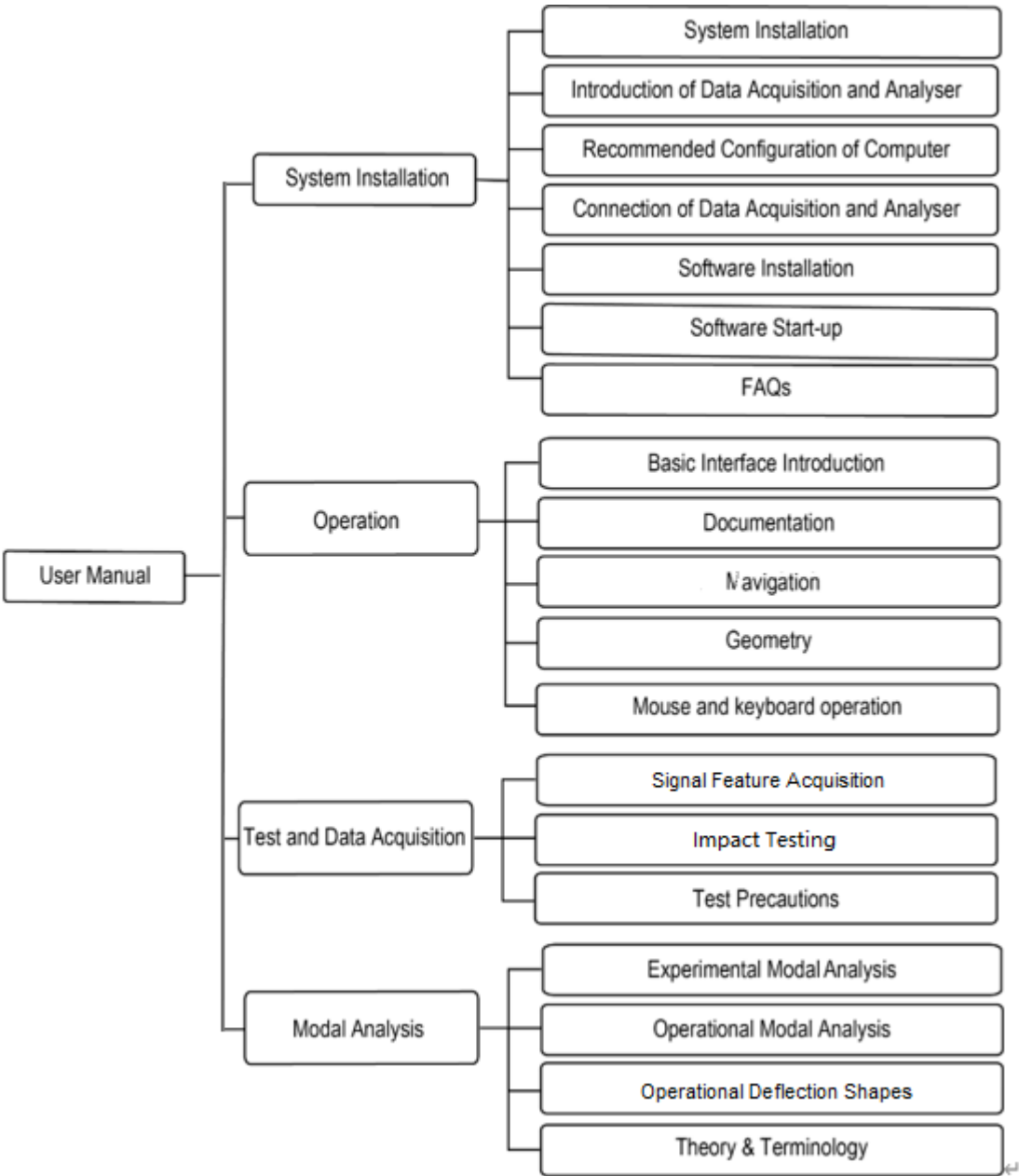
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Documentation Map

We provide one operating documentations: **User Manual**.

The **User Manual** includes unpacking, hardware description, system requirements, Analyzer connection, software installation, software configuration, operating flow, and test applications. Use this guide to get an approximately understand of DAS system and learn how to make a test.



Please read the contents of the configuration of the product you purchased. Features not purchased will not be available. If the function or feature you require is not available in your configuration, please contact your seller or ECON.

Important Safety Instruction

Before you use the Analyzer, you must read the safety considerations described below:

◆ Different models of Analyzer can be powered by different power supply with the following specifications:

Model	MI-7208	MI-8206	MI-8104 MI-8109 / MI-8118
Voltage Range	$\pm 10 V_{PEAK}$		
Temperature & Humidity Range	Temperature -10 ~50°C; humidity (20 ~ 90%)		Temperature 0~50 ° C, Humidity (20~90%)
Power supply mode	DC power supply		AC Power Supply
Power Supply	Voltage range 9 – 30 V DC	Voltage range 12 – 30 V DC	Voltage range 100 - 240 V AC Frequency range 50/60 Hz, automatic matching

- ◆ To minimize damage to the control system from power surges, the system should be connected to power ground (safety ground). The system power cord is a three-pronged AC power cord, which must be plugged into a three-pronged power outlet where the earth wire is connected to power ground (safety ground).
- ◆ Be sure to ensure that the ventilation openings of the instrument can be kept free of air flow to avoid malfunction, abnormality and shortened life. When the power is turned on, the system should be operated under the permitted operating environment.
- ◆ Do not expose the instrument to rain or humid air.
- ◆ Do not operate the system in explosive atmospheres or in fumes; operation of any electronic equipment in such atmospheres is hazardous.
- ◆ Please do not use in strong magnetism, high pressure and other harsh environments, if you must use, need to confirm with the manufacturer's technical staff to have no effect on the instrument before use.
- ◆ Under no circumstances should the operator remove the instrument screws, casing, and do not make any modifications to the instrument or install or replace parts in the instrument. If the instrument fails, contact the manufacturer or supplier immediately.
- ◆ Please use a soft, dry cloth to clean the surface of Analyzer, and not use any chemicals such as wax, benzene, alcohol, thinners, insecticide, air freshener, lubricant, detergent, or other organic solvent. Please don't splash any water on the Analyzer. If there is any water entered the Analyzer, please stop using it immediately, otherwise it may probably cause an electric shock, an electric leakage, or even a fire.

Important Safety Instruction



We are not responsible for any consequence for failure to follow the safety rules and operation attentions mentioned by this safety convention and the whole manual.

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1

System Overview

EconTest test analysis software is a new software platform independently developed by Econ Technology. It supports almost all hardware developed by Econ Technology in recent years, including the MI-7208 portable data acquisition front end, the MI-8206 field multi-channel data acquisition front end, and the MI-81 series ultra-multi-channel data acquisition front end.

Modal testing is a specialized software module within EconTest testing and analysis software developed specifically for structural dynamics analysis. The software utilizes a streamlined design and step-by-step guidance to help users obtain accurate test data, quickly completing the entire process from modal parameter calculation to analysis and verification, and solving structural dynamics issues for their products.

1 System Overview

[1] Modal test software module features

- ✧ Comprehensive functionality: Supports force-based hammer and shaker modal tests, as well as non-force-based ambient excitation operational modal analysis. It also supports EMA experimental modal analysis, ODS operational deformation analysis, and OMA operational modal analysis.
- ✧ Flexible combination of multiple modules: When you need to add other modules to a certain function, you can quickly add and combine them through Add-ins.
- ✧ Multiple modal analysis algorithms: PolyLSCE and PolyLSCF are suitable for experimental and operational modal analysis. Operational modal analysis also supports the multi-reference random subspace method (Op. PolySSI).
- ✧ Advanced Modal Parameter Estimation Methods: The Multi-reference Least Squares Complex Frequency Domain method (PolyLSCF) is an advanced modal parameter estimation method with excellent modal parameter identification capabilities. It can identify modes that are not fully excited, and the stability diagram is clear, making the final modal analysis results independent of the user. It also excels in modal identification of heavily damped structures, identifying more modes in their high-frequency range. PolyLSCF also supports Maximum Likelihood Estimation (MM_MLE) based on modal models. The MM_MLE algorithm automatically iterates the modal model parameters, further improving the accuracy of modal parameter identification and making modal testing easier.
- ✧ Fast geometric modeling : Define geometric models through Excel-like spreadsheets, support copying and pasting geometric information from Excel, and also support importing UNV format universal models and STL universal format 3D models supported by most 3D modeling software.
- ✧ Intelligent testing process: automatic ranging, automatic determination of continuous hits and overloads, model feedback function, and visualization of the modal testing process;
- ✧ Clear Steady-State Diagrams : High-order, fast calculations provide clear steady-state diagrams, with optional automatic pole selection, allowing even novice testers to obtain optimal analysis results.
- ✧ Comprehensive modal verification: MAC modal confidence criterion, MOV modal complexity, MP modal participation factor, MPC modal phase collinearity, MPD modal phase deviation, etc., help analyze potential problems in modal analysis results.
- ✧ Mode Shapes: High-contrast mode shapes with support for mode shape comparison. Mode shapes can be exported as graphics or videos.

[2] Modal test software module application

- ✧ Automotive industry: Modal analysis of body-in-white, auto parts, on-board electronic equipment, engines, etc. to ensure high driving safety and comfort.

- ✧ Civil Engineering: Modal analysis of civil structures such as bridges and houses, and assessment of the effects of seismic activity and strong winds on buildings.
- ✧ Aerospace: Ground Vibration Test (GVT) analysis of aircraft, modal analysis of aircraft components, launch pads, airborne equipment racks, airborne systems, turbine blades, etc., analysis of the natural frequency and fatigue life of the mechanism.
- ✧ Power: Modal analysis of wind turbine blades to assess fatigue life.
- ✧ Household appliances: Modal analysis of white appliances such as washing machines to achieve product vibration and noise reduction.

2

System Installation

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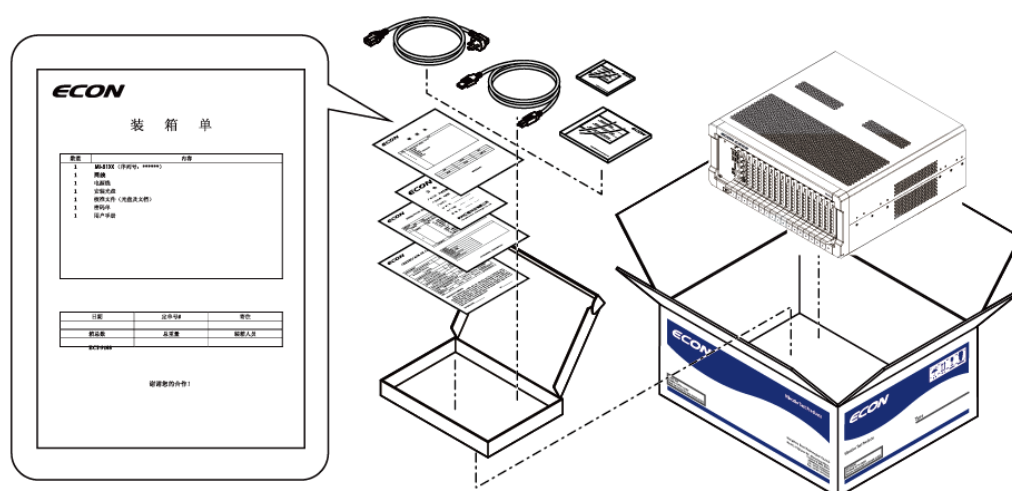
2 System Installatin

[1] Unpacking

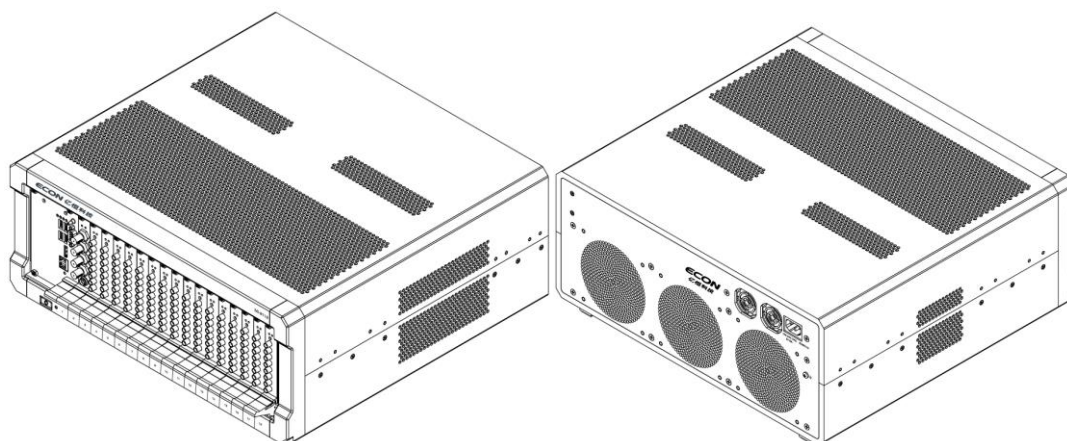
First check the packaging for damage when you receive the Analyzer, then check the following when the Analyzer opens from its package. Check the contents of the package against the Package List to make sure that all accessories are included in the package and all accessories are in good condition.

In the package there are:

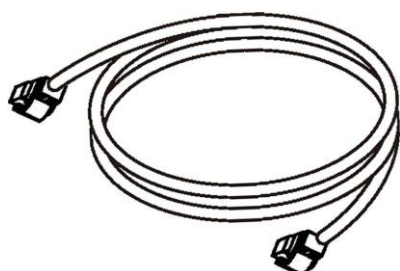
1. Package List, a piece of paper, it lists all contents in the package.



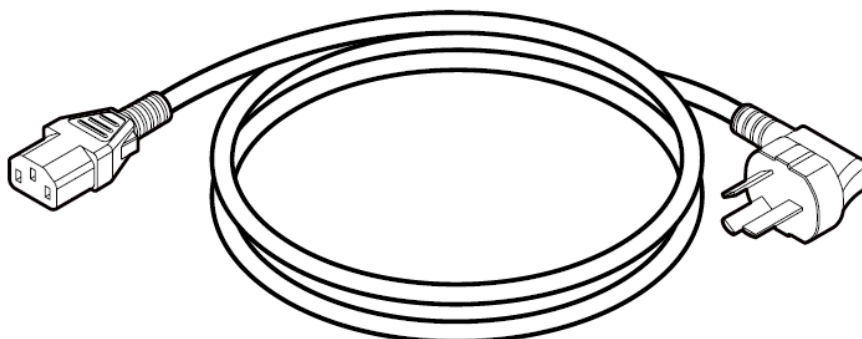
2. An Analyzer, check the Analyzer for any apparent physical damage.



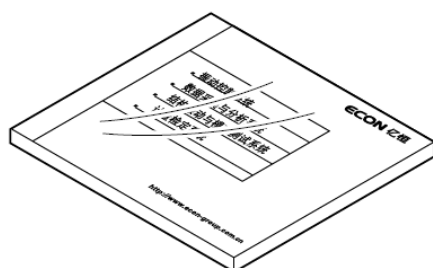
3. Network Cable.



4. AC Power Cable



5. Software CD, includes software and manuals.



EconTest



Manual



RuntimeUpdate



SoftRep

AUTORUN
.INF

Install.exe



mfc100.dll

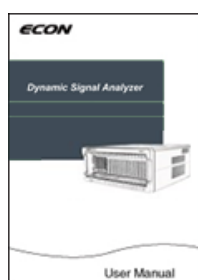
msucr100.
dll

Files in CD

6. A password Sheet.



7. User Manual



2 System Installatin

8. Certificate of Compliance

ECON	
Certified Certificate	
Product:	Analyzer
Brand:	AVANT
Model:	MI-B118
SN:	987654321
Date:	2010-10-10
Checker:	01
Econ Technologies Co., Ltd	

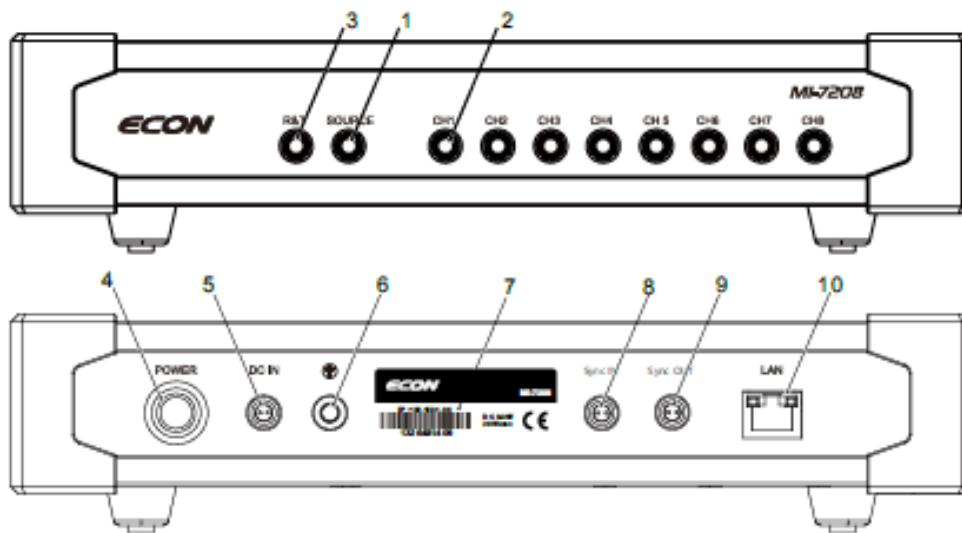
Pictures for reference only, please prevail in kind.



Different types of equipment, accessories vary, please check on the packing list items are complete. If any of these items are missed or damaged, please contact you agent or sales representative for assistance.

[2] Hardware Description

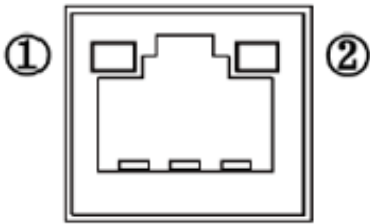
(A)MI-72XX Series Analyzer



■ MI-7208

Index	Name	Description
1	Output Channel	Generate various signals.
2	Input Channel	Used to connect with transducer. It support AC,DC voltage output or IEPE type sensor directly connect, and also support for the sensor which need +12/+24 VDC power supply.
3	Rotate and External trigger Channel	Used to connect with Rotate speed transducer and external trigger signal.(Defined in Software)
4	Power Switch	Press the button to turn on/off the Analyzer
5	Power Connector-DC IN	It can be directly connected to the power supply with a power Adapter. The power supply requires: Voltage range: DC 9 ~ 30 V
6	Ground Pole	It must be correctly connected to the grounded outlet.
7	Nameplate	Displays the serial number of this analyzer.
8/9	Sync OUT/ Sync IN	When cascading multiple instruments, interface IN is used to connect the previous analyzer, and interface OUT is used to connect the next analyzer. The IN interface of the first analyzer is suspended, and the input channel number starts from the first analyzer and is sorted in sequence.
10	Gigabit Ethernet Port	Used to connect the MI-7208 Analyzer to the gigabit Ethernet with a network cable.

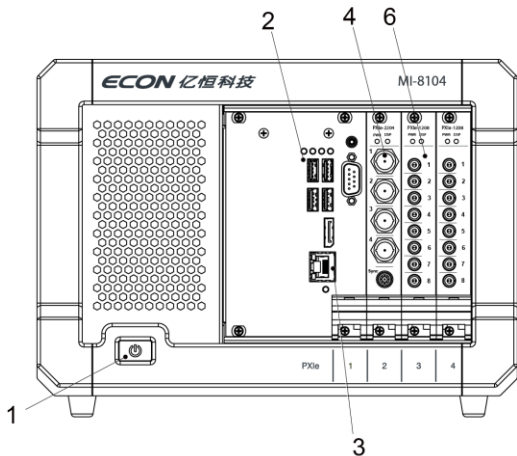
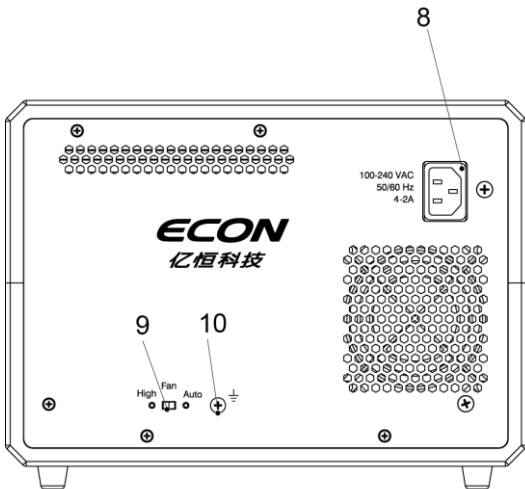
2 System Installatin



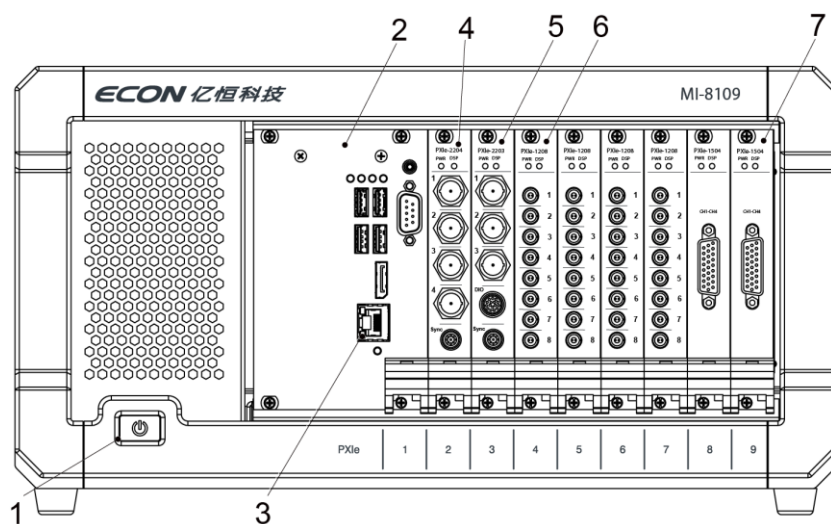
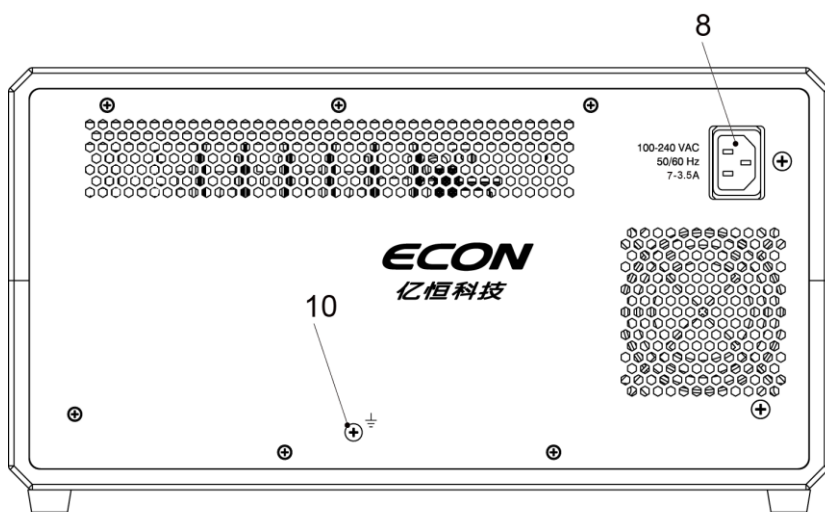
■ Gigabit Ethernet Port

Ethernet LED		
LED	Color/Status	Description
①	Yellow	100Mbps
	Green	1000Mbps
②	Flash	transmit/receive data

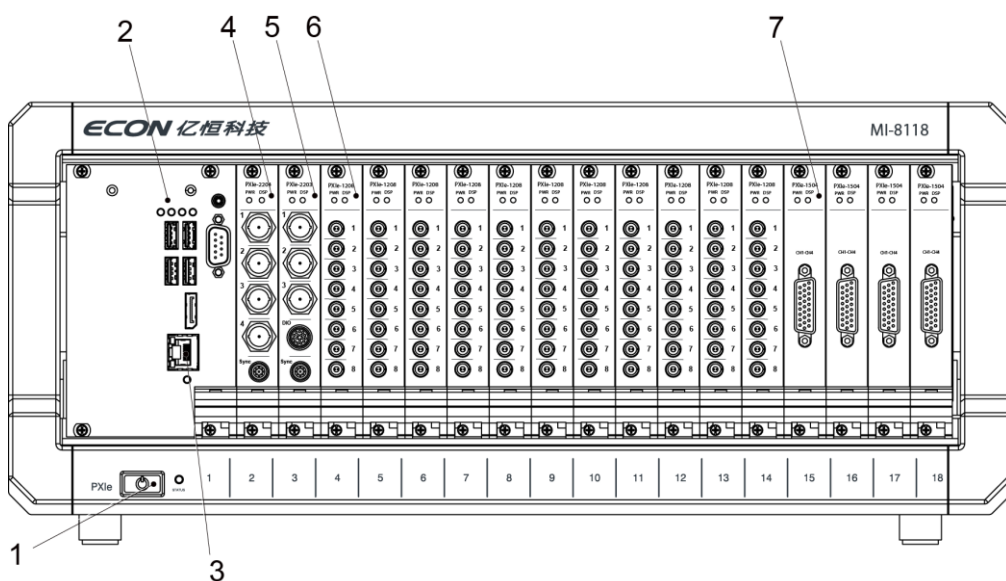
(B)MI-81XX Series Analyzer



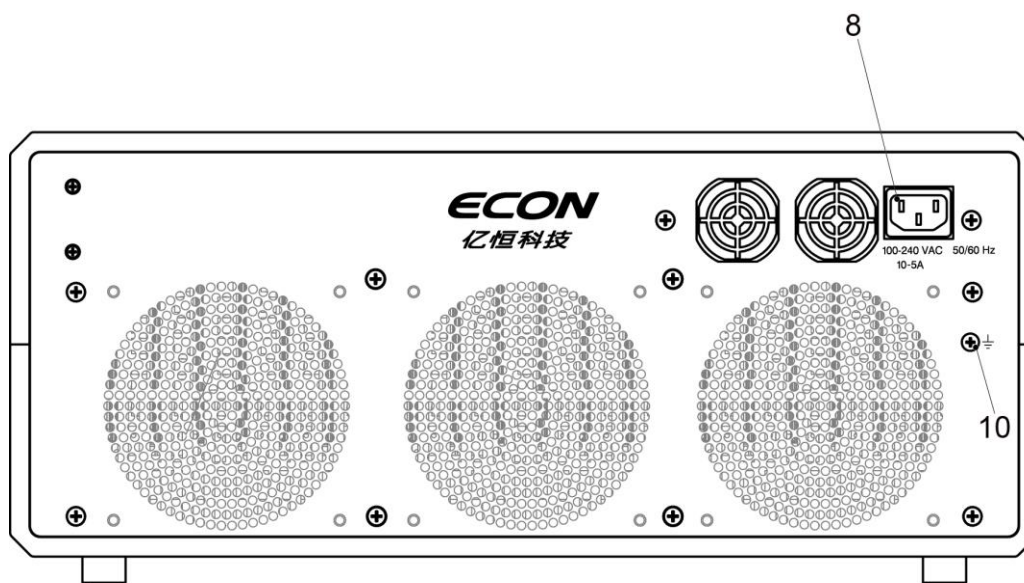
■ MI-8104



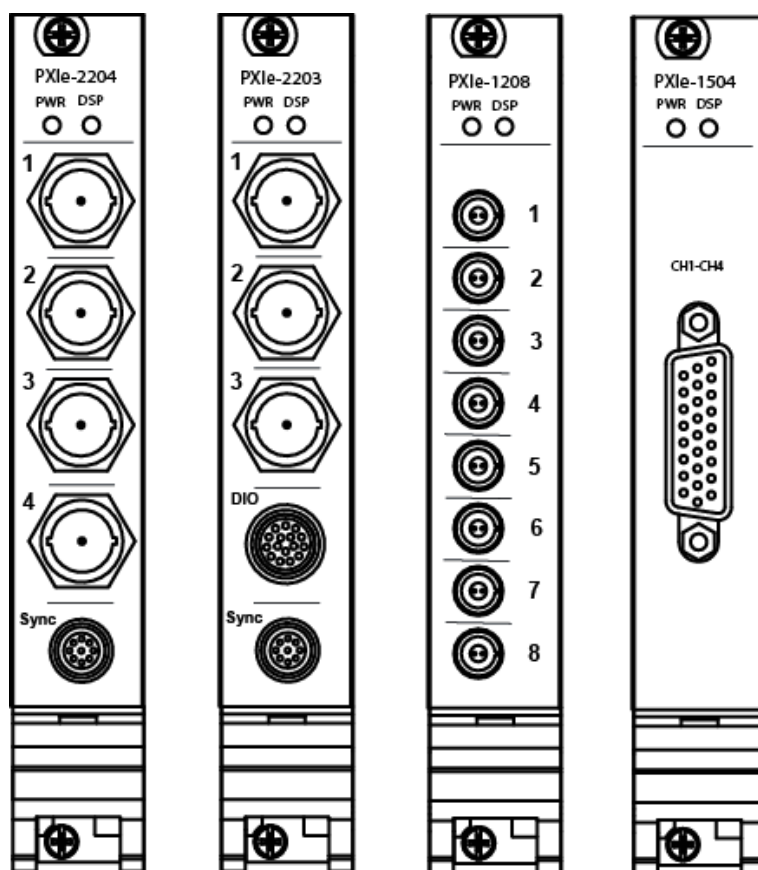
■ MI-8109



2 System Installatin



■ MI-8118

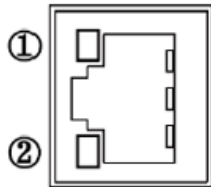


■ PXIe-2204/PXIe-2203/PXIe-1208/PXIe-1504 Module

Index	Name	Description
1	Power Switch	Press the switch in to turn on the Analyzer. Press the switch again to turn off the controller.
2	Real-time Controller	Real-time controller is located on slot 1 in the left. Real-time controller provides real-time, determined, and reliable system for measurement, analysis, and control.
3	Gigabit Ethernet Port	Used to connect the controller to the gigabit Ethernet with a network cable.
4	Output Module PXIe-2204	The output module is labeled "PXIe-2204". Each output module includes four BNC connectors and one 9-core connector. The BNC output channel number is arranged from the top down and from left to right. 9-core connector is for cascade connection to extend input channels.
5	Output Module PXIe-2203	The output module is labeled "PXIe-2203". Each output module includes three BNC connectors, one 16-core connector (Digital I/O) and one 9-core connector (Sync/Abort). The BNC output channel number is arranged from the top down and from left to right. 9-core connector is for cascade connection to extend input channels.
6	Input Module PXIe-1208	The input module is labeled "PXIe-1208". Each input module includes eight 2-core connectors and the channel number is arranged from the top down and from left to right. Input channels are used to connect to transducer with voltage output.
7	Input Module PXIe-1504	The input module is labeled "PXIe-1504". For DB26 integration interface, standard configuration includes a 5-meter-long DB26 to shielded bare wire connection cable. The channel number is arranged from the top down and from left to right. Input channels are used to connect to transducer with voltage output. Used to connect sensors and strain gauges.
8	AC Connector	It can be directly connected to the power supply with a power cable. The power supply requires: Voltage range: 100-240 V; Frequency range: 50/60Hz.
9	Fans Switch	Used to modify the running mode of fans inside of Analyzer. There are two modes: HIGH and AUTO. Switching to HIGH makes the fans running in high speed and switching to AUTO enables the fans running in

2 System Installatin

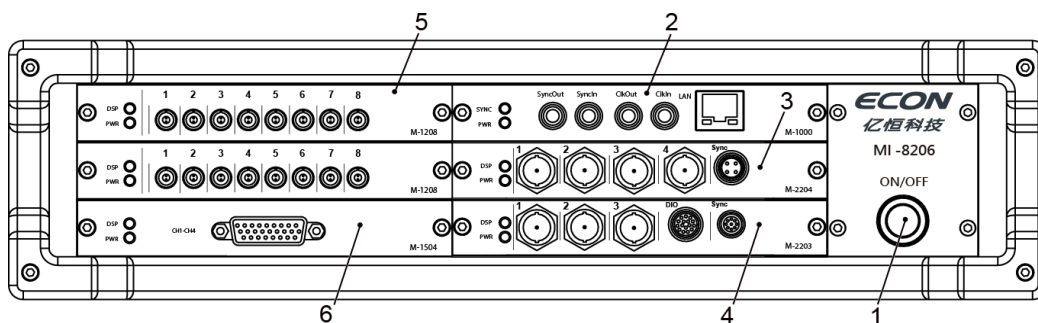
		different speed according to the temperature of inside of Analyzer. Only for MI-8104 Analyzer.
10	Grounding port	Used for equipment common ground.

