



# A E Q

( AUTO EQ )

## QUICK START GUIDE