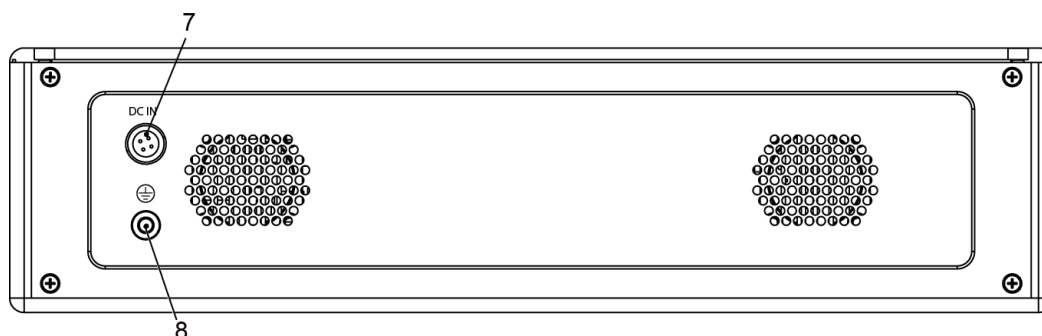
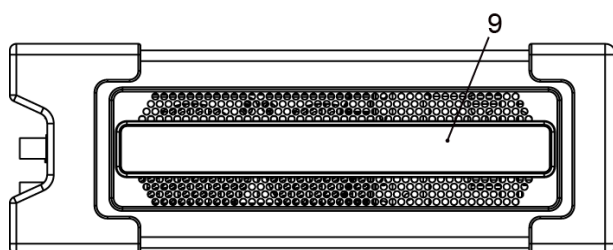
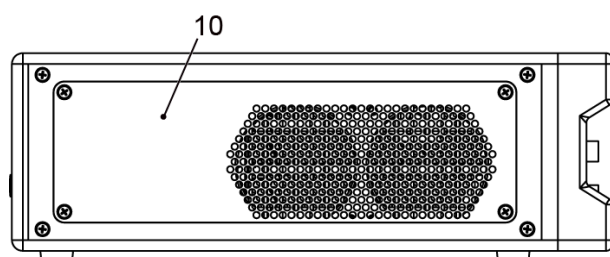


■ Gigabit Ethernet Port

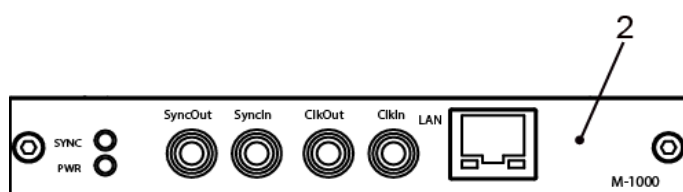
Ethernet LED		
LED	Color/Status	Description
①	Flash	transmit/receive data
②	Green	100Mbps
	Yellow	1000Mbps
PXI-1000/ PXI-2204/ PXI-2203/ PXI-1208/ PXI-1504 Module indicator LED		
LED	Color/Status	Description
PWR(Green)	Off	Module power supply not available
	On	Module power supply is available
SYN/DSP(Yellow)	Flash	The module is in working condition

(C)MI-82XX Series Analyzer

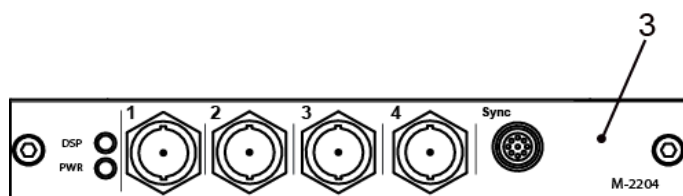




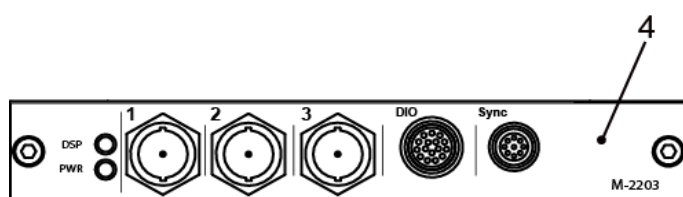
■ MI-8206



■ M-1000 Communication Module

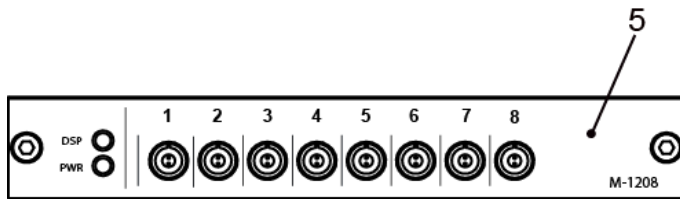


■ M-2204 Output Module

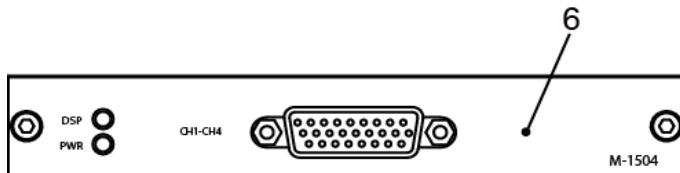


■ M-2203 Output Module

2 System Installatin



■ M-1208 Input Module



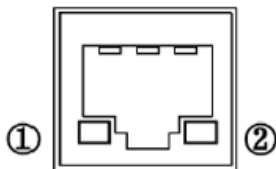
■ M-1504 Input Module(Strain)

Index	Name	Description
1	Power Switch	Press and hold the button for 1-2 seconds until the switch turns green and the power is turned on. Press and hold the button again for 6-8 seconds until the switch light goes out and the power is turned off.
2	Communication Module M-1000	The communication module of model M-1000 has one Gigabit Ethernet interface, four FC interfaces, and one solid-state drive. The gigabit Ethernet interface is connected to Ethernet through Ethernet cables. Solid state drives come standard with 512GB and can be expanded up to 2TB. The FC interface is a fiber optic interface, with SyncOut, SyncIn, CIKOut and CIKIn from left to right respectively when cascading multiple instruments. When cascading multiple instruments, interface IN is used to connect the previous analyzer, and interface OUT is used to connect the next analyzer. The IN interface of the first analyzer is suspended, and the input channel number starts from the first analyzer and is sorted in sequence.
3	Output Module M-2204	The output module is labeled "M-2204". Each output module includes four BNC connectors and one 9-core connector. The BNC output channel number is arranged from the top down and from left to right. 9-core connector is for cascade connection to extend input channels.
4	Output Module M-2203	The output module is labeled "M-2203". Each output module includes three BNC connectors, one 16-core connector (Digital I/O) and one 9-core connector (Sync/Abort). The BNC output channel number is

		arranged from the top down and from left to right. 9-core connector is for cascade connection to extend input channels.
5	Input Module M-1208	The input module is labeled “M-1208”. Each input module includes eight 2-core connectors and the channel number is arranged from the top down and from left to right. Input channels are used to connect to transducer with voltage output.
6	Input Module M-1504	The input module is labeled “M-1504”. For DB26 integration interface, standard configuration includes a 5-meter-long DB26 to shielded bare wire connection cable. The channel number is arranged from the top down and from left to right. Input channels are used to connect to transducer with voltage output. Used to connect sensors and strain gauges.
7	Power Connector-DC IN	It can be directly connected to the power supply with a power Adapter. The power supply requires: Voltage range: DC 12 ~ 30 V
8	Grounding port	Used for equipment common ground.
9	Handle	Convenient to move instruments.
10	Fan disassembly cover	Used to open the fan removal cover and perform regular dust cleaning on the fan. Before cleaning, ensure that the instrument is powered off.



The communication module must be inserted into the starting position of the MI-8206 chassis card slot. The MI-8206 chassis card slot number is sorted from top to bottom and from right to left, with the communication module position as slot 0. For both output and input modules, modules of the same type must be continuous. The output module must be plugged into the slot in front of the input module, and the M-1208 input module must be plugged into the slot in front of the M-1504 module.



■ Gigabit Ethernet Port

Ethernet LED		
LED	Color/Status	Description
①	Yellow	100Mbps

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	Green	1000Mbps
②	Flash	Transmit/receive data
PXI-1000/ PXI-2204/ PXI-2203/ PXI-1208/ PXI-1504 Module indicator LED		
LED	Color/Status	Description
PWR(Green)	Off	Module power supply not available
	On	Module power supply is available
SYN/DSP(Yellow)	Flash	The module is in working condition

[3] Recommended Configuration of Computer

Requirements	MI-7208
Operating System	Windows 7/8/10/11 and advanced version
CPU	CORE i5 or higher is recommended
Memory	8G or bigger
Hard Disc	500G or bigger, and more disc space is necessary if you wish to save data.
Disc Drives	CD-ROM or DVD-ROM Drive, required for CD installations
Network Card	Gigabit network card
Others	Mouse, Keyboard
Requirements	MI-81XX、MI-82XX series
Operating System	Windows 7/8/10/11 and advanced version
CPU	CORE i5 or higher is recommended
Memory	8G or bigger
Hard Disc	500G or bigger, and more disc space is necessary if you wish to save data.
Disc Drives	CD-ROM or DVD-ROM Drive, required for CD installations
Network Card	Gigabit or 10GbE network card
Others	Mouse, Keyboard



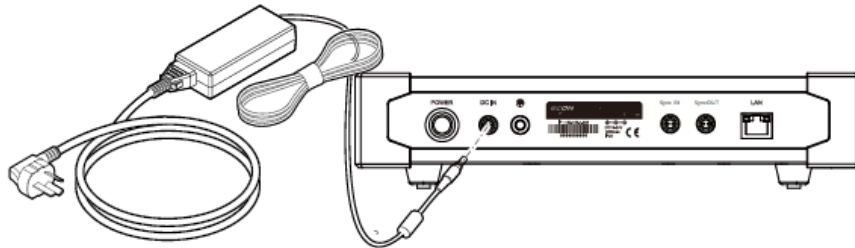
When the number of channels in the system increases to hundreds or thousands, it is necessary to increase the CPU performance, memory and hard disc capacity appropriately. A graphics card is required to operate the computer.

2 System Installatin

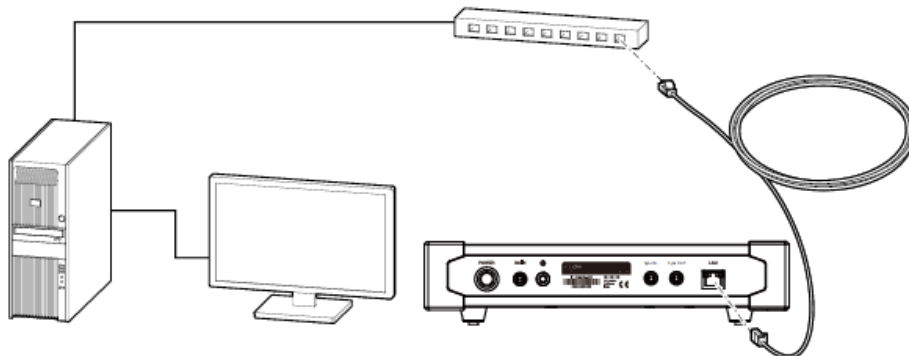
[4] Connection of Data Acquisition and Analyser

(A)MI-7208

1. Take MI-7208 as an example. Connect the power adapter with power cable, then connect the other end of adapter to Power Connector of Analyzer and connect the other end of power cable to power supply.



2. Connect Analyzer to the gigabit ethernet with a network cable through the Gigabit Ethernet port.

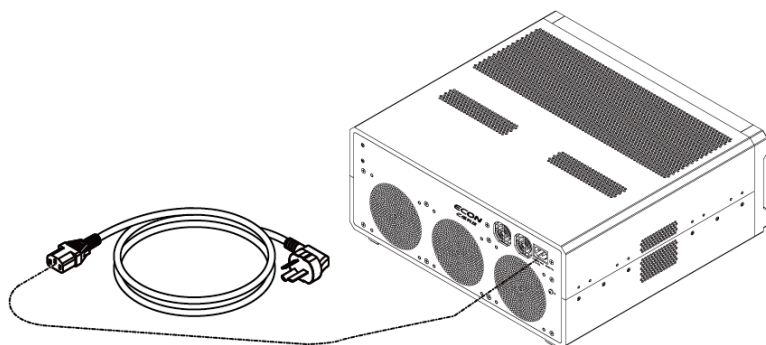


3. Connect the operating computer to the same gigabit ethernet and start the computer.
4. Press the Power switch in to turn on the Analyzer, and then the switch will be in inline status.

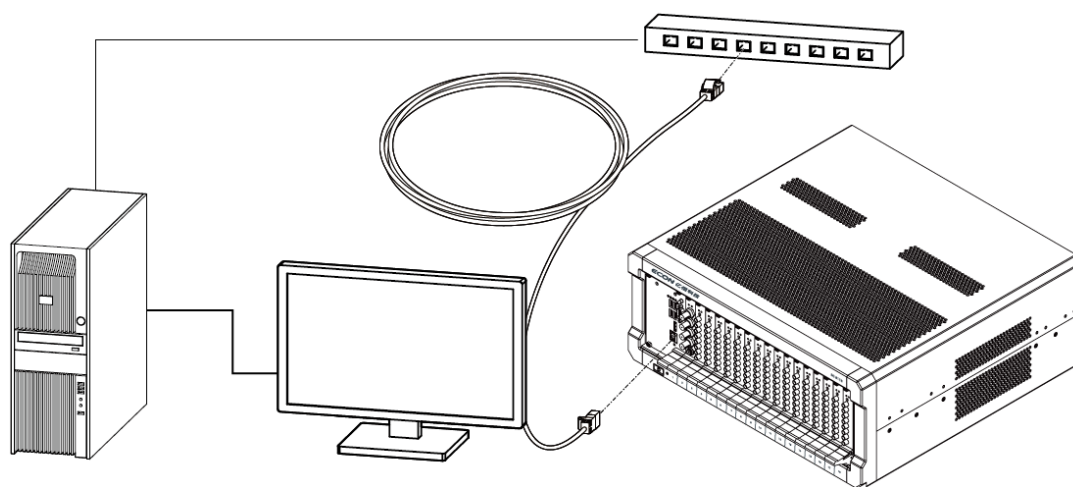


(B)MI-81XX series

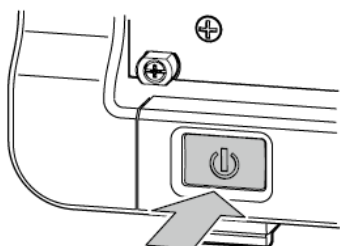
1. Connect the supplied standard AC power cable to the AC connector on the back panel.



2. Connect Analyzer to the gigabit Ethernet with a network cable through the Gigabit Ethernet port.



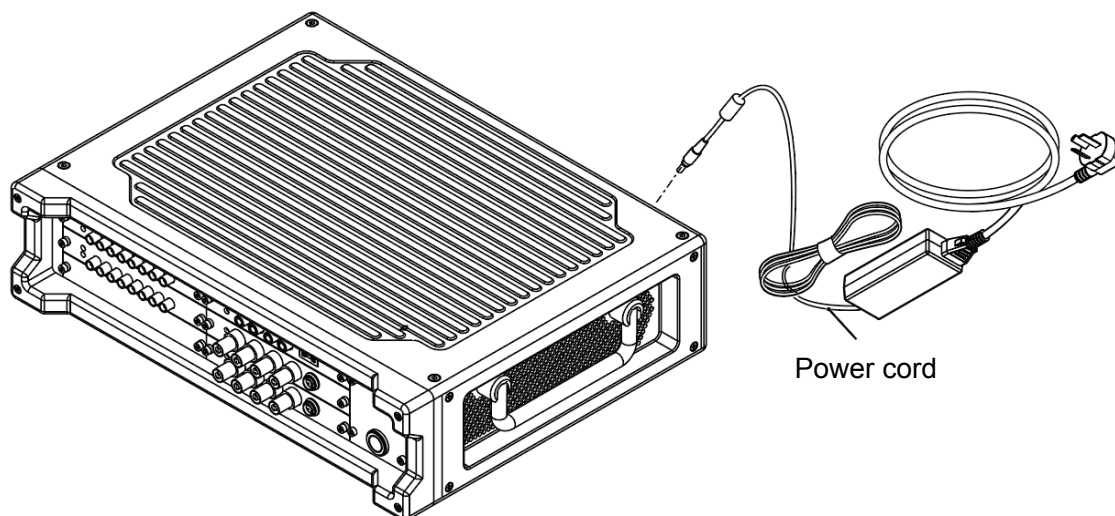
3. Connect the operating computer to the same gigabit Ethernet and start the computer.
4. Press the Power switch in to turn on the Analyzer, and then the switch will be in inline status.



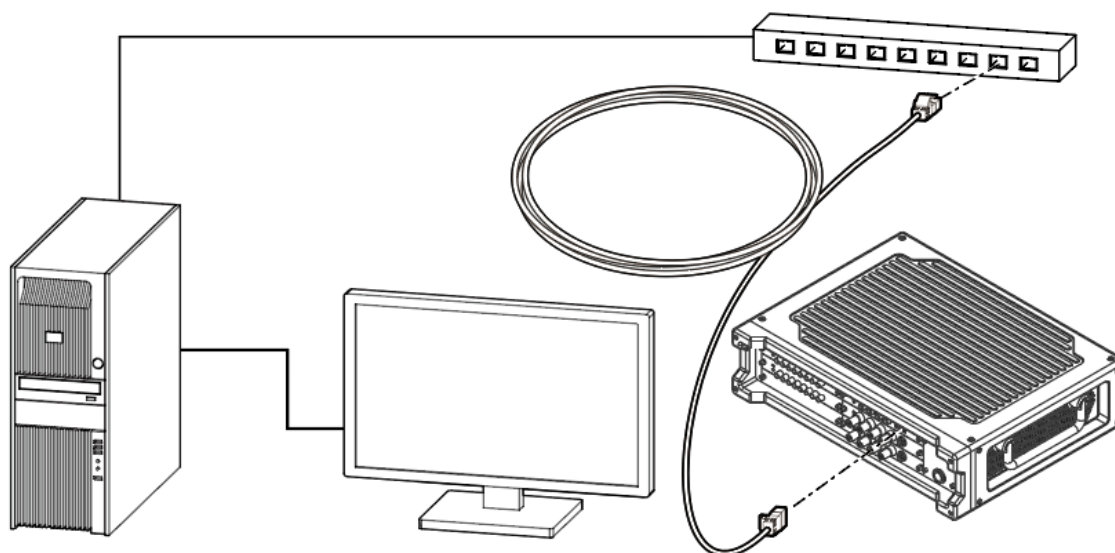
(A)MI-82XX series

1. Connect the data acquisition analyzer to the power supply using a power adapter.

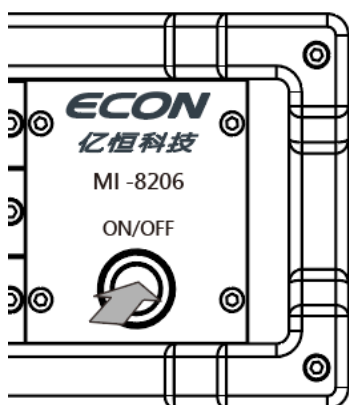
2 System Installatin



2. Connect the data acquisition analyzer to Gigabit Ethernet using Ethernet cable.



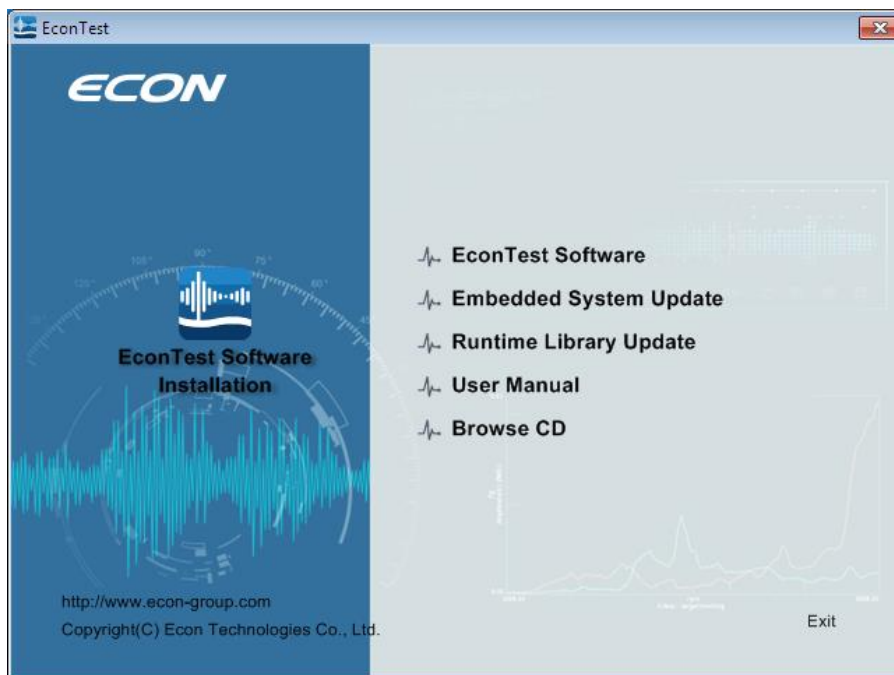
3. Connect the operating computer to the same Gigabit Ethernet, which can be used with a laptop or desktop computer, and turn on the operating computer.
4. Press the Power switch in to turn on the Analyzer, and then the switch will be in inline status.



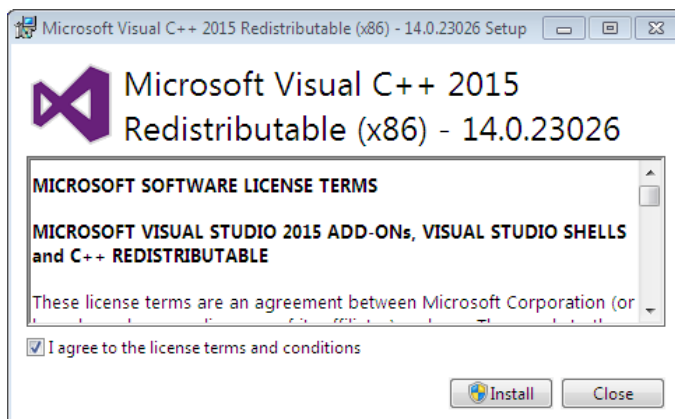
[5] Software Installation

Please log on to the operating system as a computer administrator and follow the steps below to install the software:

1. Insert the installation disc into your computer, the CD-ROM drive will automatically run and display the installer on the screen.

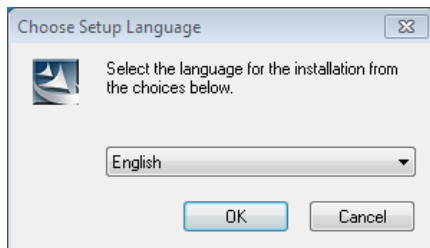
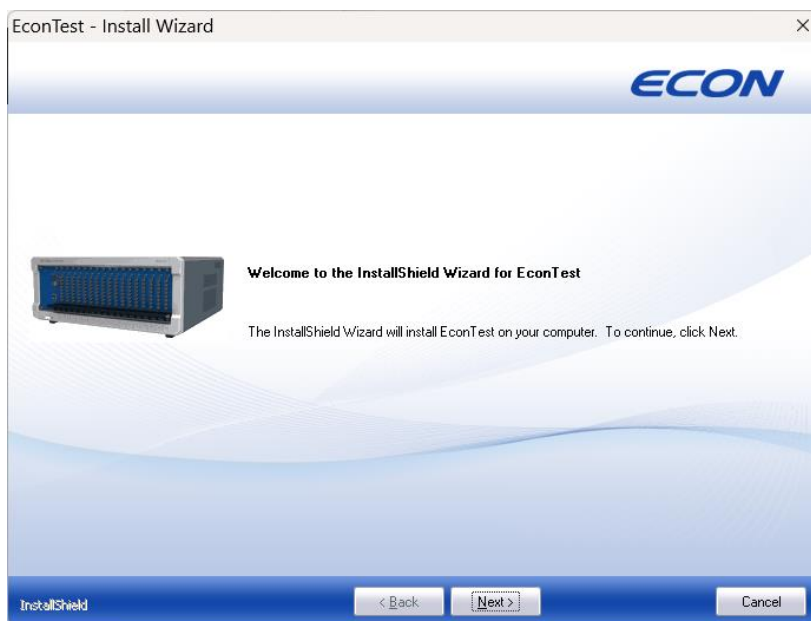


2. Click 'Update Software Repository' to configure the software environment. Follow the installation guide to complete the installation. If you are prompted with 'Setup Failed' after clicking Install, it means that the software environment has met the requirements, and you can click the 'Close' button to perform the next step.

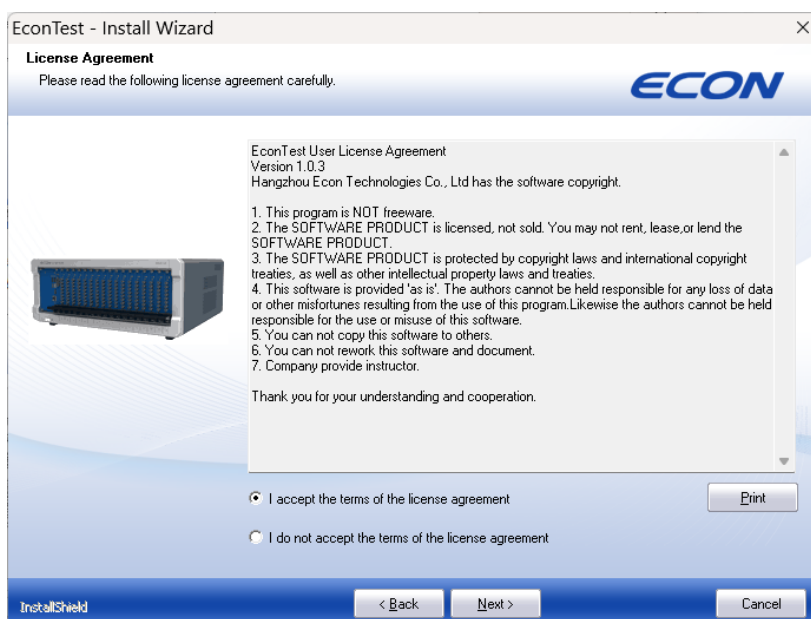


2 System Installatin

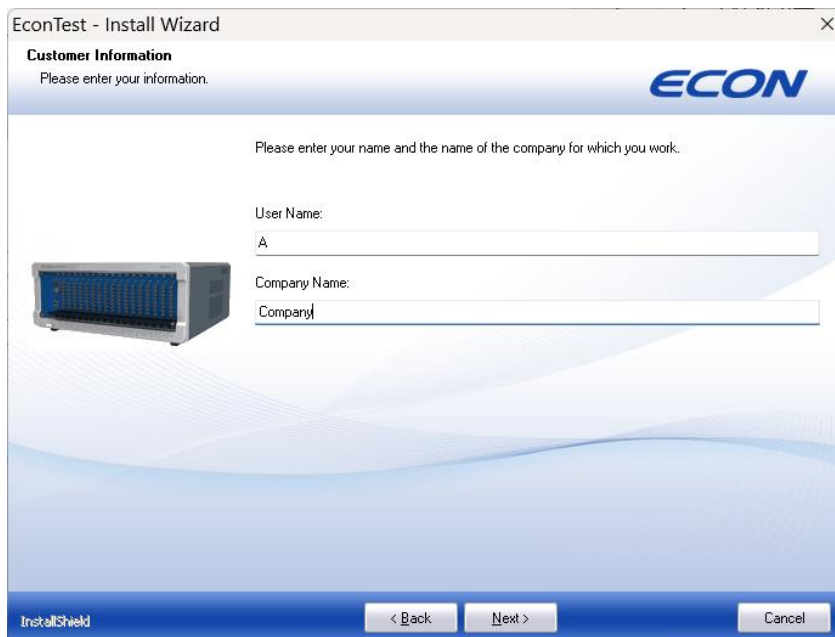
3. Then click 'EconTest Software' to start the software installation. After Windows has loaded the installation file, you will need to select the language category of the software and click 'OK' to bring up the 'Installation Wizard' screen. Click 'Next' to read the software licence agreement.



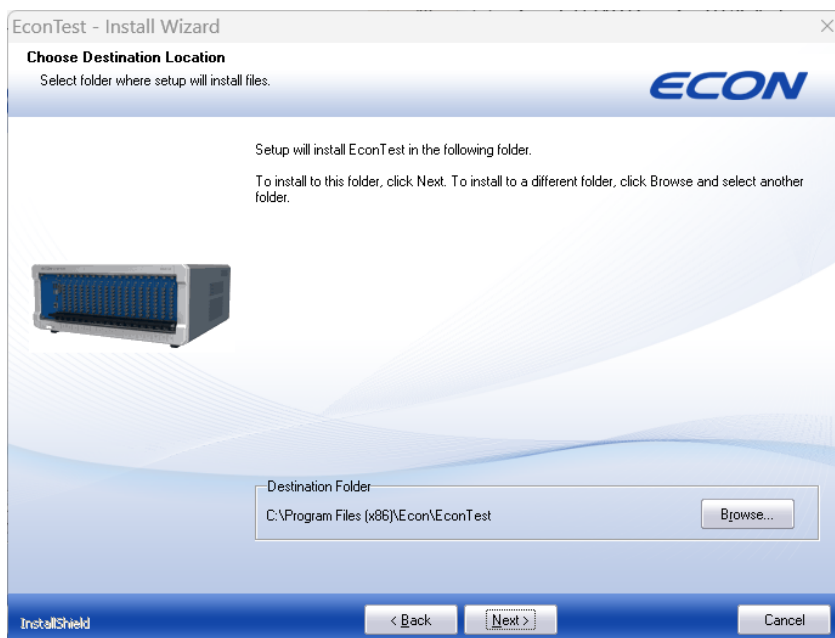
4. Read the Software License Agreement carefully and click 'I accept the terms of the License Agreement' to accept the license terms. Click 'Next' to continue with the installation, or click 'I do not accept the terms of the license agreement' to reject the terms and cancel the installation.



5. Enter 'User Name' and 'Company Name' and click 'Next'.

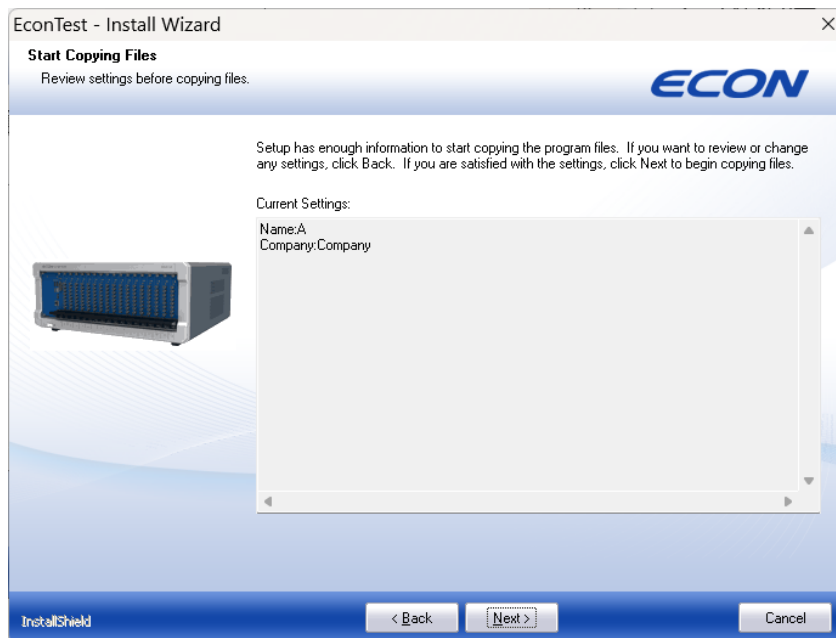


6. We recommend accepting the default path 'C:\Program Files (x86)\Econ\EconTest' as the installation path for the system software. You can also click 'Browse' to specify another installation path.

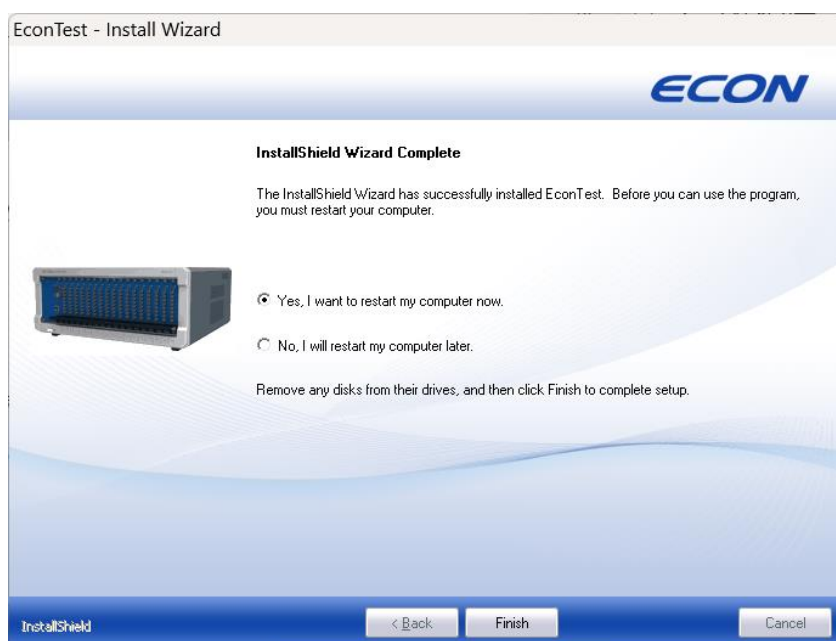


2 System Installatin

7. Clicking 'Back' allows you to view information about the current setup in order to prepare the files for correct copying. Confirm and click 'Next' to begin the automatic installation of the software.



8. At the end you need to select 'Yes, restart your computer now' and click 'Finish' to exit the installation.



[6] Starting the Software

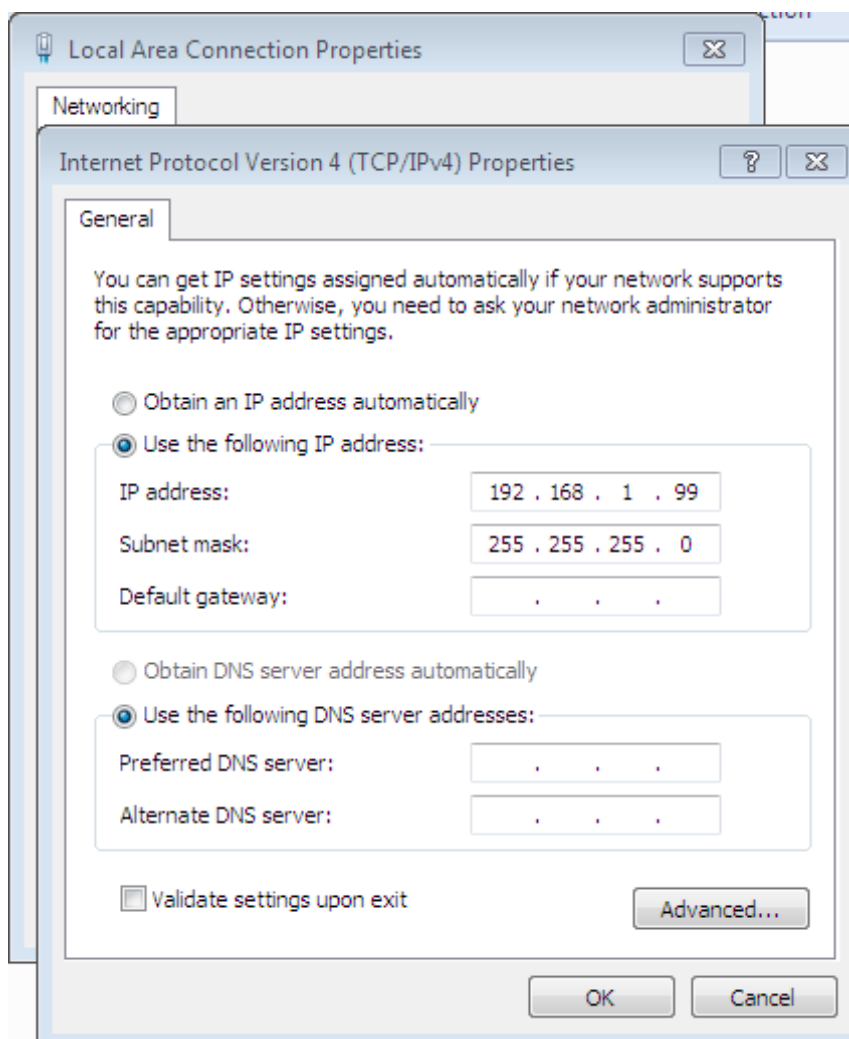
(A) Network Configuration

After the EconTest software has been successfully installed, network configuration of the operating computer is required before running the software.



For each Analyzer, IP address and subnet are configured when leave factory. You should only setup network of your operating computer in the same subnet, then your operating computer can access to Analyzer.

For example, the IP address of Vibration Controller is 192.168.1.88 and the subnet mask is 255.255.255.0, then you can set the IP address of operating computer from 192.168.1.1 to 192.168.1.254 that is different from 192.168.1.88 and set the subnet mask as 255.255.255.0.



■ Network Configuration

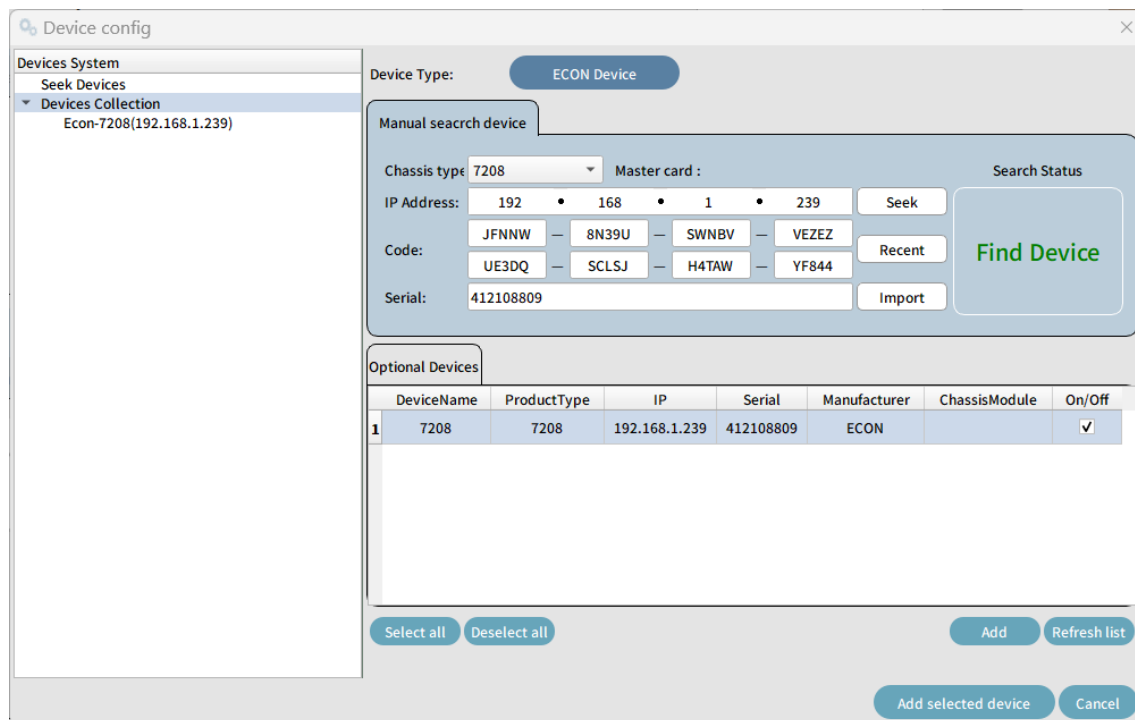
2 System Installatin

(A)Software Configuration

The first time you run the EconTest software, you will need to configure the software.

1. Online acquisition software

On the Windows desktop, click the icon  open the online acquisition software. The online acquisition software needs to be connected to the device in order to run, and the software needs to be configured the first time it is run. Click  open interface, set the software password, serial number, and configure the chassis model and IP address of the Analyzer.



The 'Device config' window is shown with the following fields and controls:

- Device Type:** ECON Device
- Manual search device:**
 - Chassis type:** 7208
 - Master card:** (empty)
 - IP Address:** 192 • 168 • 1 • 239
 - Code:** JFNNW, 8N39U, SWNBV, VEZEZ, UE3DQ, SCLSJ, H4TAW, YF844
 - Serial:** 412108809
 - Buttons:** Seek, Recent, Import
 - Search Status:** Find Device
- Optional Devices:**

	DeviceName	ProductType	IP	Serial	Manufacturer	ChassisModule	On/Off
1	7208	7208	192.168.1.239	412108809	ECON		✓

Buttons: Select all, Deselect all, Add, Refresh list, Add selected device, Cancel

■ Network configuration

Please select the chassis type according to the actual instrument model and enter the software password and serial number according to the password list. You can also import xxxxxxxxxx_801.dat (MI-7208) or xxxxxxxxxx_802.dat (MI-81XX、MI-8206 series) from the configuration file disc, the software will read the software password and serial number.



Each controller has a group of unique password and serial number. They are printed on the password sheet, so please keep the sheet in a safe place.

Click  button, The searched devices will be displayed in the optional devices table

below (if any of the entries are incorrect, the system will not work). Tick the 'On/Off' column. Click

Add

button to add the device to the list of devices on the left hand side, then click

Add selected device

to complete device configuration.



Before starting the application software, make sure that both the operating computer and the collector are connected to the network, that the Analyzer is powered on, and that network communications are normal.

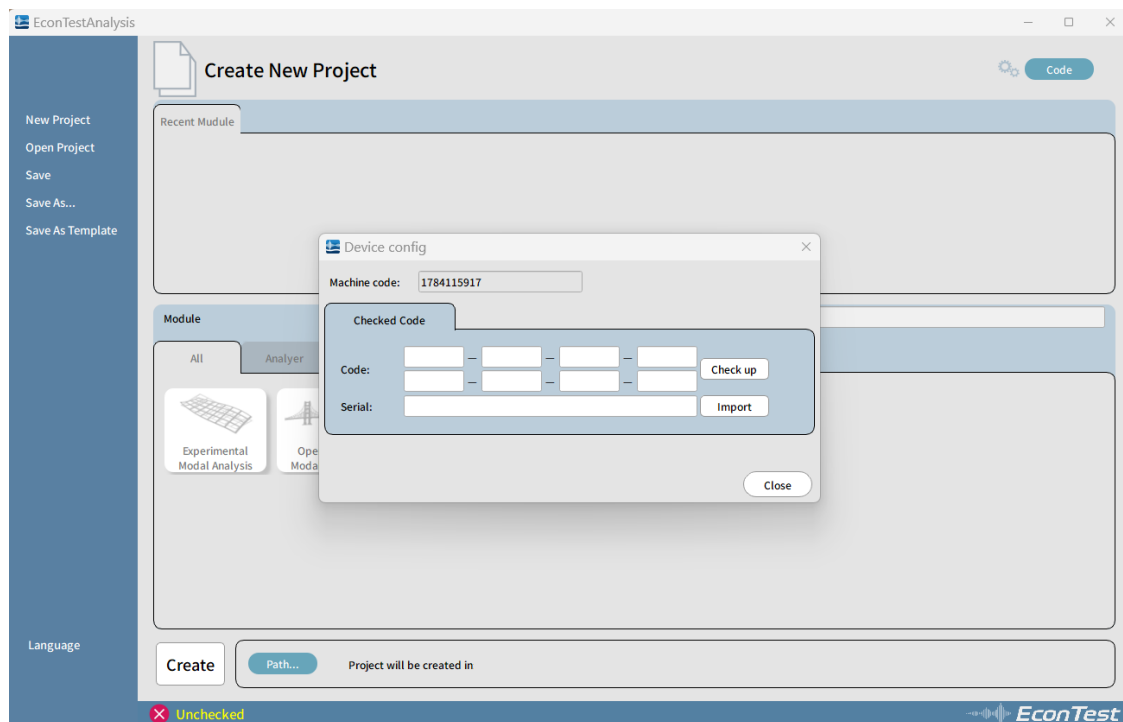
2. Modal Analysis software



On the Windows desktop, click the icon **EconTest** open the modal analysis software. The software

Code

needs to be configured for the first run. Click open the device configuration interface, The interface displays a string of machine codes (each computer has a unique machine code). Please send your machine code to the vendor or ECON to obtain the verification password for the modal analysis software. You can import xxxxxxxxxx_810.dat from the configuration file disc, the software will read the software password and serial number.



■ Network configuration

Import the modal analysis passwords sent to you by your vendor or ECON. Click **Check up** button to complete the calibration.

2 System Installatin



The types of tests that can be activated by the system are related to your ordering information, so please contact your seller when the types of tests available to you do not correspond to your ordering information or when you need to add new test functions.

[7] FAQs

(A) EconTest Software Installation, Uninstallation and Upgrade

Only one EconTest software can be installed on each operating computer. If you reinstall the software or upgrade the software version, you must uninstall the previously installed software.

1. Software Installation

A software installation CD is provided with each Data Acquisition and Analyzer System. Users should refer to the procedure in 2-[5] 'Software Installation' to install the EconTest software.

2. Software Uninstallation

There are several ways to uninstall the EconTest software after successful installation:

- Find and click on 'EconTest' in 'Remove or Add Programs' in the 'Control Panel'. Click the 'Remove' button and the software uninstaller will start.
- Refer to the software installation procedure, you can also start the software uninstaller. Insert the installation disc into your computer's CD-ROM, the CD-ROM drive will automatically run and display the installer on the screen. Then click 'EconTest Software' to start the software uninstaller. Or directly execute the 'setup.exe' file in the EconTest directory on the CD-ROM.

3. Software Upgrade

If you receive a new version of the software installation package and need to update the software, you must first uninstall the previously installed EconTest software. Alternatively, select an uninstallation method to uninstall the software, and then follow the software installation steps to install the software.

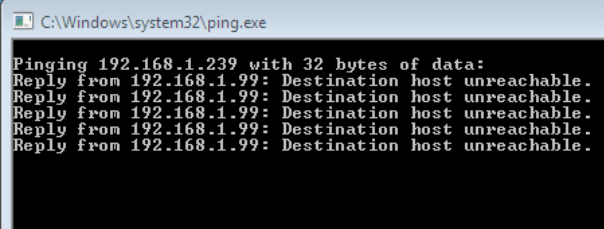
(B) Failed to find device

General steps to resolve the 'Failed to find device' message when configuring the software with EconTest software:

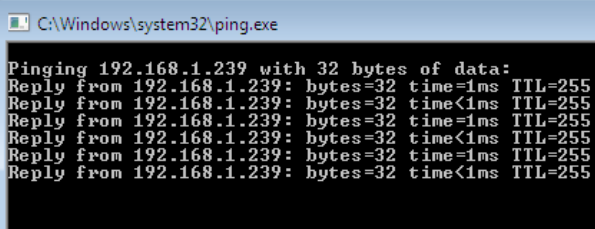
- Confirm whether the power of the instrument is turned on normally and whether the light of the network port blinks normally. You can judge whether the hardware is correctly connected by ping command in the run command (the computer and the instrument should be in a network segment).

2 System Installatin

- Confirm that the instrument chassis type, software password and serial number are imported correctly.



```
Pinging 192.168.1.239 with 32 bytes of data:
Reply from 192.168.1.99: Destination host unreachable.
Reply from 192.168.1.99: Destination host unreachable.
Reply from 192.168.1.99: Destination host unreachable.
Reply from 192.168.1.99: Destination host unreachable.
```



```
Pinging 192.168.1.239 with 32 bytes of data:
Reply from 192.168.1.239: bytes=32 time<1ms TTL=255
Reply from 192.168.1.239: bytes=32 time<1ms TTL=255
Reply from 192.168.1.239: bytes=32 time<1ms TTL=255
Reply from 192.168.1.239: bytes=32 time<1ms TTL=255
```

Disconnecting

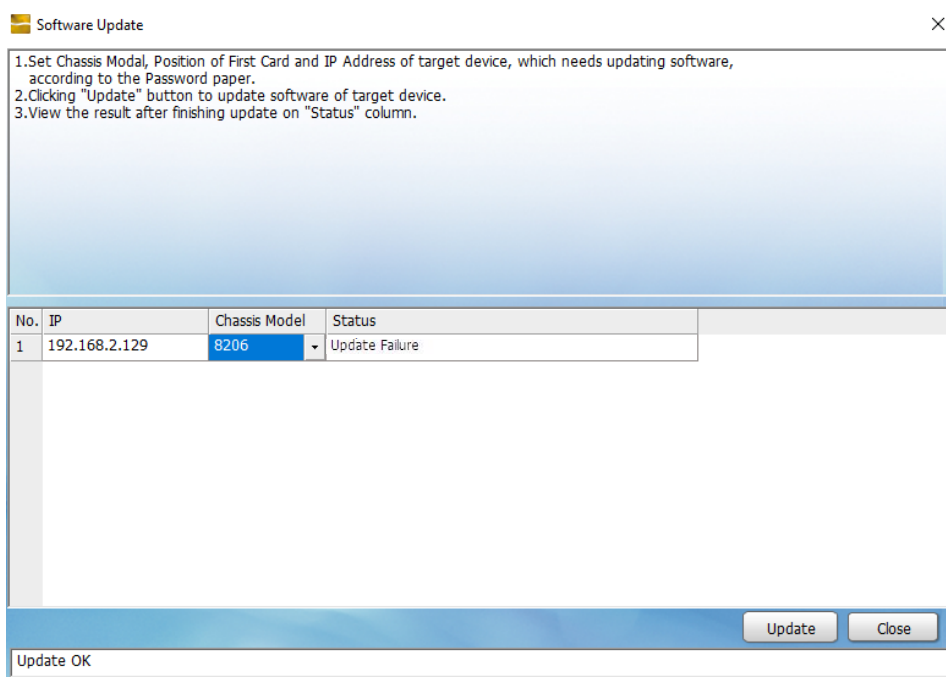
Connecting

- Run the -ping command

(C)Update failure

General steps for resolving update failures when running 'Underlying System Update':

- Confirm that there is no Chinese path to the directory '.....\Econ\EconTest' where the application is located.
- The underlying system update program '.....\Econ\SoftRep' cannot be placed on the desktop.



- Software update failure



If the above does not solve your problem, please contact your seller or ECON.

3

Test Operation

[1] Basic Interface Introduction.....	34
[2] Documentation	36
[3] Navigation	37
[4] Geometry	46

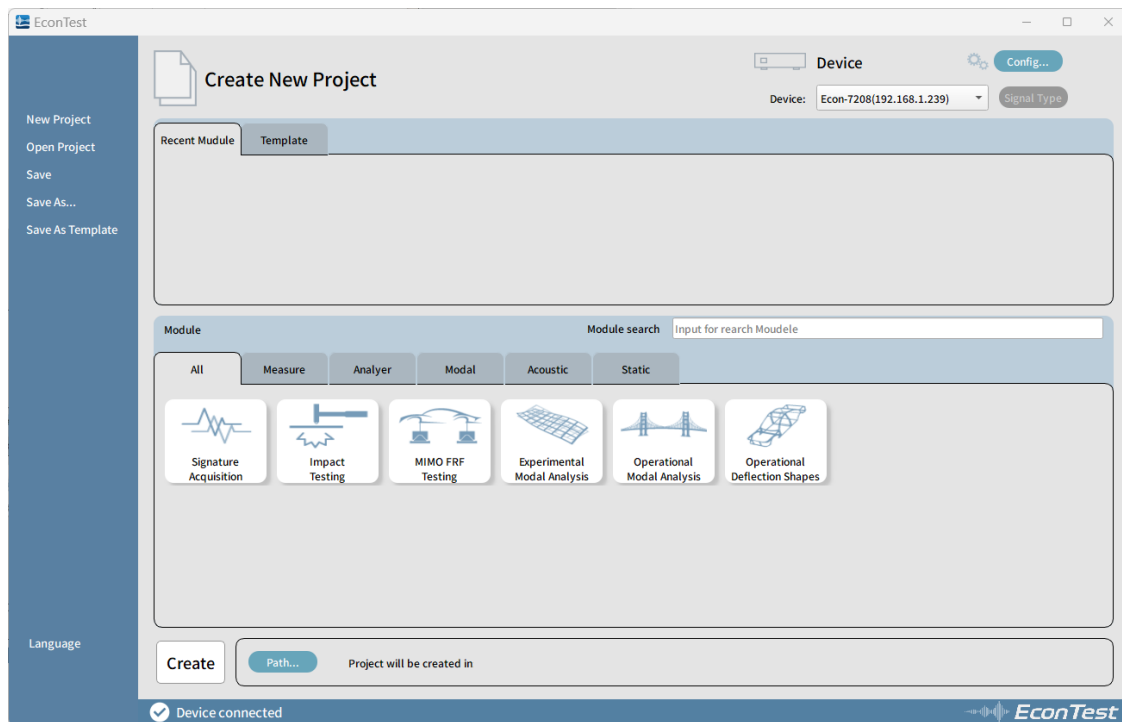
3 Test Operation

[1] Basic Interface Introduction

(A)Function Selection Interface

The function selection interface of the EconTest software consists of the following areas:

- ✧ Project management area on the left
- ✧ Device configuration and signal type selection in the upper right corner
- ✧ Module selection and file path selection in the middle
- ✧ Device connection status bar at the bottom

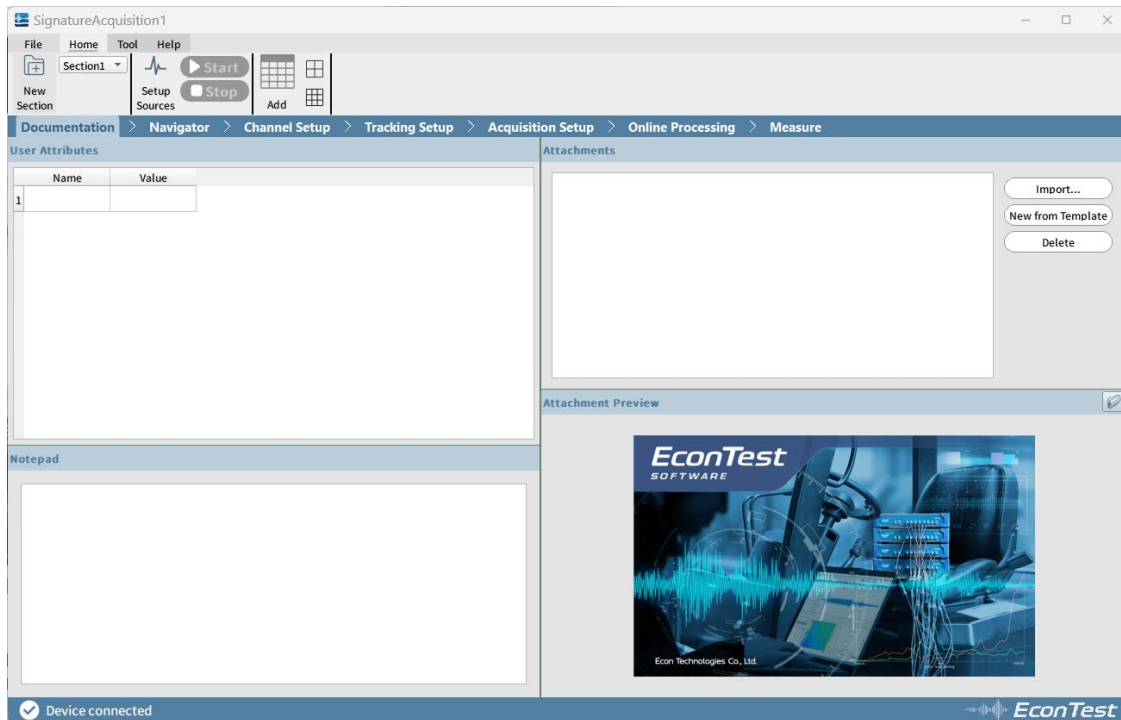


■ EconTest Function Selection Interface

(B)Introduction to Function Interface

The functional interface of the EconTest software consists of the following areas:

- ✧ Menu bar and toolbar at the top
- ✧ Process bar and operating area in the middle
- ✧ Device connection status bar at bottom



■ EconTest Function Interface

EconTest divides the interface according to the test process. Separate the parameter setting and testing and then put them in different interfaces according to the process. Users only need to operate according to the process. Through the menu bar and toolbar, you can set and modify the parameters of the software. The operation area in the middle is for test parameter setting and test mode selection.



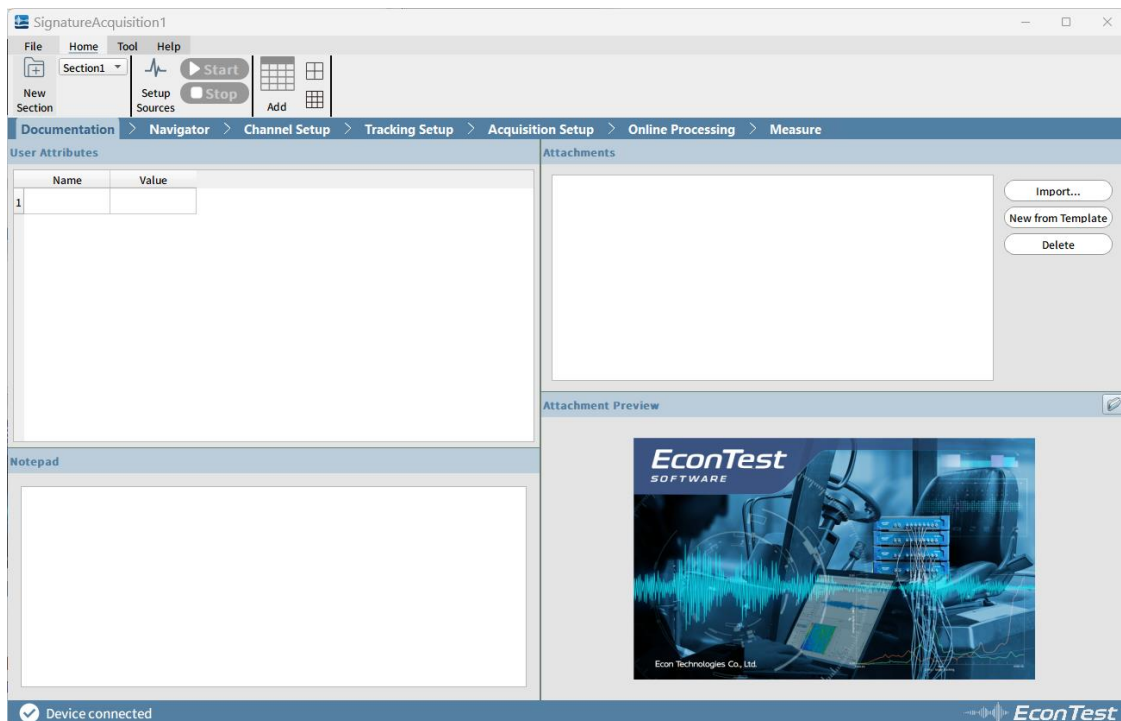
The types of tests that can be activated by the system are related to your ordering information. When the test types available to you do not correspond to your ordering information or when you need to add new test functions, please contact your seller.

3 Test Operation

[2] Documentation

The Documentation interface is used to document the experiment. The file page is divided into four main sections: User Properties, Notebook, Attachments, and Attachment Preview.

- ✧ User Attributes: You can add test parameters such as name and time of the test.
- ✧ Notebook: Allows direct description of the test.
- ✧ Attachments: Documents, pictures, multimedia and other materials can be added.
- ✧ Attachment Preview: You can view a preview of the selected attachment.



- Documentation interface

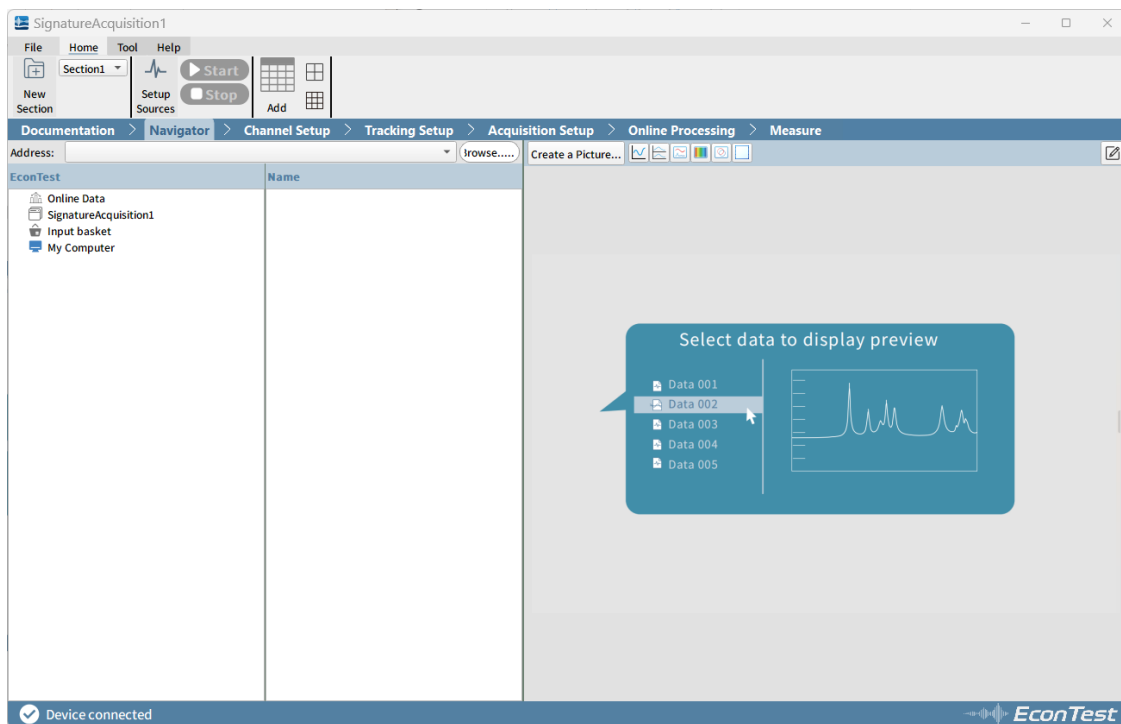
[3] Navigation

When the pilot test is complete, the test data first needs to be viewed to determine if the data is valid. The data can be viewed through the Data Navigation page and displayed through the graphical display function in Data Navigation.

(A) Browsing data

On the left side of the data navigation page is the file browsing area:

- ✧ Project File: Browse the online data defined during the online collection.
- ✧ Data basket: Temporary storage of data ready for processing.
- ✧ My computer: You can browse the data in your computer.



- Data navigation interface

3 Test Operation

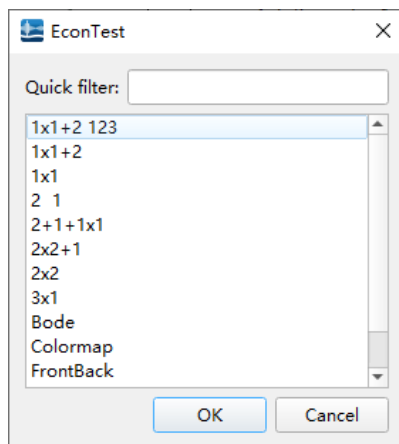
(B)Window display

1. Window creation display

Click **Create a Picture...** creating a Display Window. You can also click on the shortcut chart



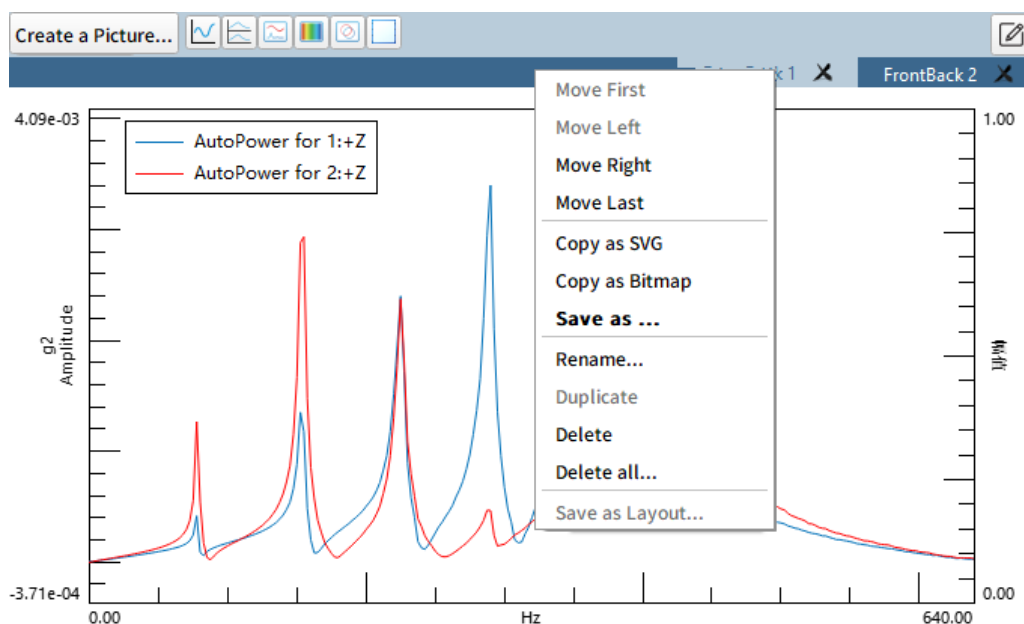
logo (Hovering over a button displays the corresponding label).



- New Drawing Dialog

2. Window operations

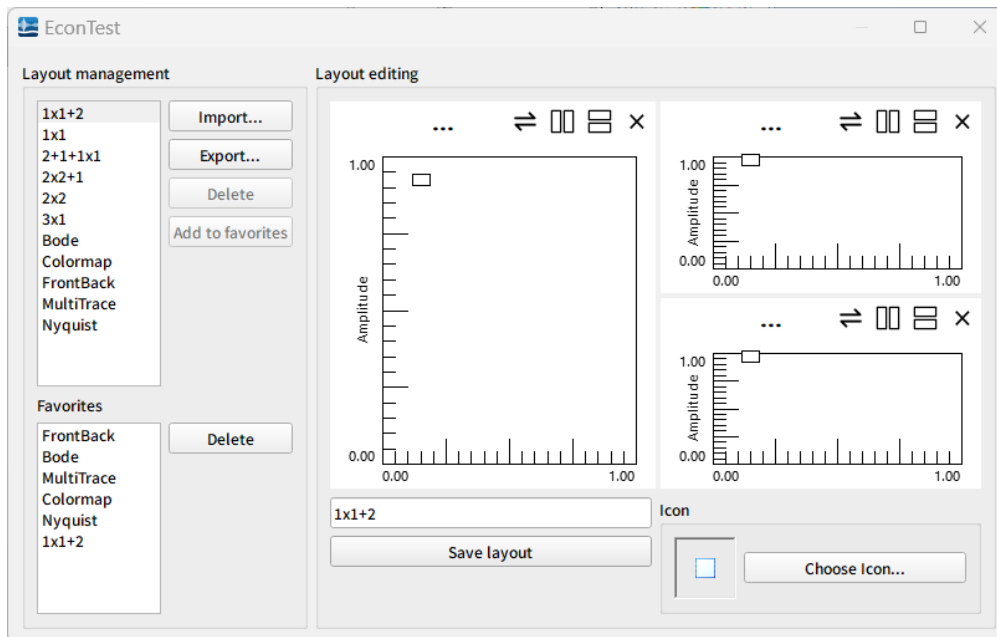
After adding a window, left-click on the window name above to switch to a different window for display, or right-click on the window name to move, copy, save, rename, delete and save the layout.



- Window right-click menu

3. Window layout

Click the Edit button in the upper right corner of the window , then you can add a custom layout window to display. It supports window layout and window icon customization.



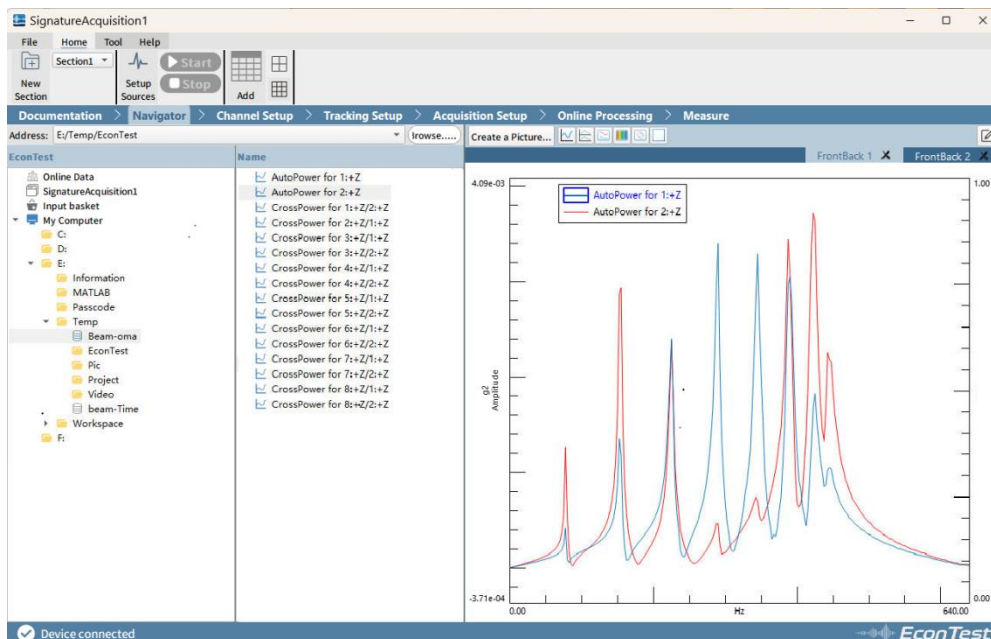
■ Window Layout Management

4. Data display

The procedure for displaying data:

1. Select the data folder in the area on the left.
2. Click on the FrontBack icon  to create a new graphical window.
3. After selecting the corresponding signal in the Name screen, drag the signal to the FrontBack window with the mouse.
4. Repeat the above action to select another data and put it into the graph to compare the data of different measurement points.

3 Test Operation



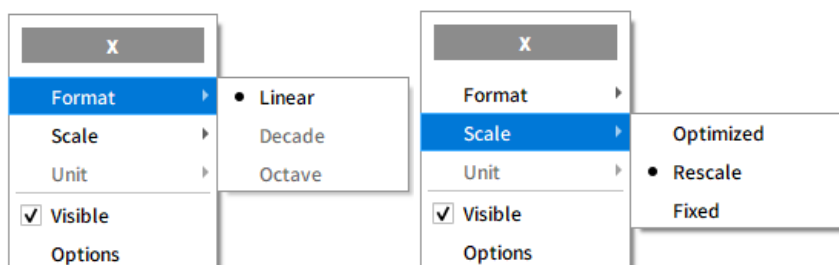
- Data display window

(C)Graphical operations

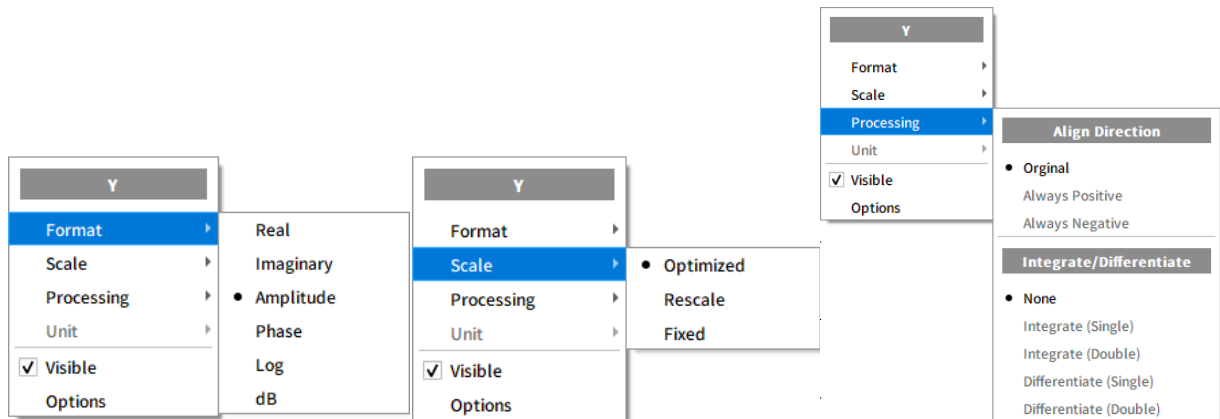
Each pane's graphical display area can show multiple functions of the same type and related additional information to help you monitor tests, analyze data, and document test results.

1. X-Y Axis settings

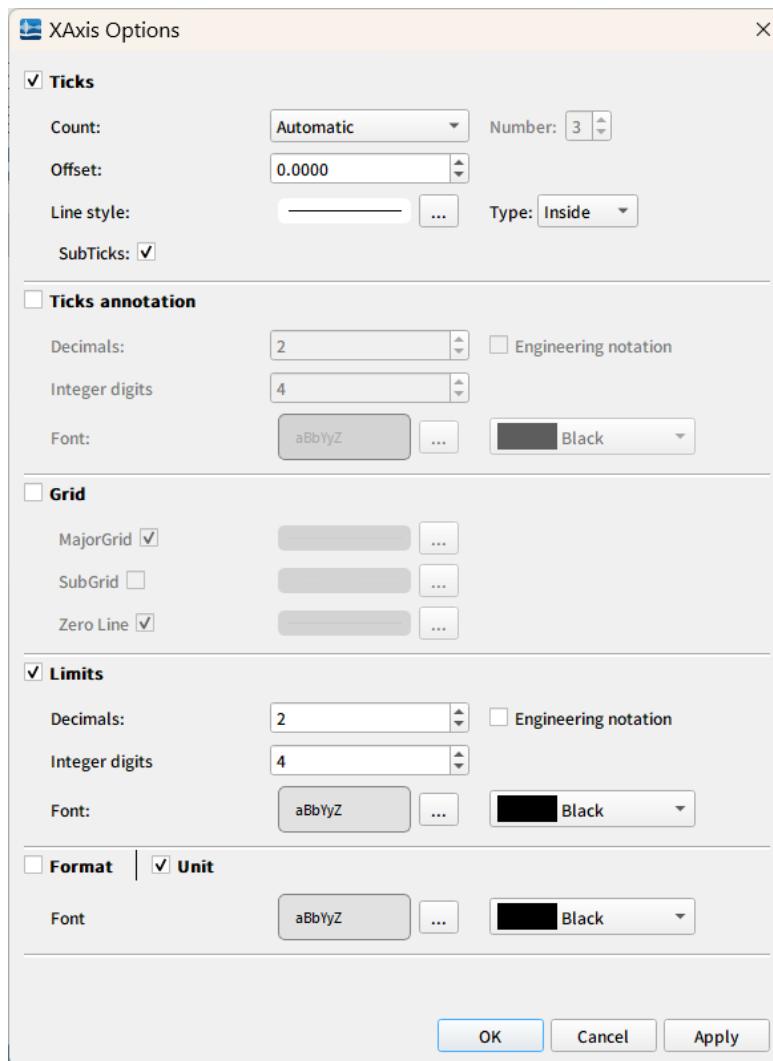
Right-click on the X/Y axis to set the display of the axes.



- X-axis right-click menu



■ Y-axis right-click menu



■ X/Y Setting Options

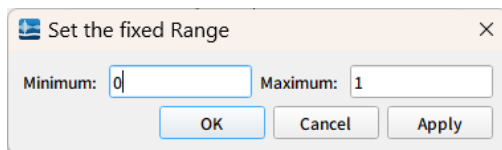
3 Test Operation

2. Adjusting the graphic display

When the mouse is placed on the window area and the scroll wheel is slid, prompts for adjusting the graphic display will appear. The user can follow the prompts to adjust the graphic display.

a. Custom axis ranges

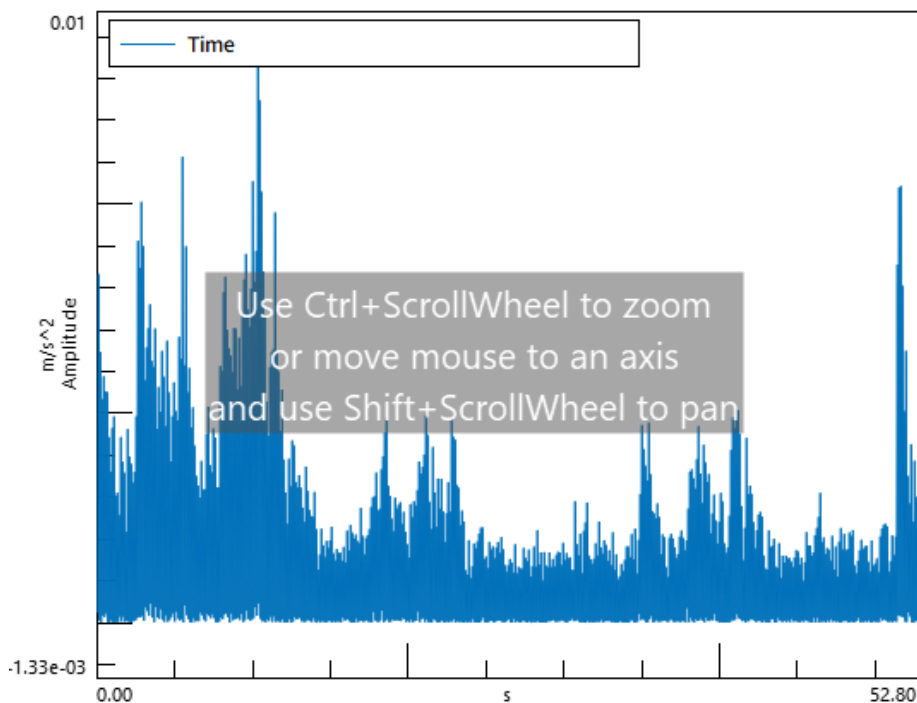
Double-click on the axes with the left mouse button to set a fixed display range for the axes.



- Set the fixed range

b. Moving graphics

Mouse over the axes and press Shift+Scroll Wheel to pan the graph in different axes.

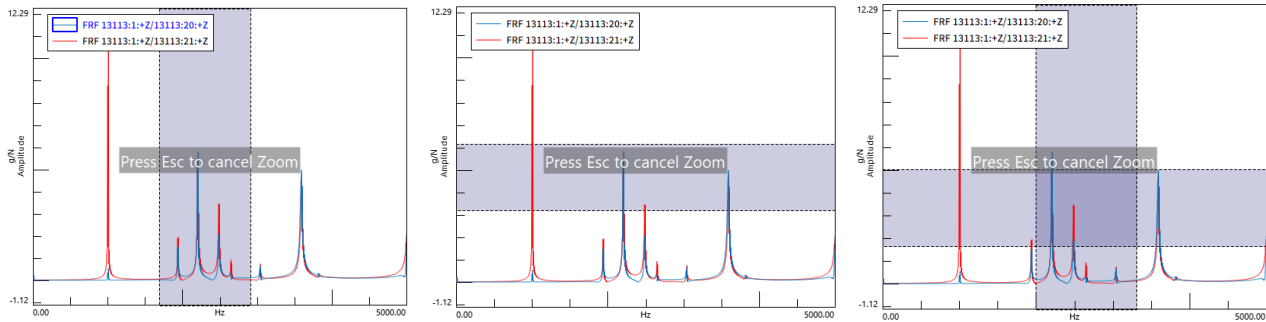


- Graphics panning and zooming tips

c. Selection area zoom

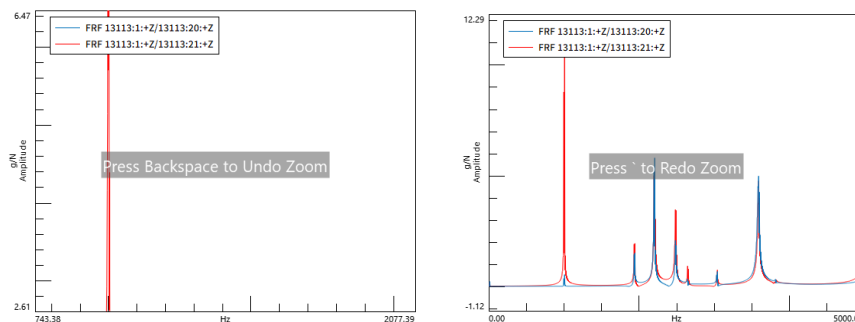
- Move the mouse to the window area and press Ctrl+Scroll Wheel to zoom the graphic.

- In zoom interactive mode (default option, ticked in the right-click menu): place the mouse over the graph and click and drag the left mouse button. This will create a corner of the zoom box. Drag the mouse until it covers the area to be zoomed in, release the left mouse button and the system automatically zooms in on the graph in the selected area.



■ Selection area zoom

In addition to the above operations, 'Backspace' and '\ ' can also be used to retract and re-zooming operations.



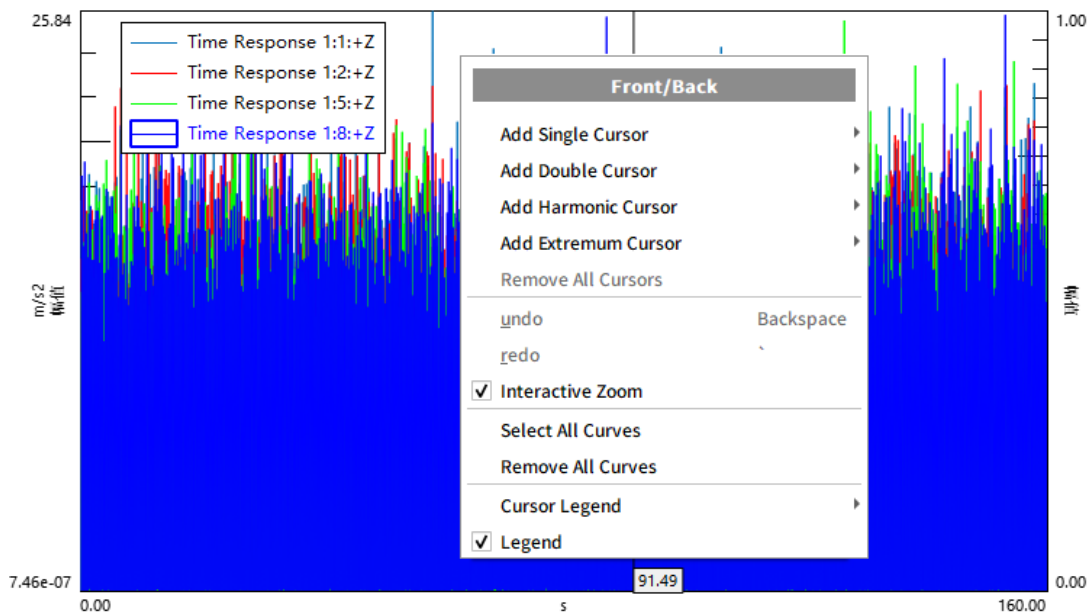
■ Retract and re-zooming

3. Adding and removing cursors

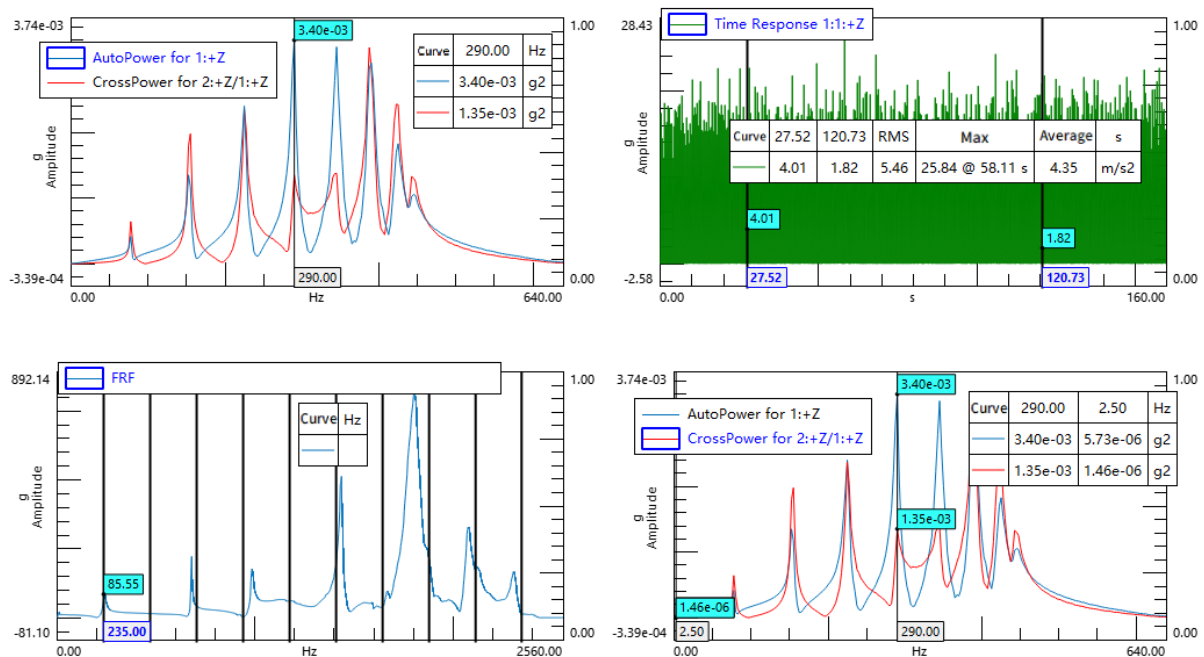
Single and double cursors give precise X and Y values. The extreme value cursor automatically checks and marks the maximum and minimum values of the signal curve. The simple harmonic cursor is used to mark information about the fundamental frequency and its harmonic frequency components. Cursor addition and deletion operations can be performed in the following two ways:

- In the non-signaling area of the window, click the right mouse button.
- In any area of the window, click Ctrl + right mouse button.

3 Test Operation

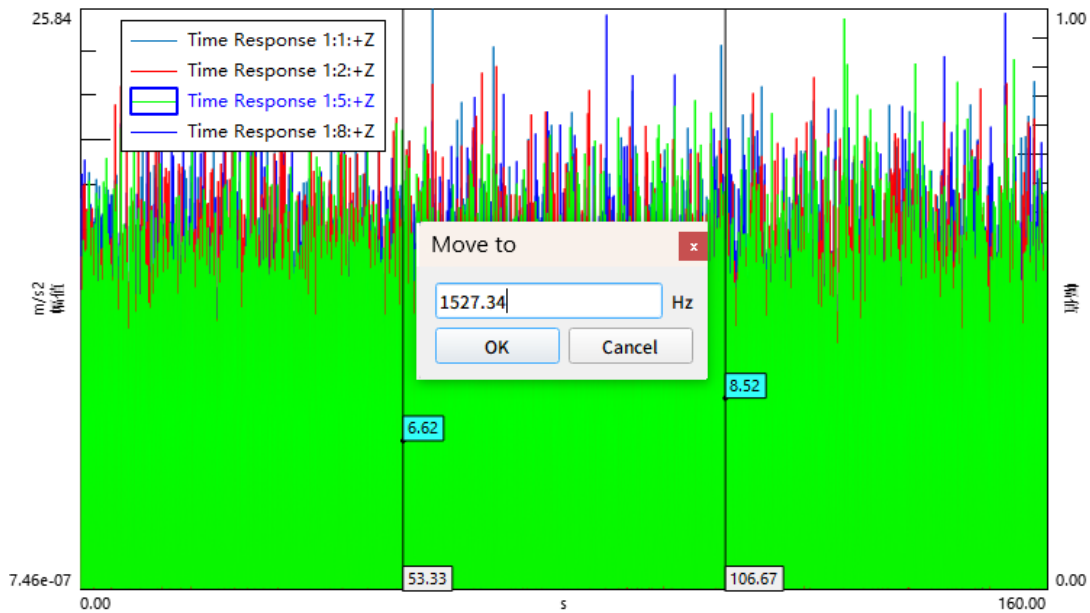


■ Adding and Removing Cursors in the Window



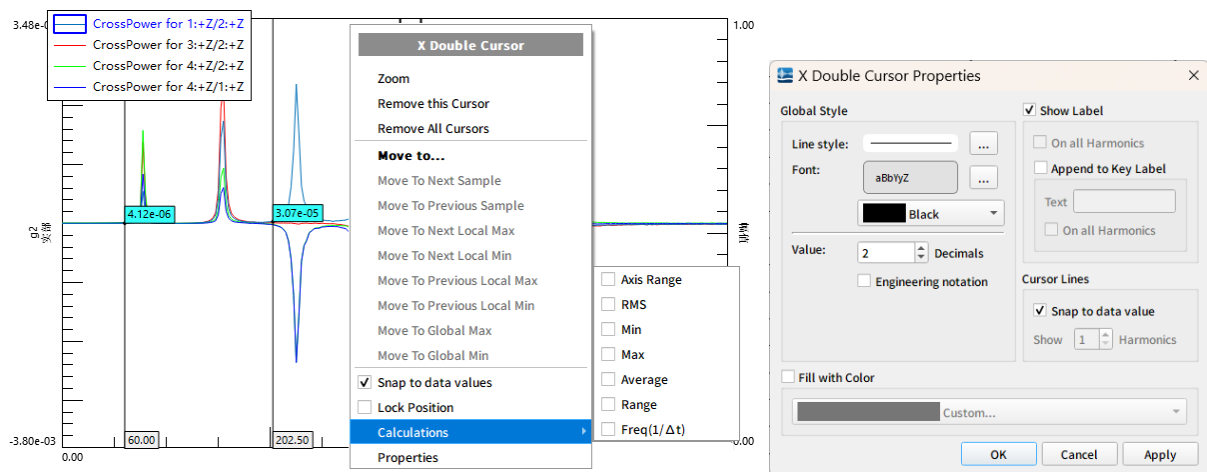
■ Single Cursor, Double Cursor, Simple Harmonic Cursor and Extreme Value Cursor

The cursor can be moved roughly over a wide range with the mouse, or precisely by double-clicking on the cursor with the left mouse button.



■ Precise movement of the cursor

Select the cursor and then right-click on the mouse, you can set the cursor properties. (Dual Cursor supports calculation of RMS, Max, Min, Average etc. between two cursors).

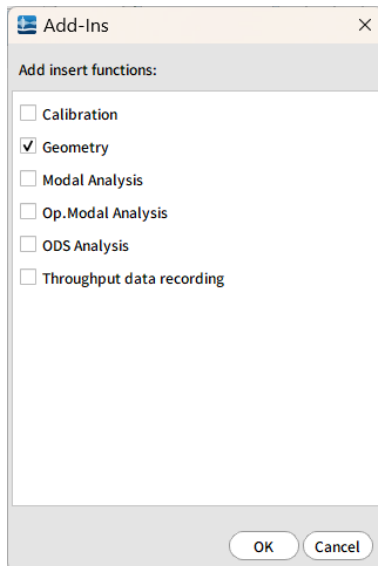


■ Cursor Properties

3 Test Operation

[4] Geometry

In the Tools menu - Insert Module, you can add different modules. After ticking different modules, the corresponding module page will appear in the flow bar. If there is no geometry module within the entered function, you can call out the geometry module by the above operation.



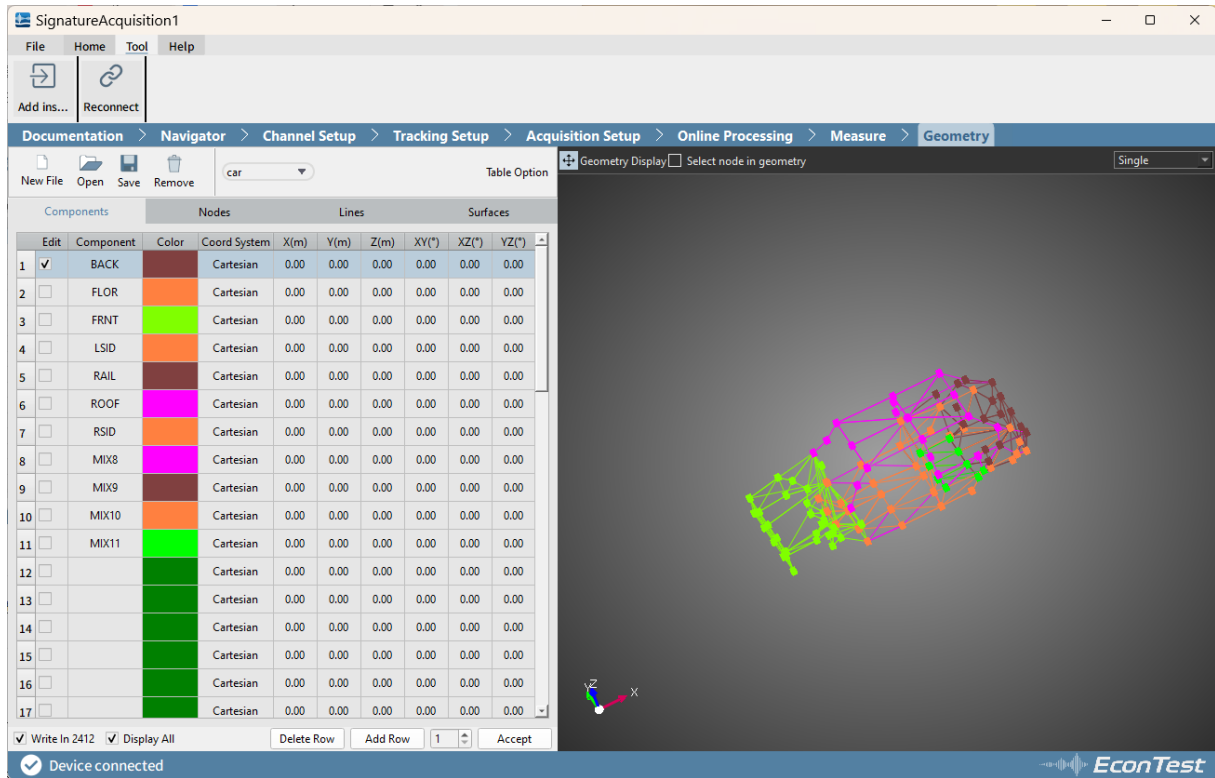
■ Insert Module



Please read the contents of the configuration of the product you have purchased. Functions not purchased will not be available. If you need a function or feature that is not available in your configuration, please contact your seller or ECON.

The Geometry page consists of three sections: the file management area, the geometry preview area and the coordinates area. Geometry models can be created, stored, imported, and deleted through the file management area, and imported geometry models can be switched through a drop-down list. The geometry worksheets in the coordinates area include:

- ✧ Components: Component Worksheet, Creating Components.
- ✧ Nodes: node worksheet to create nodes.
- ✧ Line: Line worksheet to create lines.
- ✧ Plane: Plane worksheet to create a plane.



■ Geometry



If you want to save the information of the faces in the model, you need to tick 'Save 2412' (default ticked).

1. Create components

Geometric coordinates can be entered in three ways: right-angled (Cartesian), cylindrical and spherical coordinates. You can select different coordinate input methods in the component worksheet. To create a component, proceed as follows:

1. Define component names: the structure can be divided into different components to facilitate modification of the model.
2. Define the corresponding component color: you can distinguish different components.
3. Define the relative position between components.
4. Click Accept to accept the component information.



Components can only be created after a model has been created by clicking the 'New' button. You need to create components before creating points, lines and surfaces.

If you are not satisfied with the points, lines and surfaces created, you can select the corresponding serial number cell in the list and click 'Delete Row'.

3 Test Operation

After editing the information of component/point/line/face, you should click 'Accept' button, if you don't click 'Accept', all the modification will be invalid.

Components			Nodes		Lines			Surfaces		
Edit	Component	Color	Coord System	X(m)	Y(m)	Z(m)	XY(°)	XZ(°)	YZ(°)	
1	☒ BACK		Cartesian	0.00	0.00	0.00	0.00	0.00	0.00	
2	☐ FLOR		Cylindrical	0.00	0.00	0.00	0.00	0.00	0.00	
3	☐ FRNT		Spherical	0.00	0.00	0.00	0.00	0.00	0.00	
4	☐ LSID		Cartesian	0.00	0.00	0.00	0.00	0.00	0.00	
5	☐ RAIL		Cartesian	0.00	0.00	0.00	0.00	0.00	0.00	
6	☐ ROOF		Cartesian	0.00	0.00	0.00	0.00	0.00	0.00	
7	☐ RSID		Cartesian	0.00	0.00	0.00	0.00	0.00	0.00	
8	☐ MIX8		Cartesian	0.00	0.00	0.00	0.00	0.00	0.00	
9	☐ MIX9		Cartesian	0.00	0.00	0.00	0.00	0.00	0.00	
10	☐ MIX10		Cartesian	0.00	0.00	0.00	0.00	0.00	0.00	
11	☐ MIX11		Cartesian	0.00	0.00	0.00	0.00	0.00	0.00	
12	☐		Cartesian	0.00	0.00	0.00	0.00	0.00	0.00	

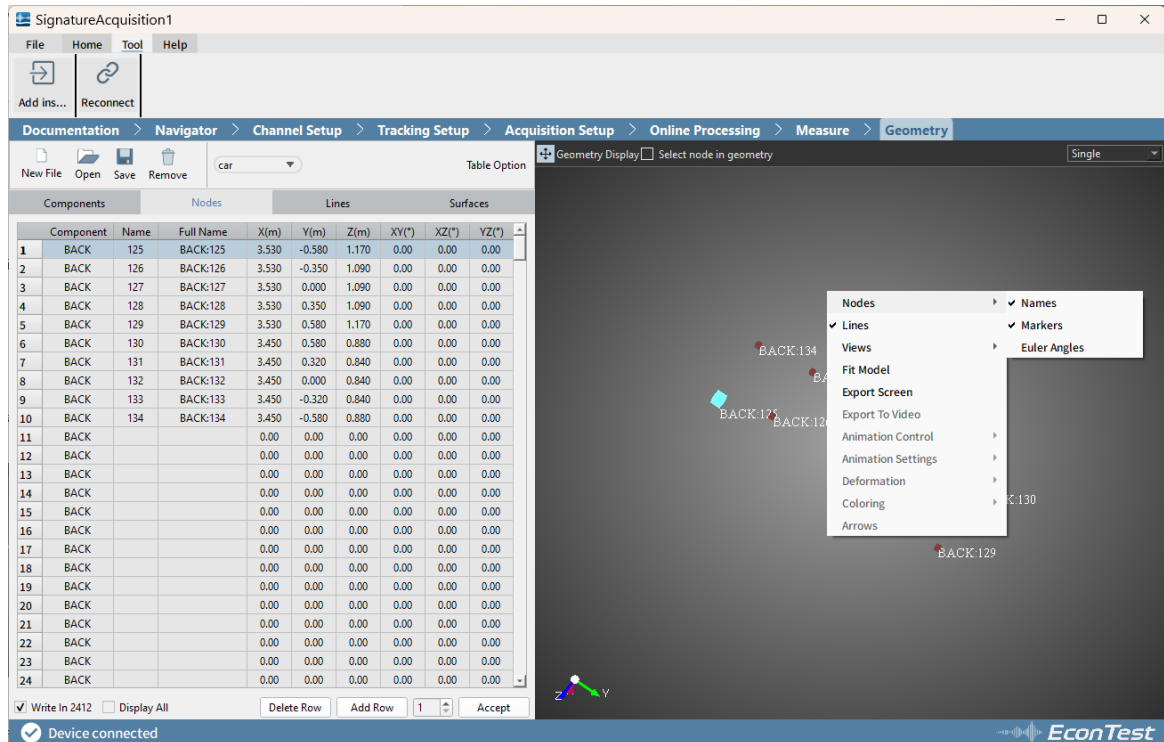
■ Component worksheet

2. Create nodes

After completing the definition of the components, you can start creating the geometry. Start by creating the nodes. The steps for creating nodes are as follows:

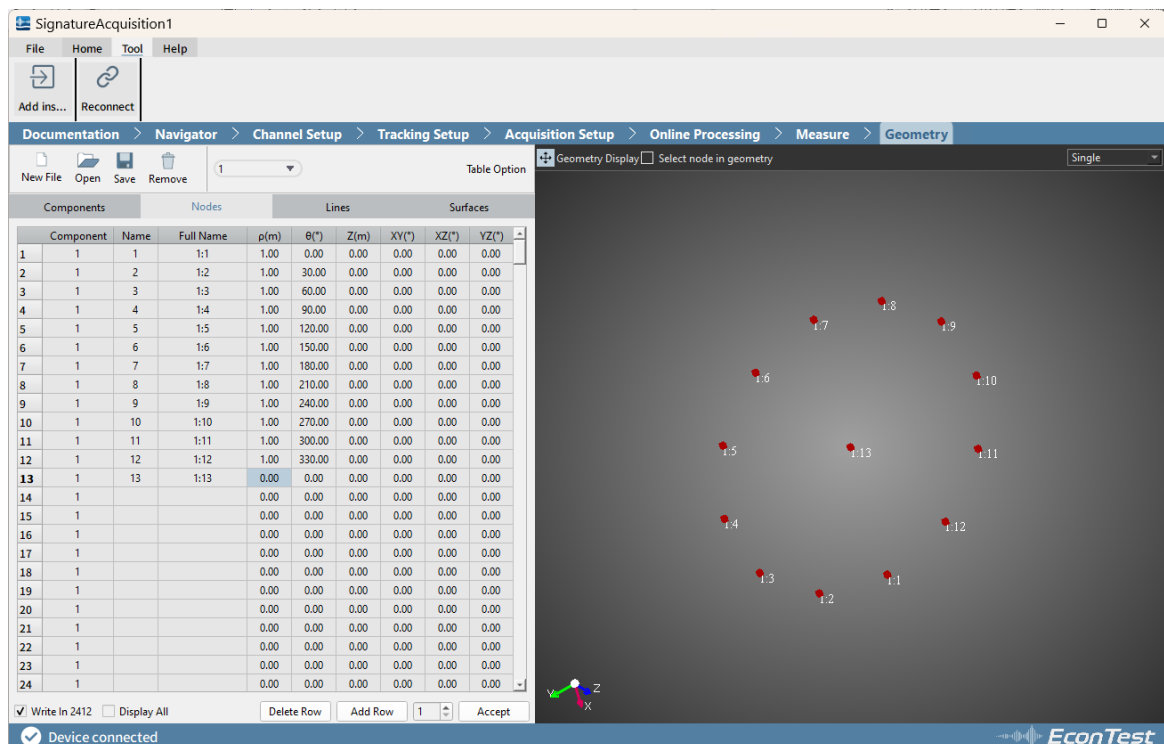
1. Select the component for which you want to define a node (the component's editing state is ☒).
2. Define the node name.
3. Enter the node coordinates.
4. Click Accept to accept the node information.

Completing the above will display the created nodes in the geometry preview area on the right. By clicking the right mouse button in the geometry preview area and selecting the Points option, you can change the way the different nodes are displayed: Name, Marker, Euler Angle.



■ Node worksheet

To create a circular structure, such as a disc, modify the coordinate system in the component to the cylindrical coordinate system 'Cylindrical', then switch to the Points worksheet, define the radius, angle and height, and quickly create a disc model using the shortcut Fill Down.

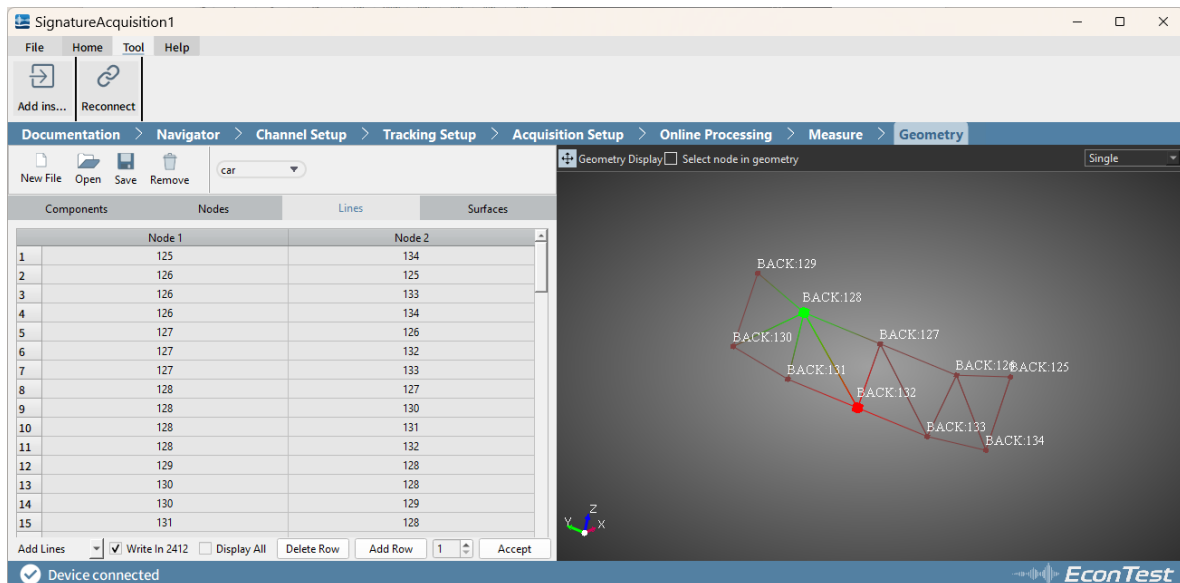


■ Node worksheet

3 Test Operation

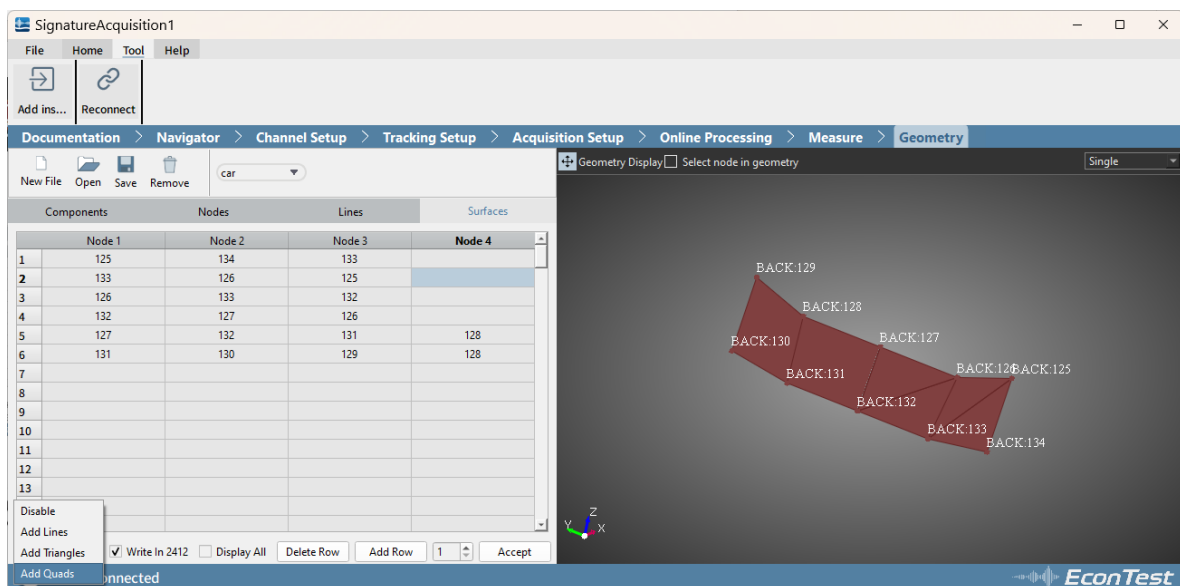
3. Create Lines and Surfaces

You can create a line by connecting the created nodes. Steps to create a line: Select the Line worksheet and connect two nodes in turn. After connecting each two nodes, click the Enter button to complete the line.



■ Line worksheet

To display the geometric model more realistically, faces can also be created on top of the nodes. Select Create Triangle plane or Quadrilateral plane in the lower left corner of the interface, and then select three or four points in turn to build the corresponding face.



■ Surface worksheet



Geometry worksheet supports Ctrl+C, Ctrl+V shortcut copy and paste methods, and also supports importing from Excel files.

In the worksheet, after selecting two rows, click and hold on the left mouse button, then drag from top to bottom to fill down (increment, decrement, fill, etc.).

3 Test Operation

[5] Mouse and keyboard operation

Windows display		
Panning	Y direction	Shift+Left Mouse Button Vertical Drag
		Mouse over Y-axis, Shift+Mouse Scroll Wheel
	X direction	Shift+Left Mouse Button Horizontal Drag
		Mouse over X-axis, Shift + Mouse Scroll Wheel
Graphics zoom	Y direction	Left mouse button to drag vertically
	X direction	Left mouse button to drag horizontally
	XY direction	Left mouse button drag diagonally
		Ctrl+Mouse Scroll Wheel
Withdrawal of zoom		Backspace
Reset Zoom		` (upper left corner of keyboard)
Cancel zoom		Esc
Open window right-click menu		Right mouse button (non-signal display area of the window) Ctrl+right mouse button (any area of the window)
Setting the coordinate fixing range		Double-click on the axis with the left mouse button
Moving cursor		Double-click on the cursor with the left mouse button
Geometrical modelling		
Copy		Ctrl+C
Paste		Ctrl+V
Confirmation of line/plane creation		Enter
Fill down		Select two rows, then click and hold the left mouse button to drag from top to bottom

4

Test and Data Acquisition

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4 Test and Data Acquisition

[1] Signal Feature Acquisition

Connect the EconTest software to the device correctly according to 1-[6]. In the function selection interface, double click the Signal Characteristics Test module to enter the function. The working interface of Signal Characteristics Test includes:

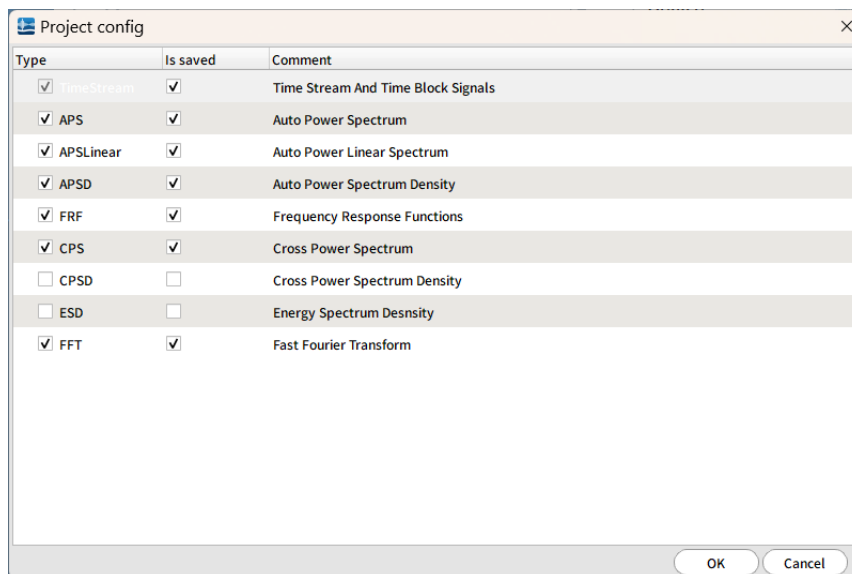
- ✧ Documentation: Used to record memos of the test (test pictures, test descriptions, and other text or pictures that need to be recorded) as an auxiliary record of the test work.
- ✧ Navigation: For post-processing time-domain data selection, file search and display of test results, etc.
- ✧ Channel Setup: Used to define all the parameters such as sensor, range, coupling method, sensitivity, etc. connected to the input channel.
- ✧ Tracking Setup: Set the trigger type for test start.
- ✧ Acquisition Setup: Set sampling parameters, add windows and other operations.
- ✧ Online processing: Selects the signals to be processed online.
- ✧ Measure: Conduct a formal test.

See 3-[2], 3-[3] for details on the operation of the document and data navigation pages.

Before entering the signal Feature Acquisition, you need to select the signal to be analyzed in

Signal Type

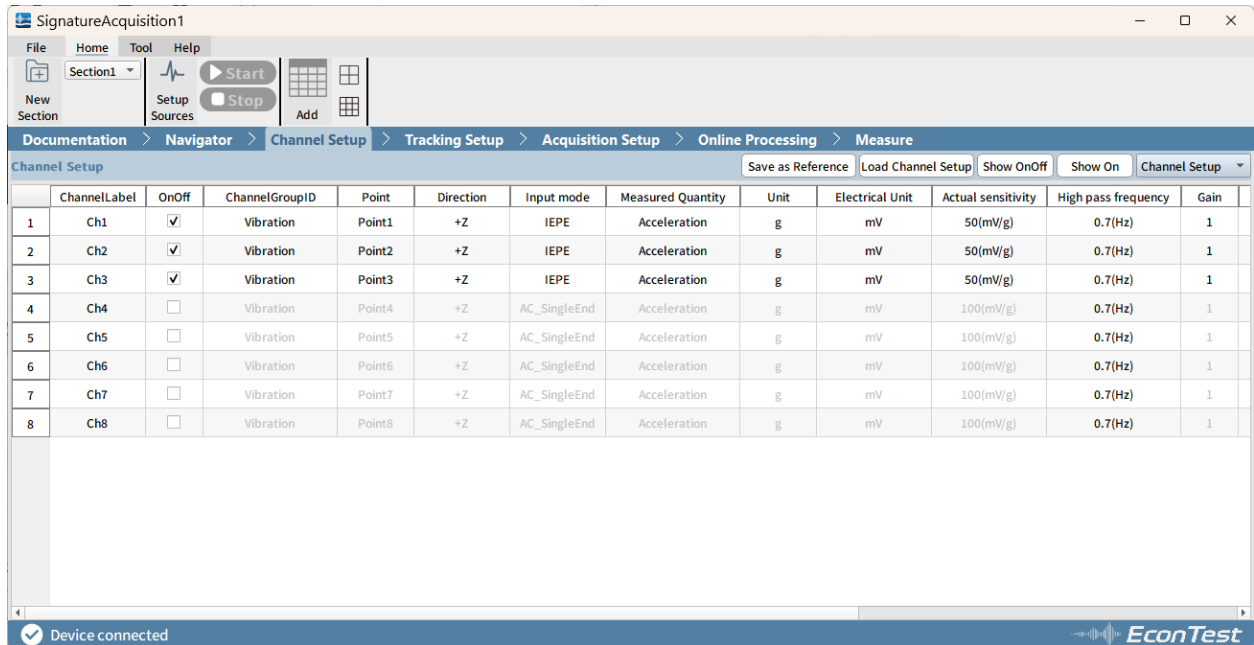
of the function selection screen.



■ Project config

(A)Channel Setup

Click 'Channel Setup' in the flow bar to switch to the channel setting page, and set the sensitivity, coupling method and sensor type of the sensor correctly with reference to the sensor manual.



■ Channel Setup

It can also load channel settings from previously stored projects, reference channels. Click

Load Channel Setup

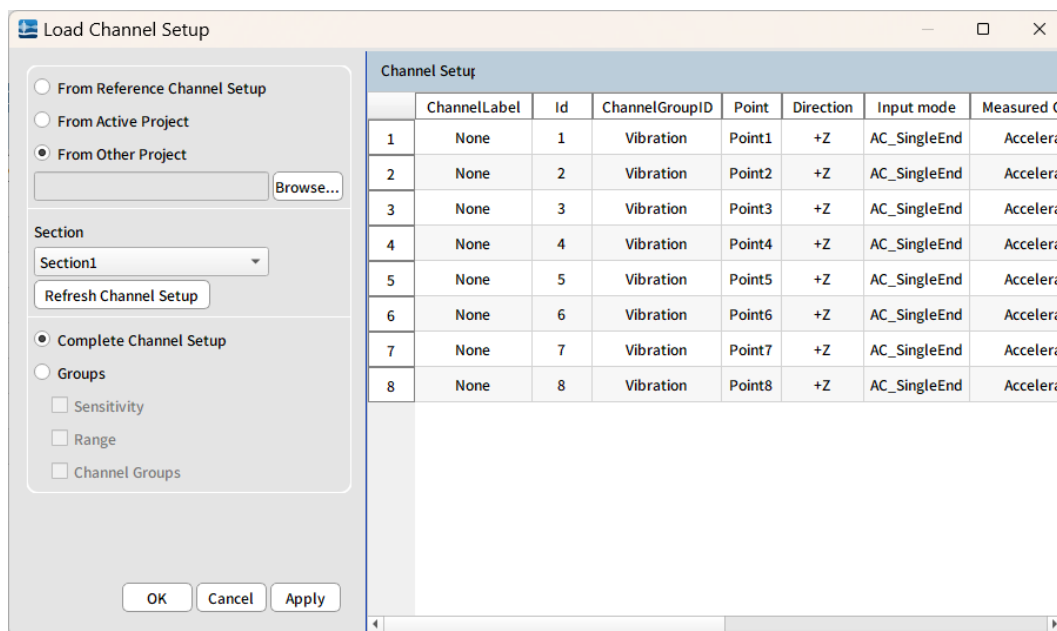
, Select 'From other projects' or 'From reference channel settings', then click

Refresh Channel Setup

to refresh the right channel settings page. After selecting a channel in the

'Channel Label' column, click **Apply** to apply it to the corresponding channel.

4 Test and Data Acquisition



■ Load Channel Setup



Charge sensors need to be converted to a voltage signal by a charge amplifier before they can be connected to the input channel of the Analyzer. In this case, the sensitivity of the input channel = Charge Amplifier Output Gain / Sensitivity Amplification Factor, where, Sensitivity Amplification System = Sensor Sensitivity set in the Charge Amplifier / Actual Sensor Sensitivity.

(B)Tracking Setup

Click 'Tracking Setup' in the flow bar to switch to the tracking settings page to set the tracking signal acquisition method and parameters.

1. Tracking settings

Tracking Settings

☐ Triggered start More...

☐ Throughput prestart times s

☐ Triggered stop More...

☐ Throughput poststop times s

Measurement mode: Tracked

Mode: Free run

Duration: s

Overlap: %

■ Tracking settings

The tracking settings work only on the measurement page. After set on this page, they will be synchronized to the  **Previous Settings** of the measurement page.

2. Signal preview

The Signal Preview is located on the left side of the main test function screen. It lists all the functions for this test. The signal type is selected at the top and the channel signal is selected at the bottom. After the signal is selected, it can be displayed by dragging it into the window display area with the mouse.

Overview

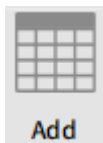
- TimeStream
- TimeBlock
- FFT
- APS
- CPS
- FRF
- APLinear
- APSD

Detail

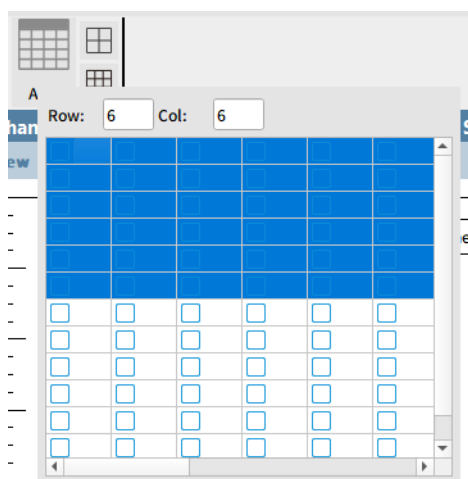
- ~\ Point1+Z(Ch1)
- ~\ Point2+Z(Ch2)
- ~\ Point3+Z(Ch3)
- ~\ Point4+Z(Ch4)
- ~\ Point5+Z(Ch5)
- ~\ Point6+Z(Ch6)
- ~\ Point7+Z(Ch7)
- ~\ Point8+Z(Ch8)

■ Signal preview

4 Test and Data Acquisition



Option **Add** of the main menu allows you to create multiple signal display panels. The number of rows/columns can be customized, and 2*2 and 3*3 panes can also be created using the  and  shortcuts.



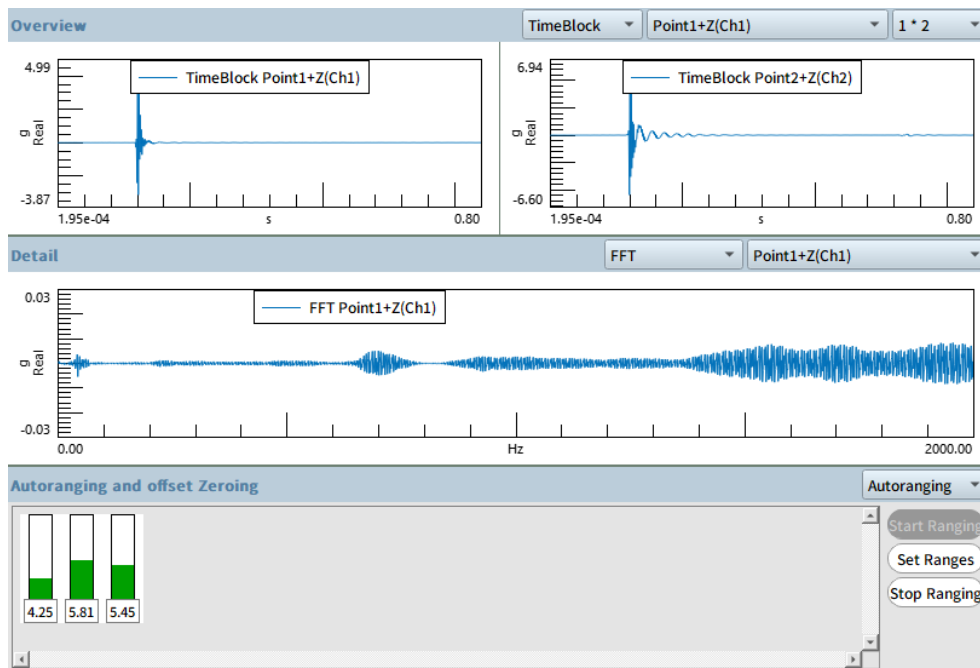
- Add signal display pane

3. Auto ranging and offset zeroing

a. Auto ranging

Automatically sets the channel ranges. The lower bar graph represents the size of the existing signal and shows different color statuses depending on the percentage of the channel's existing signal strength to each channel's range. The procedure is as follows:

1. Run state, switch to **Autoranging**. Click **Start Ranging**, the system starts to measure the signal of each open channel, and then continuously records the peak value appearing in the signal.
2. Click **Set Ranges**, the system selects an appropriate range based on the detected peak and re-runs to take effect.
3. Click **Stop Ranging**, exit Auto ranging.



■ Auto ranging

b. Bias to zero

Automatically tests the bias of the entire system and zeroes the bias. It is recommended to perform a bias zeroing when the test system is connected and the system under test is not excited. The procedure is as follows:

1. Run state, switch to **Offset Zeroing**. Click **Start**, the system starts to measure the signal of each open channel, and then continuously records the average value of the signal.
2. Click **Set Offset**, the system is applied to the corresponding input channel based on the detected average value.
3. Click **Stop**, exit bias to zero.

4 Test and Data Acquisition

(C)Acquisition Setup

Click 'Acquisition Settings' on the flow bar to switch to the Acquisition Settings page to set the sampling parameters and windowing parameters.



Fan control works only for MI-72XX series instruments.

1. Acquisition parameters

Acquisition Parameter

Bandwidth:	2000	Hz
Spectral lines:	1600	
Resolution:	1.25	Hz
Acquisition time:	0.8	s
Mode:	Free run	More

■ Acquisition parameters

Set the sampling parameters (bandwidth and number of spectral lines). Theoretically, according to the sampling theorem, as long as the sampling frequency is greater than 2.56 times the frequency of the measured signal, a correct frequency domain analysis can be obtained. For the same segment of the measurement signal, if the number of sampling points (analysis spectral lines) is fixed, then the sampling frequency (analysis bandwidth) should be taken appropriately low to obtain a higher frequency resolution, but it will reduce the fidelity of the time domain waveform. Resolution $\Delta f = \frac{\text{bandwidth}}{\text{number of spectral lines}}$. Block time $T = \frac{\text{number of spectral lines}}{\text{bandwidth}}$.

When you select the trigger mode, you can set the trigger parameters in

[More](#)

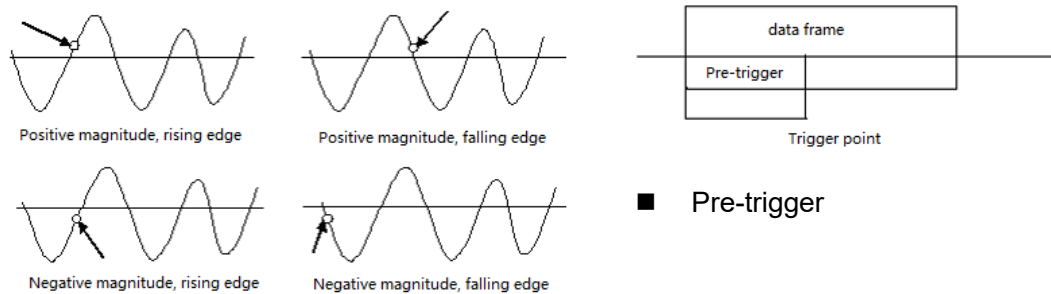
Trigger Setting

Trigger Type	Level-Time Channel
Trigger Channel:	Ch1-Point1
Trigger Level:	1 g
Trigger Slope:	Up
Pretrigger:	0 s

[Close](#)

■ Trigger parameter setting

The trigger magnitude and trigger edge constitute the trigger event. The 'pre-trigger' defines the timing of the pre-trigger, which is useful for shock analysis to ensure that the start of the shock pulse is captured.



■ Pre-trigger

■ Four trigger conditions

2. Window functions

When digitising signals, it is not possible to operate on signals of infinite length, but to truncate the original signal and take a section of it in a finite period of time to be processed, called adding a window. The meaning of 'window' is to be able to observe a part of the original signal through the window, and the other parts of the original signal outside the window are regarded as zero. Signal truncation will inevitably produce energy leakage, leakage and window function spectrum on both sides of the side of the flap, if the height of the side of the flap tends to zero, so that the energy is relatively concentrated in the main flap, can be relatively close to the spectrum without truncation, for this reason, can be used in a different time domain window function to truncate the signal.

The choice of window function should consider the nature of the measured signal and the purpose of measurement. If only required to accurately read out the frequency of the main petal, without considering the amplitude accuracy, the main petal width can be selected to facilitate the resolution of the rectangular window is relatively narrow, such as the measurement of the object's self-oscillating frequency, etc.; if the analysis of narrow-band signals, and there is a strong interference noise, you should choose to use the side of the petal with the amplitude of the window function, such as the Hanning window, the triangular window, etc., for the exponential decay over time, the signal, you can use the exponential window to improve the signal-to-noise ratio. The functional characteristics of typical window functions are as follows:

4 Test and Data Acquisition

Window Type	Best-fit signals	Frequency resolutions	Spectral leakage	Magnitude accuracy
Rectangle	Instantaneous and synchronised sampling	Best	Bad	Bad
Hanning	Random	Good	Good	Normal
Hamming	Random	Good	Normal	Normal
Barlett	Random	Good	Normal	Normal
Welch	Random	Good	Good	Normal
Tukey	Random	Good	Bad	Bad
Blackman	Random or mixed	Bad	Best	Good
Flat-top	Sine	Bad	Bad	Best
Kaiser-bessel	Random	Normal	Good	Good

(D)Online processing

Click 'Online Processing' on the toolbar to switch to the online processing page and set the online analysis function.

Number of spectral lines cleared

Used to remove the results from the first few frequency points of the spectrum results. Generally these points are close to 0 Hz and sometimes there is a problem of interference from too high a direct flow. You can use this function to filter out the effect of the results of the first few points.

Reference estimate

Sets the addition window and estimation method for the reference channel. Used to do the selection of the frequency response function estimation method. H1, H2, Hv can be selected and set when the reference channel exists, see 4-[2] Tracking Setup for details.

The screenshot shows the 'Vibration' tab in a software interface. It contains two main sections for configuration:

- Windowing:** A dropdown menu set to 'Uniform' with a 'More...' button next to it.
- First bins to clear:** A text input field containing the value '0'.
- Reference window:** A dropdown menu set to 'Uniform' with a 'More...' button next to it.
- Estimation mode:** A dropdown menu set to 'H1'.

■ Online processing settings

(E)Measure

Click on 'Measurement' in the flow bar to switch to the measurement page for formal testing and data logging.

1. Previous settings

Setting up 'Tracking Settings' and 'Acquisition Setup'

Tracked

The signal data block for each channel is the result of processing after tracking. Tracking Mode-Time: You can set the length of the tracking time for the test run and the interval time for calculating the results, i.e., one result at intervals on the waterfall graph.

Manual

Acquisition of data blocks is started and stopped by manual control and the spectrum obtained is not averaged.

Stationary

The signal data block of each channel is the result of processing after averaging, and does not change with the change of other parameters, and it is considered that the measured object is in a stable state, and a result after averaging is obtained.

Steady State Mode-Time: Signals are acquired for a fixed period of time.

The screenshot shows a 'Previous Settings' dialog box with two main sections: 'Tracking Settings' and 'Acquisition Setup'.

Tracking Settings:

- ☐ Triggered start (More... button)
- ☐ Throughput prestart times: 0.000 s
- ☐ Triggered stop (More... button)
- ☐ Throughput poststop times: 0.000 s
- Measurement mode: Tracked (dropdown)
- Mode: Free run (dropdown)
- Duration: 30 s
- Overlap: 0 %

Acquisition Setup:

- Bandwidth: 2000 Hz (dropdown)
- Spectral lines: 1600 (dropdown)
- Resolution: 1.25 Hz (dropdown)
- Acquisition time: 0.8 s
- Mode: Trigger (dropdown) (More button)

Other Setting:

- Fan Control: Lower speed (dropdown)

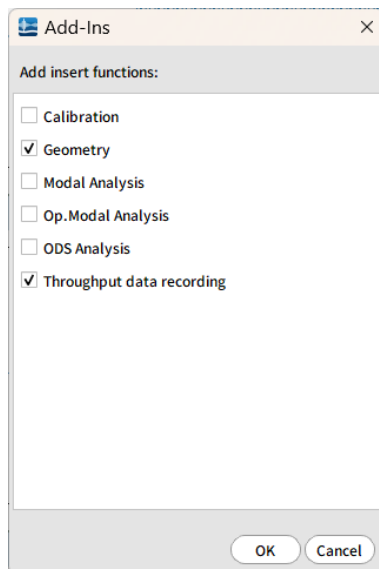
A 'Close' button is located at the bottom right of the dialog box.

■ Previous settings

4 Test and Data Acquisition

2. Throughput data recording

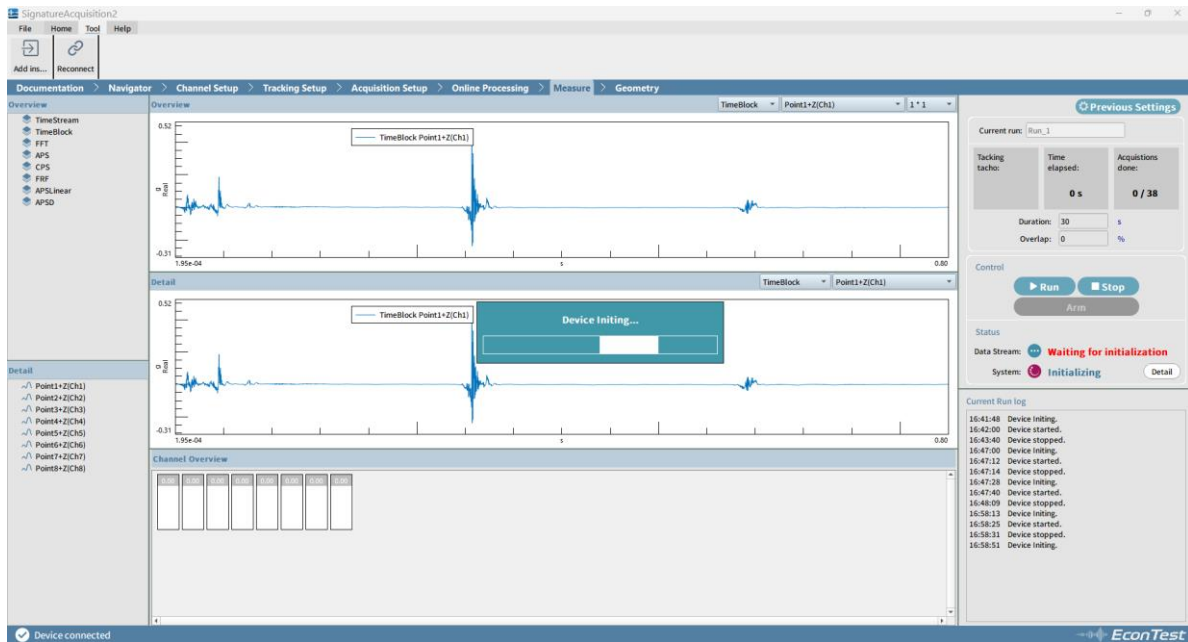
In the Tools menu - Insert function, you can add a module for Throughput data recording.



■ Insert module

By ticking the ‘Save throughput’ option, the original time domain record data will be saved in the operation status, and the operation steps are as follows:

1. Click , wait for the device initialization to complete, and allow the system to enter the oscillation state.
2. Click , start the test acquisition. After checking ‘Save pass data’, the whole time-domain signal will be recorded during the acquisition process, and the acquisition will stop automatically after completing the set number of frames.



■ Device initialization

Current run:

Tacking tacho:	Time elapsed:	Acquisitions done:
	30s	38 / 38

Duration: s
Overlap: %
☒ Save throughput

Control

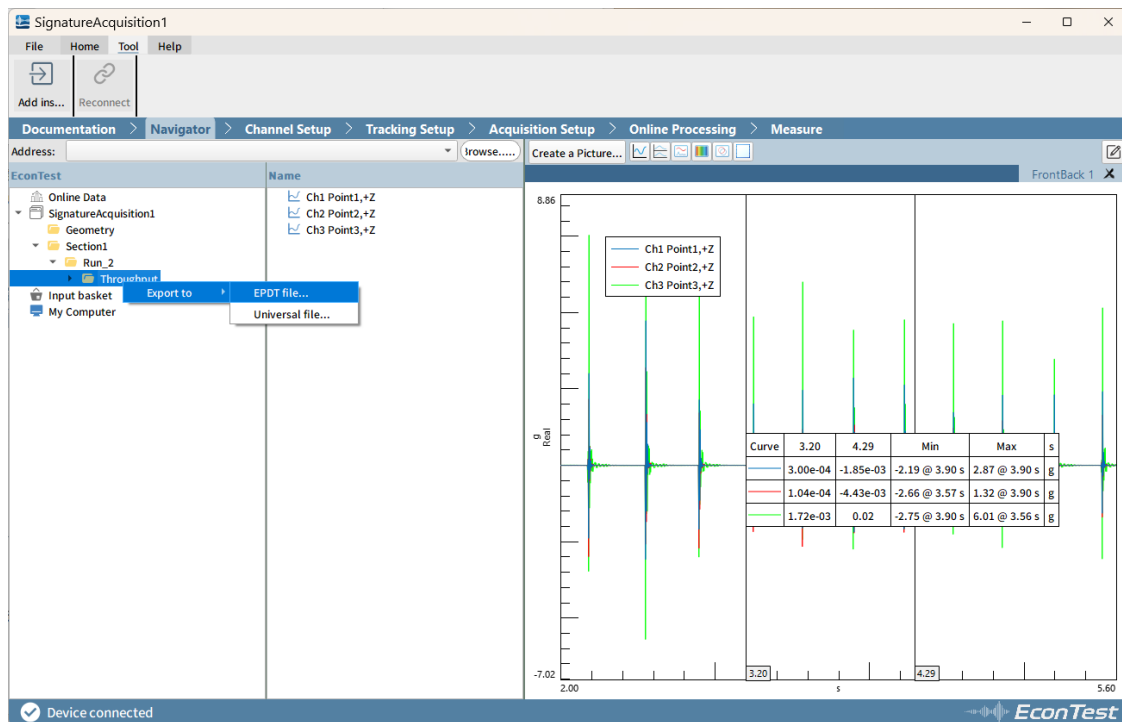
Status

Data Stream: ☒ Normal end
System: ☒ Normal end

■ Acquisition complete

4 Test and Data Acquisition

- After the collection is completed, go back to the 'Data Navigation' page, select the data in the project folder, you can view the saved collection data in the window, select the data and click the right button of the mouse, you can export the data.



■ View throughput data



If you click 'Stop' while the system is running (acquiring data), the previous data will not be saved, and you will have to wait for the acquisition to complete.

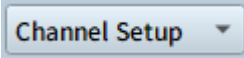
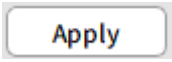
[2] Impact Testing

In the function selection interface, double click the Impact Testing to enter the function. The interface for the Impact Testing includes:

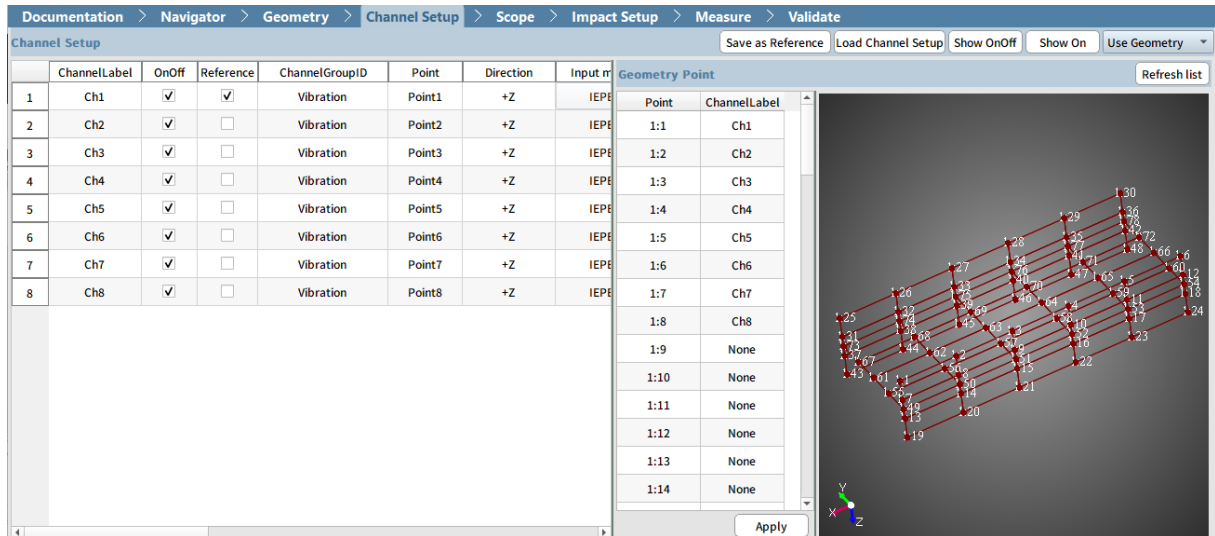
- ✧ Documentation: Used to record memos of the test (test pictures, test descriptions, and other text or pictures that need to be recorded) as an auxiliary record of the test work.
- ✧ Navigation: for post-processing time-domain data selection, file search and display of test results, etc.
- ✧ Geometry: Creates a geometric model of the structure under test.
- ✧ Channel Setup: Used to define all the parameters such as sensor, range, coupling method, sensitivity, etc. connected to the input channel.
- ✧ Scope: Determine the range of each channel.
- ✧ Impact Setup: Set the trigger, bandwidth, add window, and drive point selection.
- ✧ Measure: conducting a formal test.
- ✧ Validation: See if there are any missing measurement points.

(A)Channel Setup

Click 'Channel Setup' in the flow bar to switch to the channel setting page. Set the sensitivity, coupling mode and sensor type of the sensor correctly according to the instructions of the sensor. For modal test, it is necessary to associate the channel with the established geometrical model, and the association steps are as follows:

1. Select 'Use Geometry' from the  drop-down menu in the upper right corner.
2. Click , and select the channel corresponding to the measurement point.
3. Click  button to make the association.

4 Test and Data Acquisition



■ Use Geometry

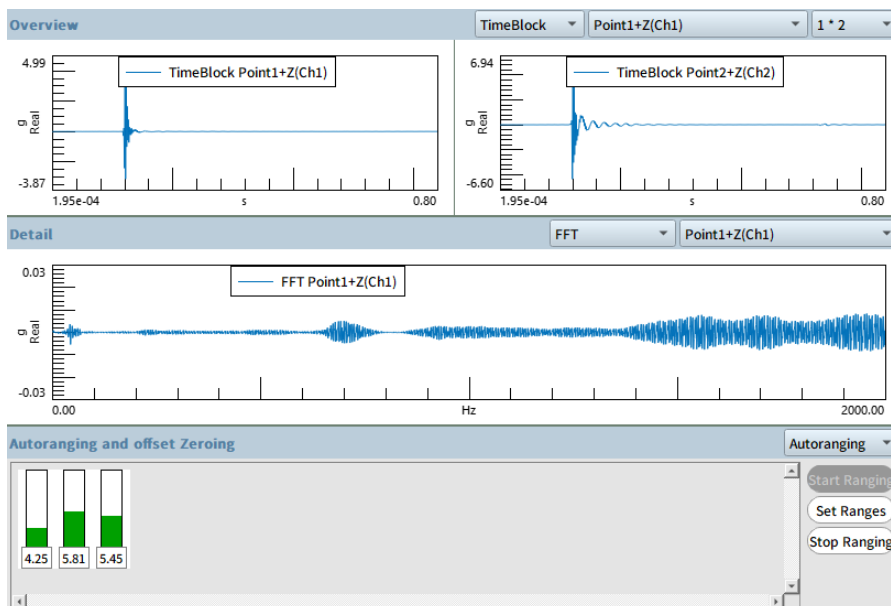
Before associating geometric model points, you need to create or import a model in the Geometry page.



Channel Settings - Define a reference channel in the 'Reference' column. Generally, the hammer input channel is set as the reference channel. Only one reference channel can be defined for hammer tests.

(B)Scope

Click 'Scope' in the flow bar to switch to the oscilloscope page. Set the appropriate range for the test by hammering the structure under test to get more accurate test results. For details of the operation procedures of auto ranging and bias zeroing, see 4-[1]-(B)-3 'Auto ranging and Zeroing'.



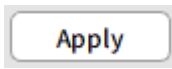
■ Auto ranging

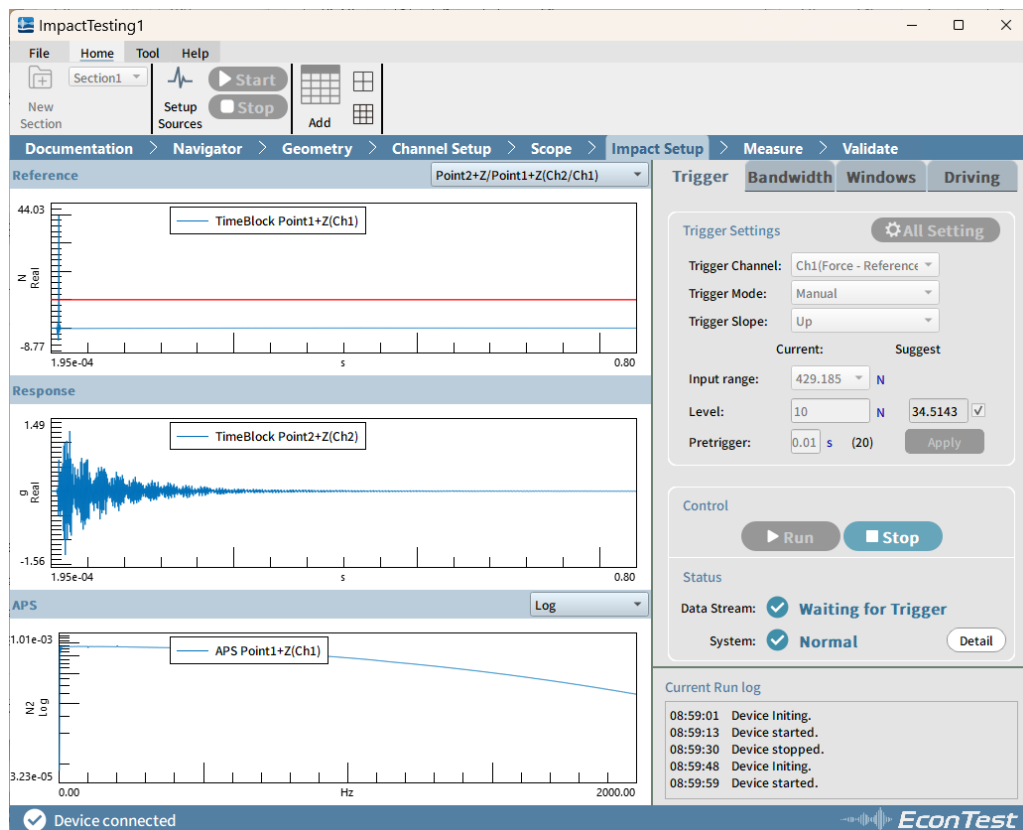
(C)Impact Setup

Click 'Impact Setup' on the flow bar to switch to the Impact Setup. The Impact Setup consists of four sub-pages: Trigger, Bandwidth, Windows, and Driving.

1. Trigger

Trigger is used to set the hammer input trigger level, pre-trigger time, etc. The procedure is as follows:

1. Click  start oscillator.
2. Hammering the structure under test. Try to keep the magnitude of the applied force as close to the same as possible to ensure that the system can determine an appropriate trigger range.
3. Click  stop oscillator.
4. Click  to apply the recommended trigger parameters. If the trigger value set automatically does not meet the requirements, it can be modified manually.



■ Trigger

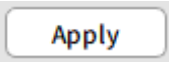
4 Test and Data Acquisition

2. Bandwidth

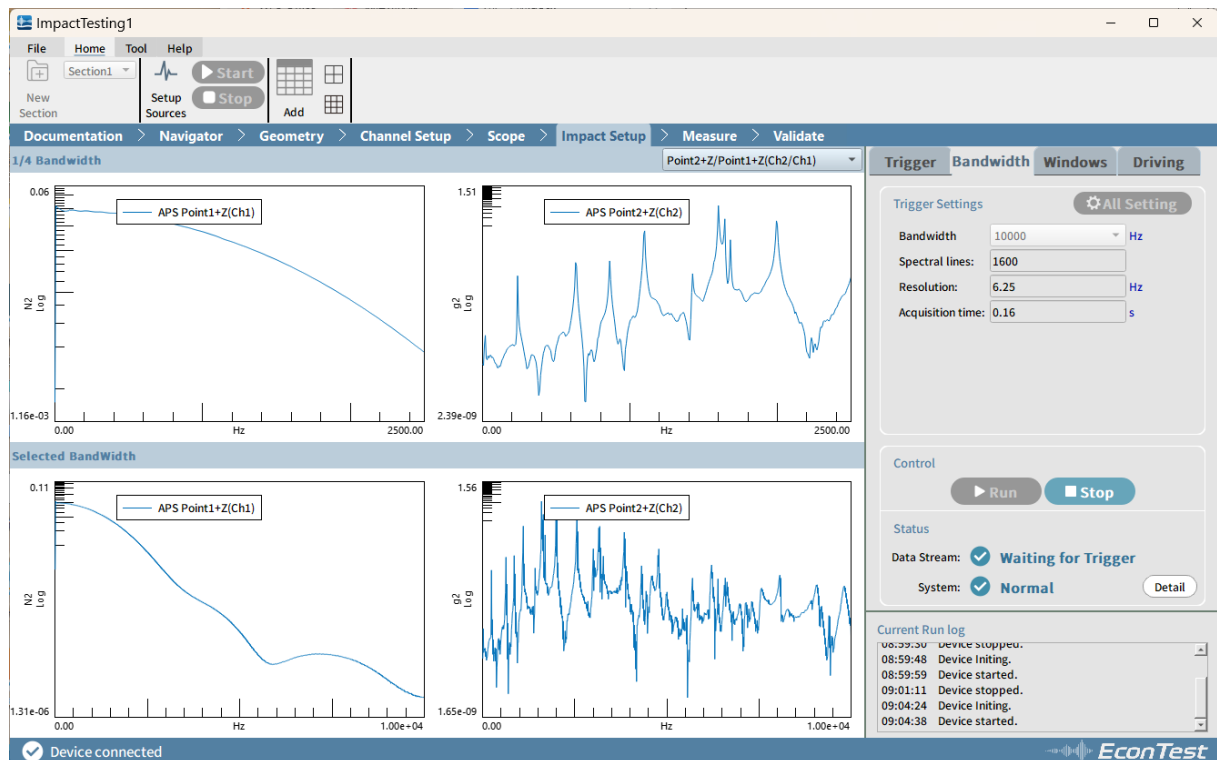
In the bandwidth setting page, you can check whether the bandwidth range and hammer head selection are appropriate. Determine whether the bandwidth selection is appropriate by observing the trend of the spectral distribution of the excitation points in the bandwidth range. Check whether the selection of the hammer head is correct through the frequency domain waveforms of different hammer heads. The operation steps are as follows:

1. Set an analysis bandwidth and click  start oscillator;
2. Hammer the structure under test and observe the frequency response and APS signal displayed in the left window. The left pane displays the frequency response curve and the APS curve for 1/4 times and 1 times the selected bandwidth, respectively.

3. Click  stop oscillator.

Click  to determine the trigger parameters. If the trigger value set automatically does not meet the requirements, it can be modified manually.

The set bandwidth should be able to measure the highest frequency of interest, and when there are closer two-order modes, the set frequency interval should be able to distinguish similar modes.

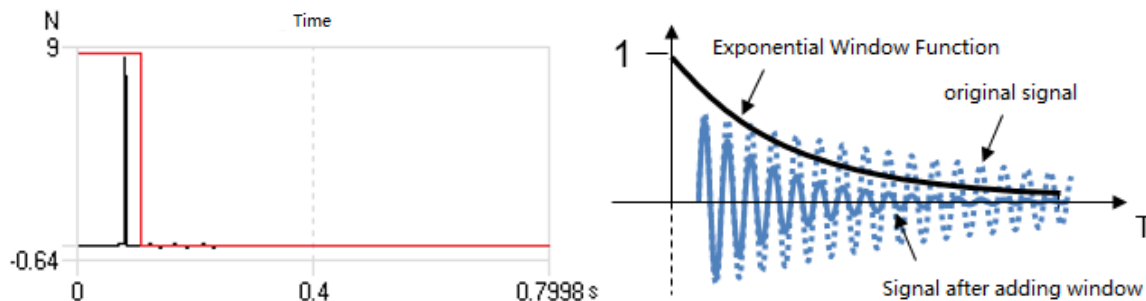


■ Bandwidth

3. Windows

When the signal is digitized, there may be energy leakage, and adding a window to the signal can reduce the impact of energy leakage on the test.

The force hammer excitation signal is usually added to the force window to suppress the noise in the tail section of the sampling period; if the response signal decays to 0 in a sampling block without adding a window (i.e., adding a rectangular window), and for a small damped structure, the response signal is still not able to decay to 0 in a sampling block by increasing the number of spectral lines, then it is necessary to add an exponential window to enable the response to decay faster in a sampling block to reduce the leakage error.



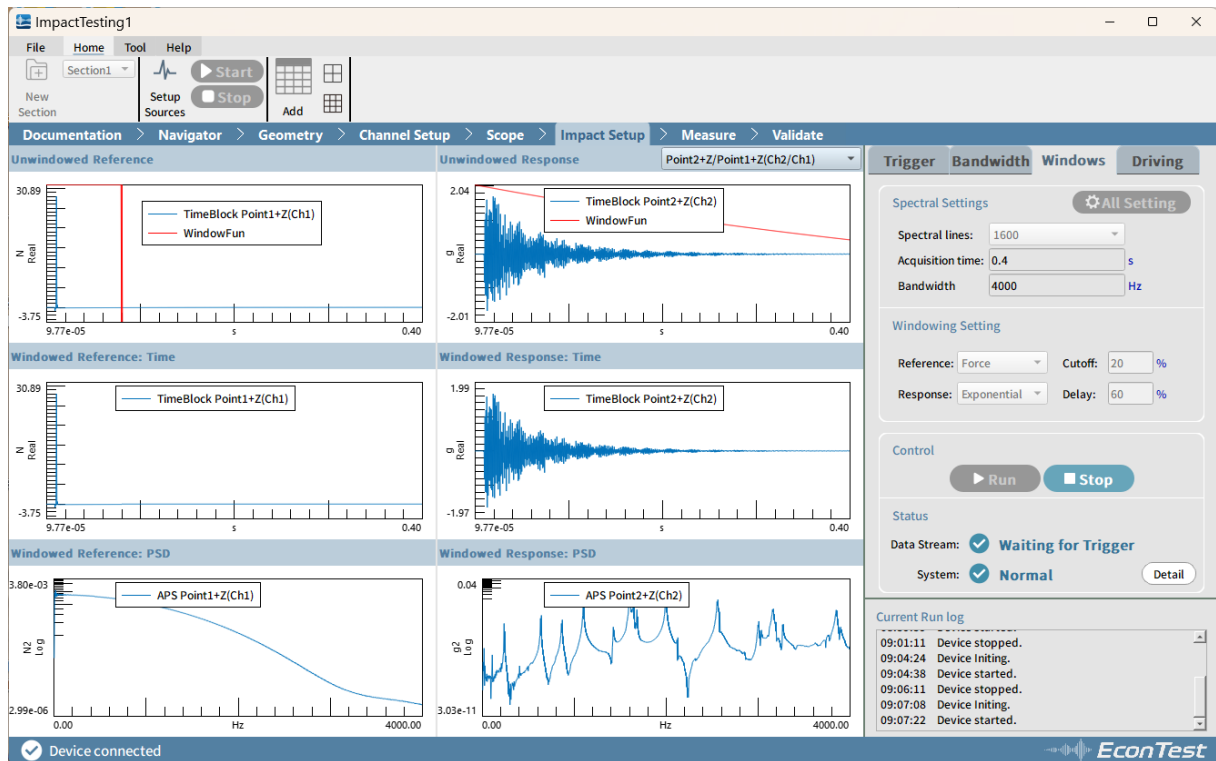
■ Adding window to signals

The steps to set up the adding window are as follows:

1. Set the appropriate number of spectral lines, the reference and the window function of the response.
2. Click  start oscillator.
3. Hammer the structure under test and observe the time domain and APS signals displayed in the left window.
4. Click  stop oscillator.

The left pane displays separate signals for adding a window and not adding a window. Depending on the truncation and delay set, the window displays a WindowFun signal indicating the adding window.

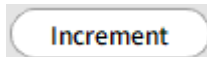
4 Test and Data Acquisition



■ Windows

4. Driving

The driving is used to quickly test a set of drive points, displaying and comparing them together to determine the best excitation point. The drive point setup procedure is as follows:

1. Click  to set the drive point position and direction.
2. Click  start oscillator.
3. The force hammer strikes the selected drive point, the number of strikes made and the number of strikes remaining are displayed on the right side. When you have finished striking, click  to test the next drive point.
4. After completing the acquisition click  stop oscillator.

Auto Move

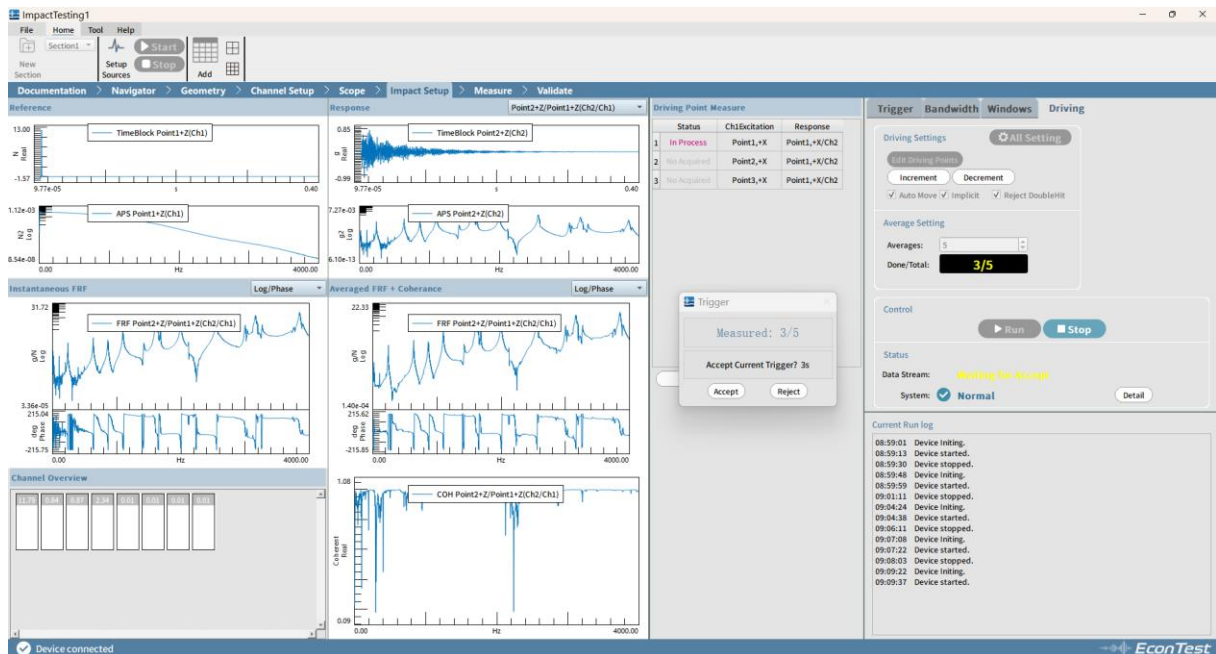
When there are multiple drive points, it automatically switches to the next set of drive points after completing the acquisition of the previous drive point.

Implicit

After the signal reaches the trigger magnitude, the data will be automatically accepted within 5s if it is not manually rejected.

Reject DoubleHit

Automatically rejects data when a double click is detected.

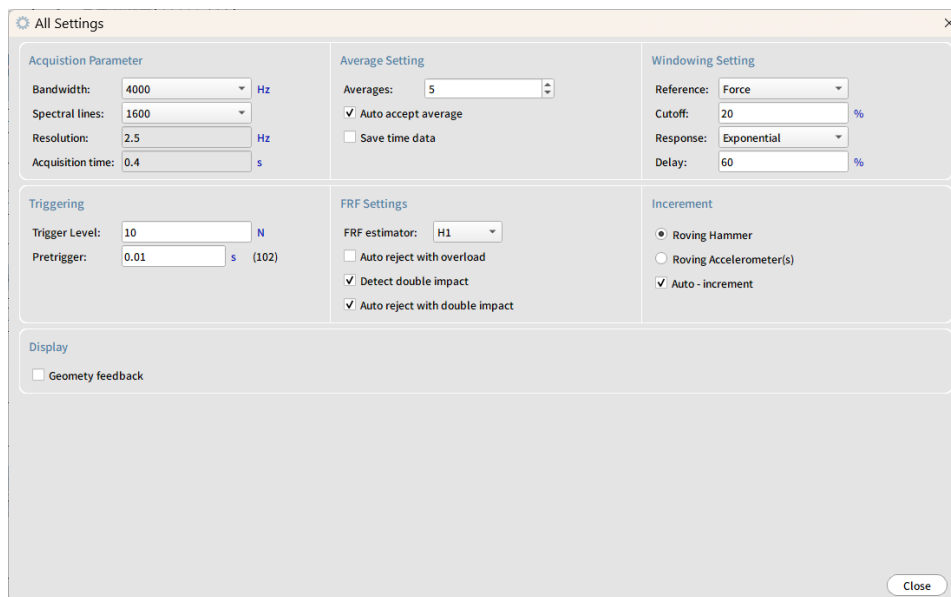


■ Driving

(D)Measure

Click 'Measure' in the flow bar to switch to the measurement page. Any changes made on the previous page will be synchronized here, and you can click  to modify the parameters.

4 Test and Data Acquisition



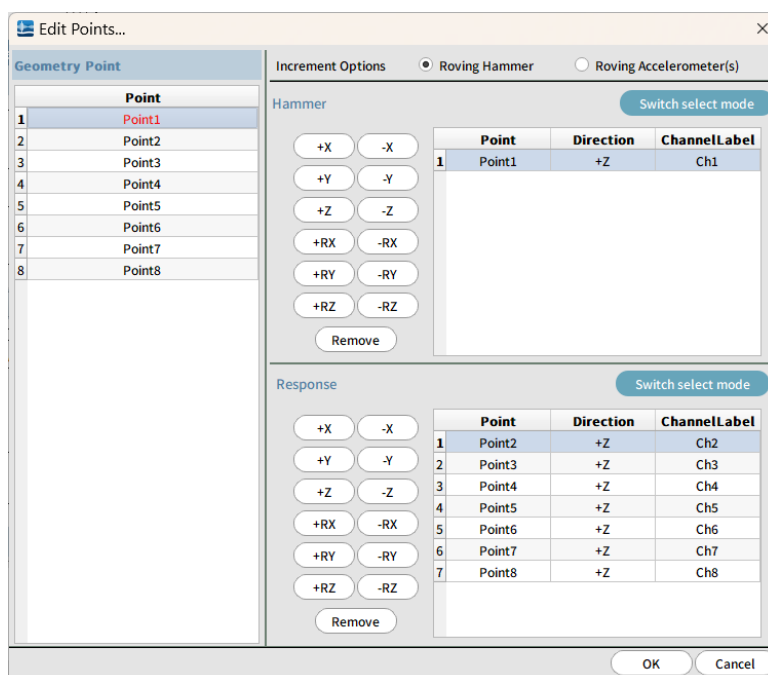
The 'All Settings' dialog box is divided into several sections for configuring the test parameters:

- Acquisition Parameter:** Bandwidth: 4000 Hz, Spectral lines: 1600, Resolution: 2.5 Hz, Acquisition time: 0.4 s.
- Average Setting:** Averages: 5, ☒ Auto accept average, ☐ Save time data.
- Windowing Setting:** Reference: Force, Cutoff: 20 %, Response: Exponential, Delay: 60 %.
- Triggering:** Trigger Level: 10 N, Pretrigger: 0.01 s (102).
- FRF Settings:** FRF estimator: H1, ☐ Auto reject with overload, ☒ Detect double impact, ☒ Auto reject with double impact.
- Increment:** ☒ Roving Hammer, ☐ Roving Accelerometer(s), ☒ Auto - increment.
- Display:** ☐ Geometry feedback.

A 'Close' button is located at the bottom right.

■ All Settings

Click **Edit Points...** to open the Measurement Point Edit dialogue box, where you can choose to move the force hammer or move the transducer. After selecting the model measuring point and direction, it will be added to the test form on the right. Click **Switch select mode** to have the option to add three directions at once.



The 'Edit Points...' dialog box is used for configuring measurement points. It includes a 'Geometry Point' list on the left and two main sections for 'Increment Options' and 'Response'.

Geometry Point

	Point
1	Point1
2	Point2
3	Point3
4	Point4
5	Point5
6	Point6
7	Point7
8	Point8

Increment Options (Selected: Roving Hammer)

Hammer

Switch select mode

	Point	Direction	ChannelLabel
1	Point1	+Z	Ch1

Response

Switch select mode

	Point	Direction	ChannelLabel
1	Point2	+Z	Ch2
2	Point3	+Z	Ch3
3	Point4	+Z	Ch4
4	Point5	+Z	Ch5
5	Point6	+Z	Ch6
6	Point7	+Z	Ch7
7	Point8	+Z	Ch8

Buttons: +X, -X, +Y, -Y, +Z, -Z, +RX, -RX, +RY, -RY, +RZ, -RZ, Remove, OK, Cancel.

■ Edit Points

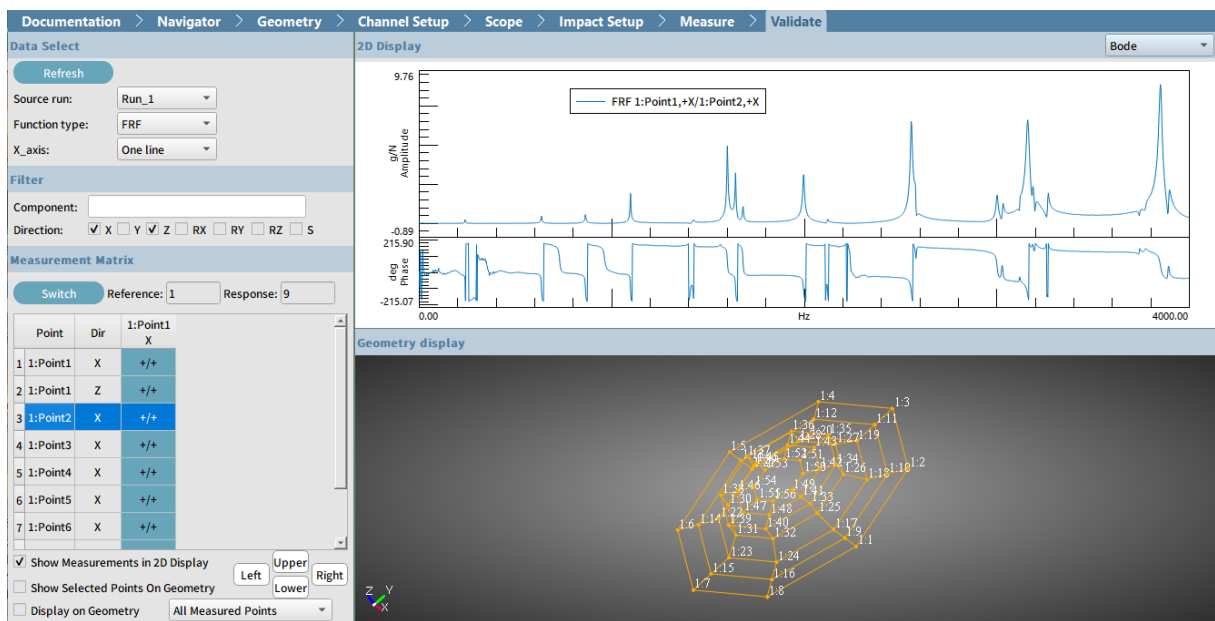
After completing the settings, you can carry out the formal test. After the test is completed, the test data can be exported by right-clicking in the project file directory of the data navigation.



Data is displayed on the data navigation page when all test points have an Acquisition status. Data from the current run is not saved for incomplete tests (i.e., where there are test points in the Not Acquired and Acquiring states).

(E) Validate

After the modal test is completed, click 'validate' in the flow bar to switch to the data verification page. In this page, you can check whether there are any missed or overloaded measurement points, and you can also check the frequency response, auto spectrum, intercentrum and coherence function of all measurement points in the experiment.



■ Validate

4 Test and Data Acquisition

[3] Test Precautions

(A) Grounding

All test equipment is required to be reliably grounded and connected to the same ground.

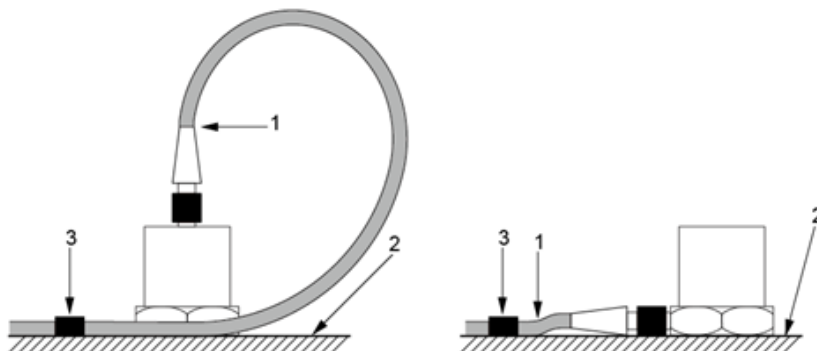
(B) Installation and Operation of Sensors

1. Installation requirements

For optimum performance of the sensor in use, follow the requirements below:

- ✧ For the mounting position of the transducer in the structure should be chosen as close as possible to its required test site so that it has the same movement.
- ✧ The sensor and its mounting object should be as solid and sturdy as possible (the mounting surface should be as clean and flat as possible) and have the most direct or shortest transmission path to the object to be measured. For uniaxial accelerometers, it is important to note whether the direction of measurement, i.e. the direction of the main axis, is the direction of measurement of interest.
- ✧ The change in motion of the test structure due to the introduction of the sensor should be as small as possible: the motion distortion due to the mounting is minimized (e.g. by using symmetrical mounting). The ratio of the mass of the sensor and mounting device to the dynamic mass of the structure under test should be as small as possible.
- ✧ The maximum operating frequency shall be well below the installed resonant frequency of the selected sensor.

When sensors with axial connections are used, hard cables may cause case strain and the cables should be carefully clamped to avoid these phenomena. Loose cables on piezoelectric accelerometers can cause friction static effects.



■ Sensor mounting method

Figure note:

- 1——Free from external force
- 2——Contact surface of the vibrator
- 3——Cable fixed to the vibrating surface

The electrical insulation of sensors varies. Some sensors come with an insulated base, others require an insulated screw with a mica spacer to ensure insulation. Insulation screws are fixed with a mica spacer on the contact surface, and the installation of insulation screws is a good solution to the problem of ground loops in the measuring system.

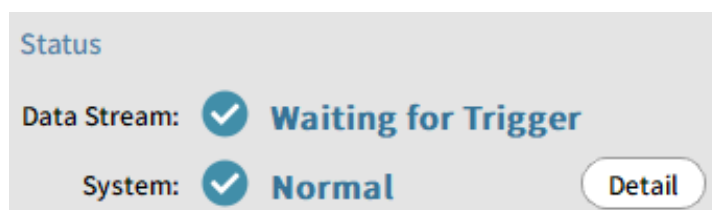
2. Attentions

- ✧ When removing the sensor gently shear from the side rather than pulling from the vertical side of the mounting.
- ✧ For most sensors, direct bonding is not recommended.
- ✧ The cable of the charge-type sensor should be fixed reliably. Shaking, bending, and stretching of the charge-type transmission cable during measurement will cause changes in the local capacitance and charge between the conductor and the shield, thus introducing more interference. In contrast, the transmission cable of IEPE-type accelerometers with built-in amplification circuits is much less affected by interference.
- ✧ When the cable is not long enough and multiple strings are used, care should be taken to ensure that the connectors are not contaminated by dust, water or conductive materials.
- ✧ For small and light objects (e.g. small blades) the mass loading effect of the mounted sensor should be taken into account. Generally the mass ratio of the sensor to the object to be measured should be less than 1/10.
- ✧ Avoid dropping the sensor onto hard surfaces.

All sensors must not be operated outside the specified temperature range.

(C)Trigger

If the software has been in the 'Waiting for Trigger' state and the test data cannot be collected, it is possible that the data level acquired by the trigger channel has not reached the set trigger level.

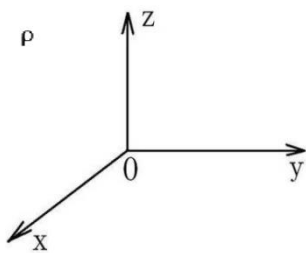


4 Test and Data Acquisition

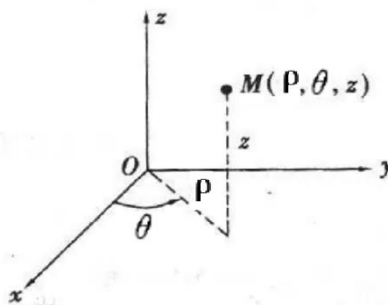
- ✧ Check the test wire connected to the trigger channel for breaks.
- ✧ Check that the sensors used are working properly.
- ✧ Check that the trigger magnitude is not set too high.

(D) Selection of the coordinate system

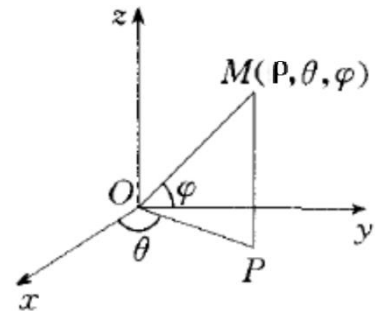
For modelling complex geometries, a combination of Euler angles, spherical and cylindrical coordinate systems can be used. There are three coordinate systems available in the software, right-angle (Cartesian), cylindrical and spherical. The Cartesian coordinate system is generally used to create non-circular structures and is relatively simple to use.



Cartesian coordinate



Cylindrical coordinate



Spherical coordinate

■ Three coordinate systems

If you choose the column coordinate system, you should enter in the node worksheet the radius r , the angle θ and the height Z of each point according to the column coordinates, so that each node created will have its own independent Euler angles (Z axis is the perpendicular direction of the column plane, X is the normal direction of the column plane, and Y is the tangential direction of the column plane). The spherical coordinate system is similar to the column coordinate system (Z and Y axes are the two tangential directions of the spherical plane, X is the normal direction of the spherical plane).

After determining the reference coordinate axes (right angle coordinate system, column coordinate system, spherical coordinate system), then according to the sensor sensing direction and installation direction, and then determine the direction of motion of the measuring point.



The reference axis must be the same for all measurement points in a test.

When setting the sensor direction in the channel setup, make sure that the sensor mounting direction is the same as the direction of the Euler angle.

5

Modal Analysis

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5 Modal Analysis

[1] Experimental Modal Analysis

In the function selection interface, double click the Experimental Modal Analysis module to enter the function. The working interface of Experimental Modal Analysis includes:

- ✧ Documentation: Used to record memos of the test (test pictures, test descriptions, and other text or pictures that need to be recorded) as an auxiliary record of the test work.
- ✧ Navigation: for post-processing time-domain data selection, file search and display of test results, etc.
- ✧ Data selection: Select modal test data.
- ✧ PLSCE/PLSCF。
- ✧ Modal Synthesis: extraction of the modal parameters of the system from the measured data.
- ✧ Modal Validation: testing the quality of the estimated modes using modal confidence criteria, modal complexity, etc.

Modal analysis techniques are used to analyze the dynamics and structural characteristics of engineering structural systems. It can obtain the modal parameters (such as frequency, mode shape, stiffness, damping, etc.) of the specimen, which provides powerful reference information for solving practical problems and has certain engineering application value.

(A)Data selection

Click 'Data Selection' on the flow bar to switch to the data selection page to select modal test data.

1. Find FRF in

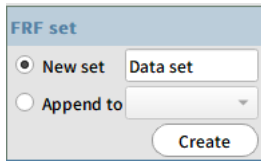
■ Find FRF in

Active section

Running: The FRF function for runtime acquisition can be freely selected when the modal analysis module is added to the online acquisition function.

Data set: Select a user-defined data set, which can be added in the 'Frequency Response Function Data set' below.

Process: reads the FRF function from the user's existing process (the result of the modal analysis).



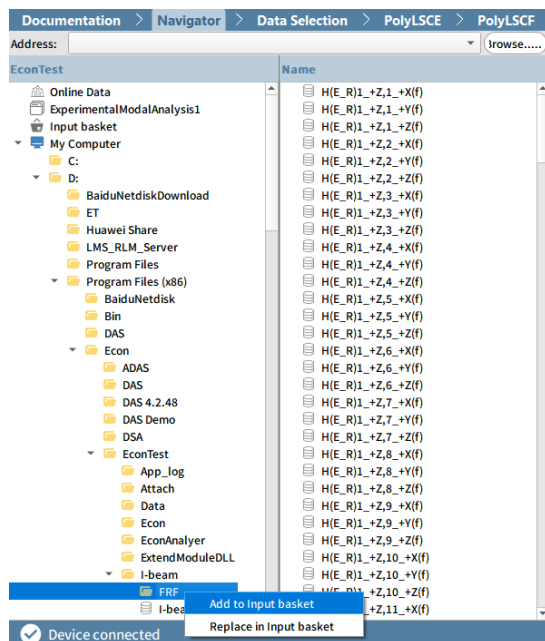
■ Frequency response function data set

Input basket

Read the data in the data basket and add it in the data navigation screen.

The procedure for adding data to the data basket is as follows:

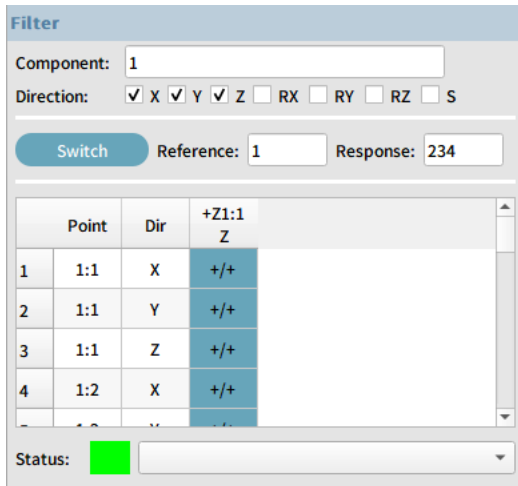
1. Click 'Navigator' in the flow bar to switch to the data navigation page.
2. Locate the test data in the file navigation.
3. Select the data folder and right-click menu to select 'Add to Input Basket'.
4. Back to the 'Data Selection' screen and select 'Data Basket', the data will be refreshed automatically.



■ Add to input basket

5 Modal Analysis

2. Filter



The Filter dialog box contains the following fields and controls:

- Component:** A text box with the value "1".
- Direction:** A row of checkboxes for X, Y, Z, RX, RY, RZ, and S. X, Y, and Z are checked.
- Switch:** A button.
- Reference:** A text box with the value "1".
- Response:** A text box with the value "234".
- Table:** A table with 4 columns: Point, Dir, and +Z1:1 Z. The first four rows are visible.
- Status:** A green square and a dropdown menu.

	Point	Dir	+Z1:1 Z
1	1:1	X	+/+
2	1:1	Y	+/+
3	1:1	Z	+/+
4	1:2	X	+/+

■ Data filter

Component

Data selection is done by component name, non-filled component names will not be displayed.

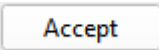
Direction

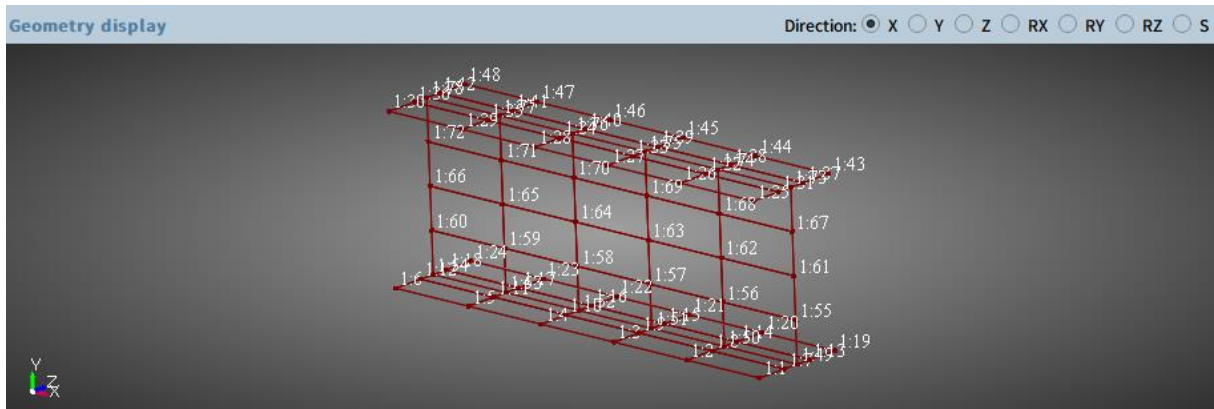
Data selection by direction.

Switch

Interchange reference and response.

3. Geometry display

Select the Geometry module from the Tools menu - Insert Module. Switch to the Geometry page and import or create a new model. Click  to return to the Data Selection - Geometry display window to view the geometry model.

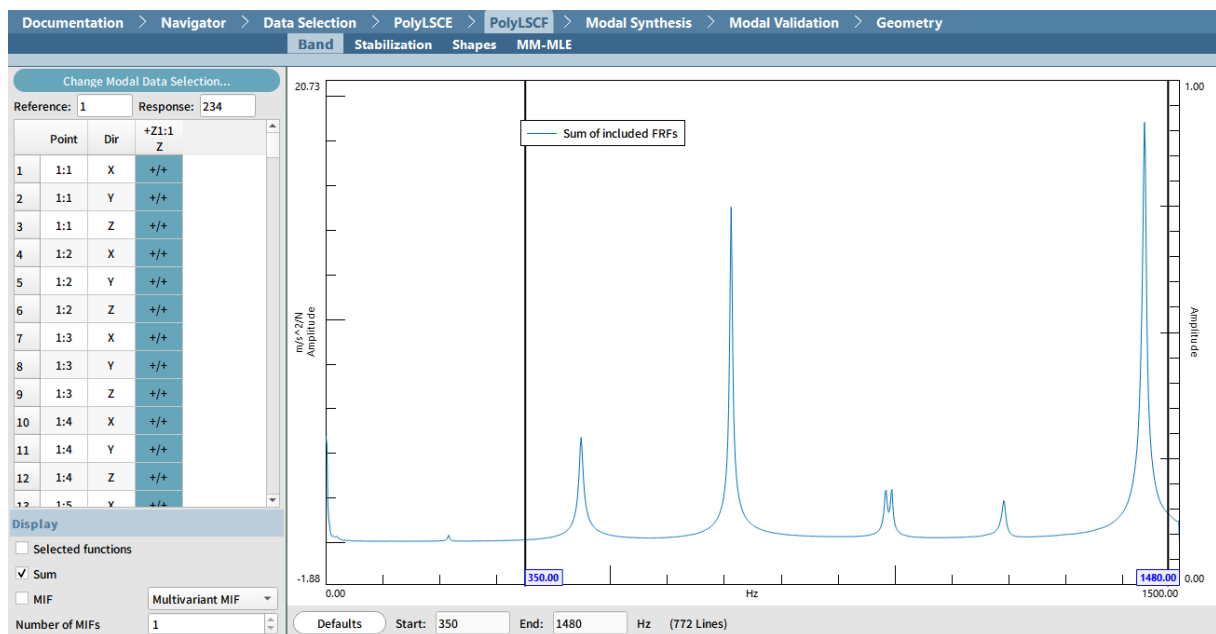


■ Geometry display

(B)PLSCE/PLSCF

The default algorithm for modal analysis is PLSCE, but the PLSCF method is more accurate in the identification of modal poles, and it is recommended to use PLSCF. PLSCE and PLSCF are just different algorithms, and the operation interface is basically the same, and the following content will introduce the multi-reference PLSCF. It is divided into three main parts: frequency band selection, steady state diagram analysis and vibration pattern analysis.

1. Band



■ Band

To select the frequency bandwidth to be analyzed, click **Defaults** button and the band cursor for bandwidth selection will be automatically displayed in the middle area of the window. The bandwidth of the analyzed frequency can be selected by moving the band cursor, or the start and end frequencies can be entered manually.

Selected functions

Displays the selected FRF function on the right.

Sum

The sum of the FRF functions is displayed on the right hand side.

MIF

MIF is displayed on the right side. MIF is a

frequency domain function that will display minima at the intrinsic frequencies of the structure, with the number of MIFs equal to the number of reference points. The first order MIF will display minima at the intrinsic frequencies. A second order MIF will only show minima where there are heavy roots. More reference points are needed to identify more heavy roots.

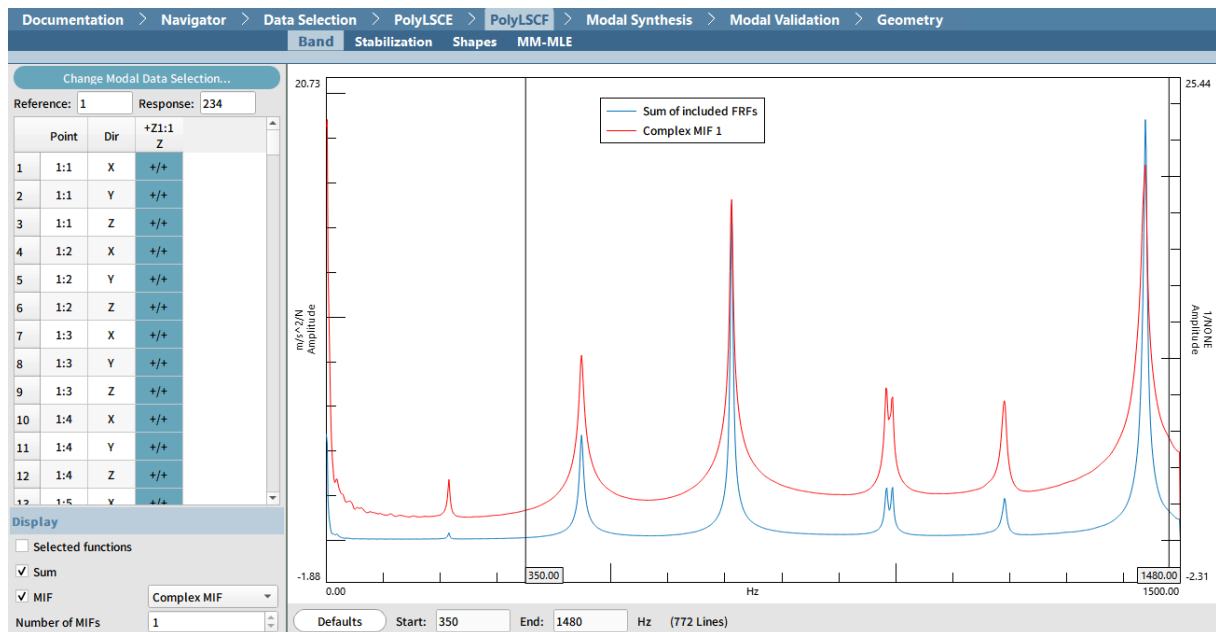
5 Modal Analysis

2. Stabilization

Click **Calculation** to calculate the poles, after the calculation is completed, the selected poles will be displayed on the left page. There are two ways to select the poles, one is the user's own judgement, through the mouse to select the poles; the other is to click **Auto select poles** to use the automatic selection of poles (need to enable the function).



Please read the contents of the configuration of the product you have purchased. Features not purchased will not be available. If the function or feature you require is not available in your configuration, please contact your seller or ECON.



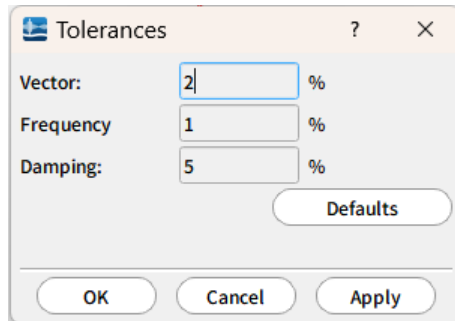
■ Pole selection

The instruction of the modal pole figure symbols :

Figure symbol	instruction
o	Pole instability
f	Frequency of the pole is stable in the threshold range
d	Damping of the poles and frequency stabilization in the threshold range
v	Pole vectors are stable over a threshold range
s	Frequency, damping, and vectors of the pole are stable in the threshold range

Tolerances for vectors, frequencies and damping can be set in **Tolerances...**. Default values are

generally used.

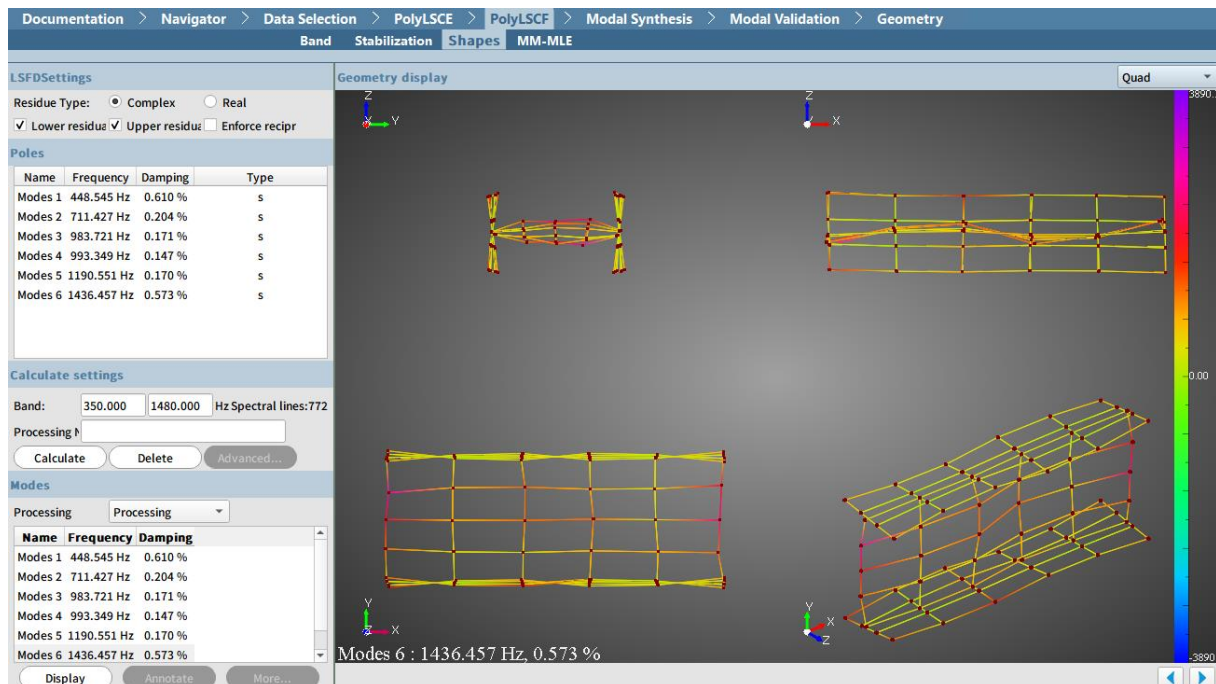


■ Tolerances

3. Shapes

The user can dynamically display and compare the modes of each order through the geometric model.

Click **Calculate** to calculate the modes, select the modes and then mouse click **Display** or double click the selected modes to animate the display.



■ Shapes analysis

(C)Modal Synthesis

Modal synthesis is the evaluation of the correlation and error between the measured FRF and the fitted FRF. The obtained modal model can be fitted to the FRF in a number of ways, and must have a modal

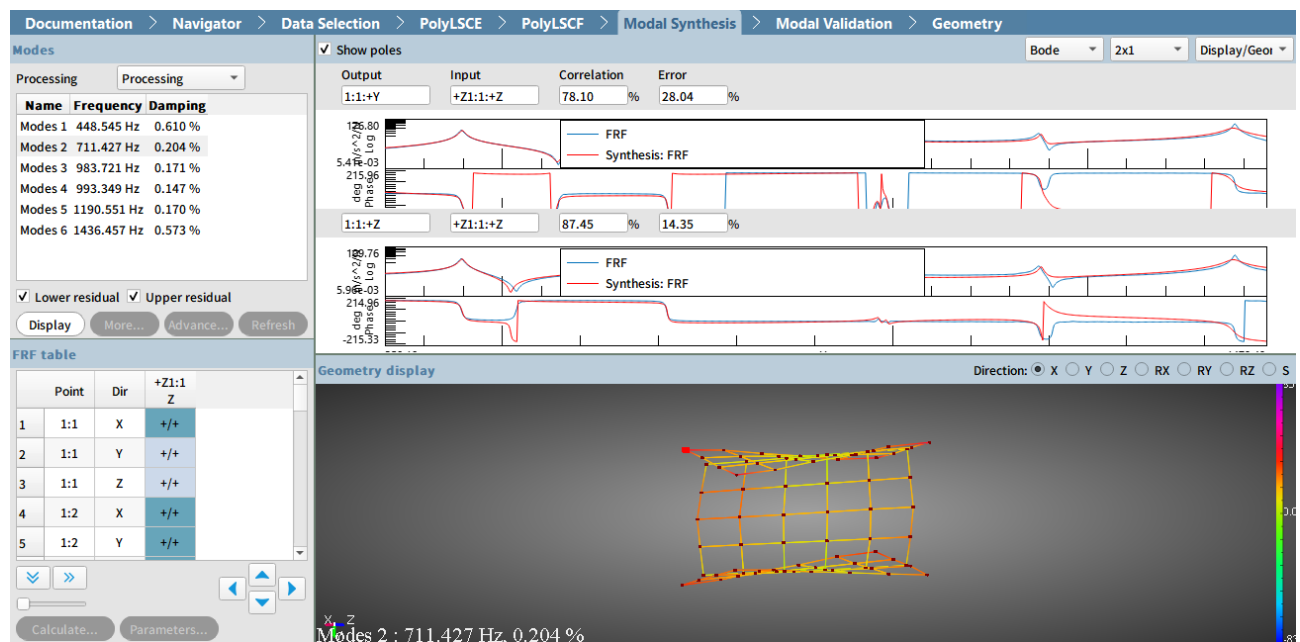
5 Modal Analysis

vibration pattern corresponding to at least one of the input degrees of freedom and a modal participation factor, and one of these must have a modal vibration parameter for the input degree of freedom. Using the Maxwell-Betti reciprocity principle, it is possible to calculate the FRF for the interaction between the two measurement points of input and counting.

Select **Display/Geor** in the upper right corner, the modal window selects the modal vibration pattern and clicks **Display**. The geometry display window shows the corresponding modal vibration pattern. The buttons at the bottom of the interface are used to switch the display of the correlation and error between the measured FRF and the fitted FRF, the left button is for the automatic display and the progress bar is used to adjust the speed of the automatic display; the right button is used for the manual display.



■ Toggle display button

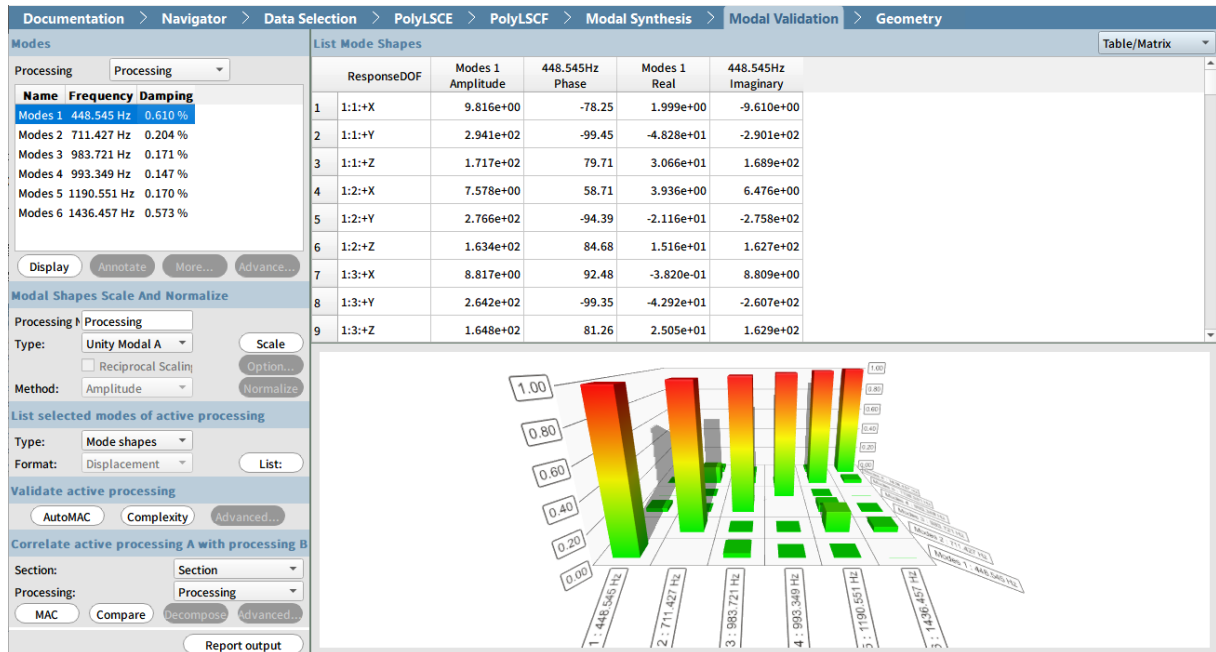


■ Modal Synthesis

(D)Modal Validation

Modal validation is used to verify the accuracy of the modal analysis results. The parameters of the modal model include mode shapes, mode participation factors and retention numbers (velocity, displacement, acceleration). The validation tools are MAC histogram/table, modal hyper complexity MOV, modal phase covariance MPC, mean phase deviation MPD, phase dispersion of each degree of freedom Scatter and modal participation factor MP.

Select different modal model parameters in Modal Information and click **List:**. The corresponding modal model parameters will be displayed in the table on the right. Click on different modal validation tools and correlation analyses, the corresponding results will also be refreshed in the table on the right.



■ Modal Validation

EonTest software supports the output of modal data reports, click **Report output** to open the modal report settings and select the parameters for the output report.

Modal report settings.

Processing: Processing

Parameters

☒ Modal table ☒ MAC table

☒ Synthesis Correlator

☒ Modal Complex

Summary

Report path: C:/Users/y2690/Documents

Report name: Modal Report

Template path: n Files (x86)/Eon/EonTest/ReportTmp/ModalReportTmp.dotx

Buttons: Advance... Cancel And Close Create

■ Modal report settings

5 Modal Analysis

[2] Operational Modal Analysis

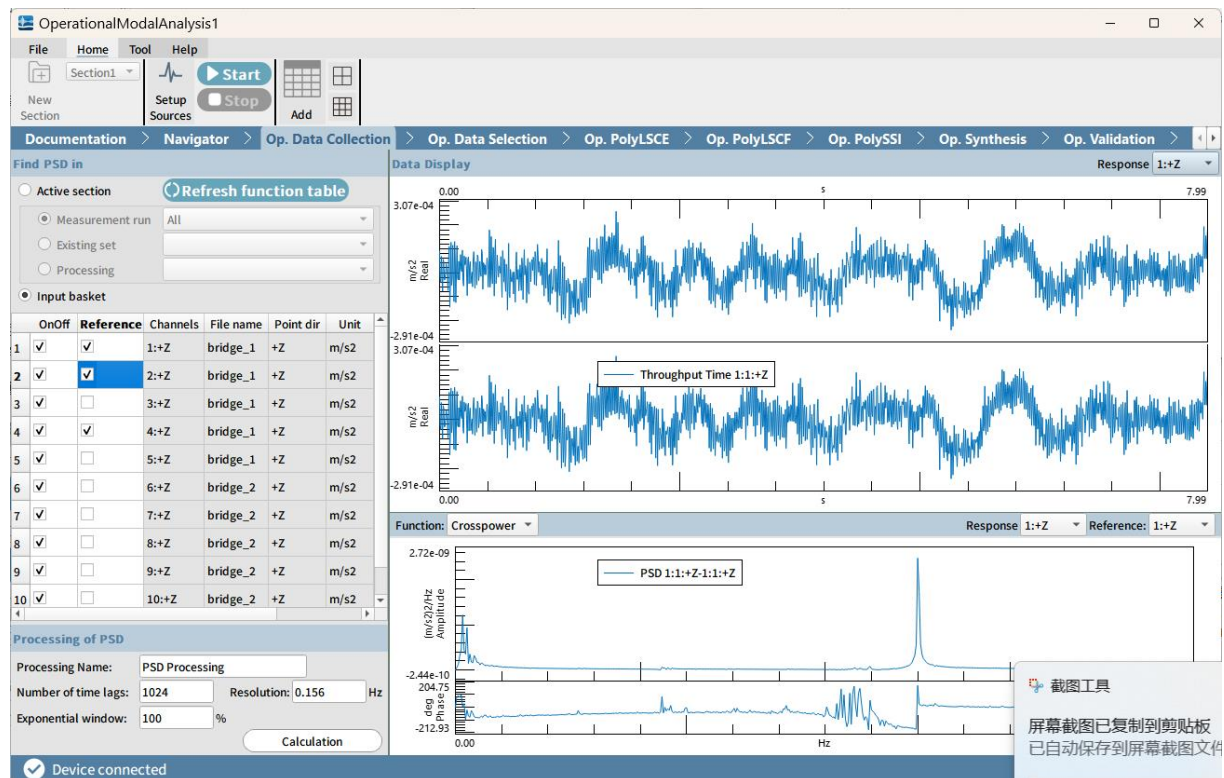
In the Function Selection interface, double-click the Operational Modal Analysis module to enter the function. The working interface of Run Modal Analysis includes:

- ✧ Documentation
- ✧ Navigator
- ✧ Op.Data Collection
- ✧ Op.Data Selection
- ✧ Op.PLSCE/Op.PLSCF
- ✧ Op.Synthesis
- ✧ Op.Validation

Unlike the experimental modal analysis, the operational modal analysis is based on the auto-spectrum and the cross-spectrum, and the first step is to calculate the cross-spectrum in the 'Op.Data Collection' page. For operational modal analysis, it is necessary to have time-domain signals to calculate the auto-spectra and cross-spectra from the time-domain signals. After importing the time-domain signals, click

Calculation

to calculate the cross-spectra.



■ Op.Data Collection



Theoretically, the smaller the time lag, the closer the result is to the unbiased estimate, but the corresponding resolution will be larger. The user should choose a moderate value according to the actual situation.

After calculating the cross-spectrum in the 'Op.Data Collection' page, switch to 'Op.Data Selection' and select the PSD process in the current project-process to complete the data selection.

Operational Modal Analysis and Experimental Modal Analysis operate in exactly the same way, except for differences in algorithms, see 5-[1] 'Experimental Modal Analysis' for details.

5 Modal Analysis

[3] Operational Deflection Shapes

In the function selection interface, double click the Working Operational Deflection Shapes module to enter the function. After getting the data from the working test of the structure, you need to analyze the raw data to get the deflection change of the structure with frequency or time. The working interface of working deflection analysis includes:

- ✧ Documentation: Used to record test pictures, test descriptions, etc., as an auxiliary record of the test work.
- ✧ Navigator: for post-processing time-domain data selection, file search and display of test results, etc.
- ✧ Freq. Animation: Frequency domain deformation display analysis
- ✧ Time Animation: time domain deformation display analysis

(A)Freq. Animation

Data types (such as Spectrum, Crosspower, etc.) can be used for data participating in ODS analyses.

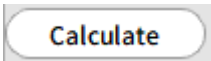
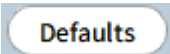
Function Type——Spectrum

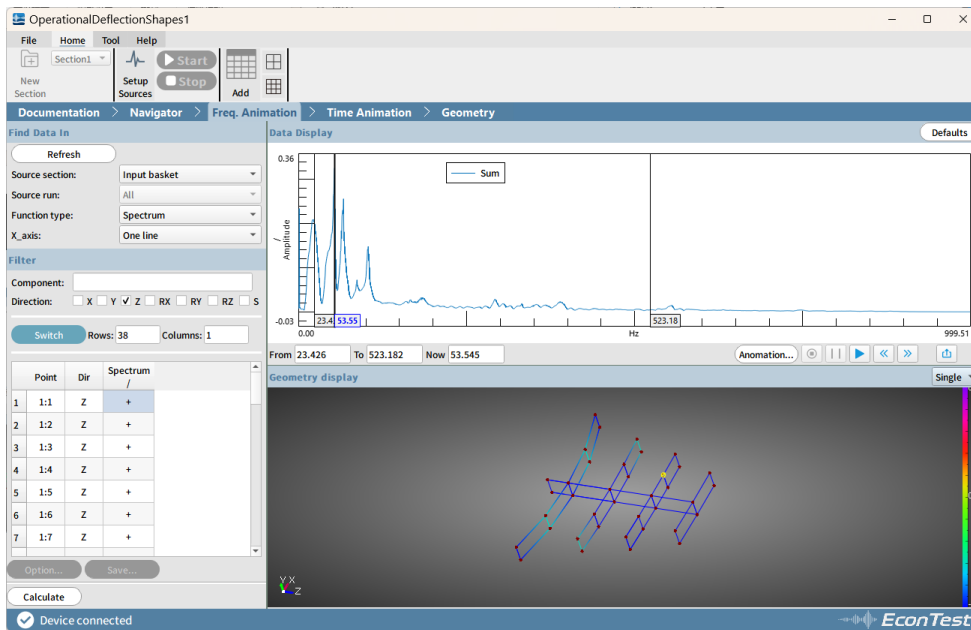
The spectrum is used to represent the actual vibration of each point, the ODS pattern reflects the actual state of structural operation, and the mutual motion relationship of each point can be reflected by the phase information contained in the spectrum.

Function Type——Crosspower

Calculations using the reciprocal spectrum reflect the interrelationships between individual points and the reference point. The ODS vibrational pattern reflects the inter-motion of the non-reference points in relation to the reference points.

Working deformation analysis procedure:

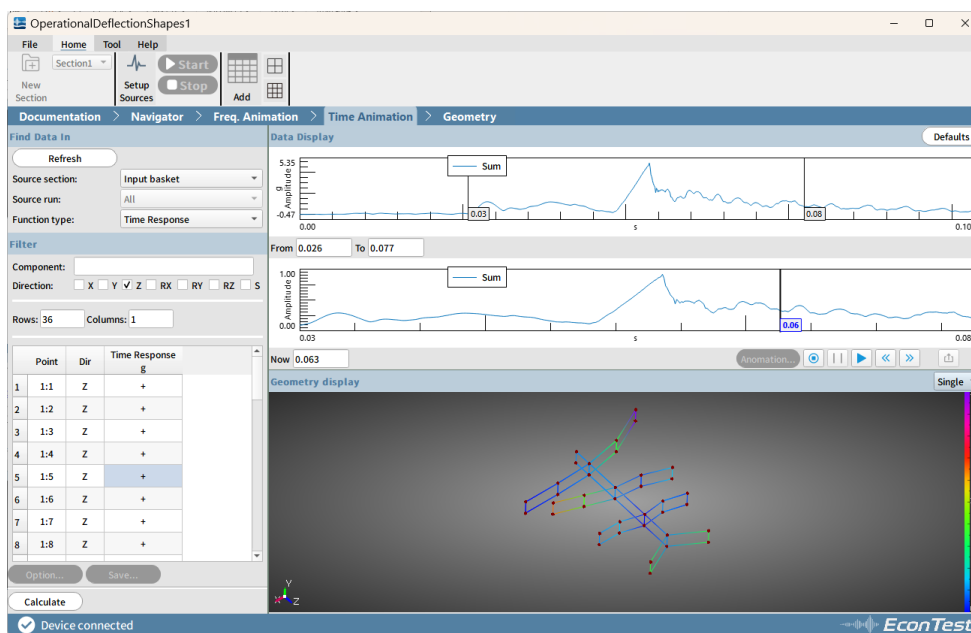
1. After setting the data source, select the type of function to be calculated.
2. Click  to calculate the sum, the result of the calculation is displayed in the data display area after selecting the data in the measurement point form.
3. Import the geometry model (Tools menu - Insert module add geometry module for import).
4. Click  to play the animation (you can move the cursor manually), the geometry display area will show the vibration pattern of the corresponding frequency point. The cursor is valid when it moves within the set analysis range, and the analysis range can be adjusted by the input box below, or you can click  to return to the initial state.



■ Freq. Animation

(B)Time Animation

The Time Animation is similar to the frequency domain deformation analysis. The operation procedure and methodology are consistent with frequency animation, see 5-[3]-(A) for details.



■ Time Animation

5 Modal Analysis

[4] Theory & Terminology

➤ **Modal**

The intrinsic frequencies, damping ratios and shapes of vibration of a structure are collectively referred to as modes. The modes are inherent properties of the structure itself, and obtaining information about the modes of the structure helps to avoid resonance of the structure.

➤ **Modal Assurance Criterion**

The Modal Assurance Criterion (MAC) is used to test the degree of similarity or consistency between different modal vectors estimated from an experimental modal test, and is calculated as a scalar value between 0 and 1 (or expressed as a percentage).

There may be reasons why the MAC is less than 1:

The extracted modal vectors are different from each other .

The vectors used for comparison may contain noise.

The vectors may be affected by the nonlinearity of the test data.

The number of measurement points characterizing the vibration modes is insufficient.

➤ **Mode Overcomplexity Value**

Mode Overcomplexity Value (MOV) is a weighted percentage of the response degrees of freedom, where the frequency is shifted downward as the mass increases. When the system intrinsic frequency sensitivity to mass is negative, the system mass sensitivity parameter = 1. When it is positive, the system mass sensitivity parameter = 0. If the MOV value is high, it indicates that the modal data is of good quality.

➤ **Modal Phase Collinearity**

Modal Phase Collinearity (MPC) is a parameter that determines whether the modal test results satisfy the phase characteristics of the real modal system. When the real modal system resonates, there are only two states of phase difference between different measurement points: homodyne (phase difference of 0) or inverse (phase difference of 180°). When the system damping is small, the system mode can be equivalent to the real mode, and the MPC value is close to 100%; when the system damping is large, the system mode is complex mode, and the MPC value is low.

➤ **Modal Phase Deviation**

The mean phase deviation (MPD) represents the amount of phase scattering present in the modal vector, with the MPD of the real modes of the canonical form approaching zero.

➤ **Modal Patriation**

Modal Patriation (MP) refers to the amount of participation of a particular mode of the system of a particular order in the frequency response of the system. Modal participation is associated with each reference degree of freedom and is meaningful when multiple reference points are used. When these factors are examined, there is one modal participation value for each order of modes under one reference degree of freedom, which helps to determine the appropriateness of the chosen reference point. This also indicates which reference point primarily excites which order of modes, with low

participation values corresponding to modal reference points being less useful for modal parameter estimation processing.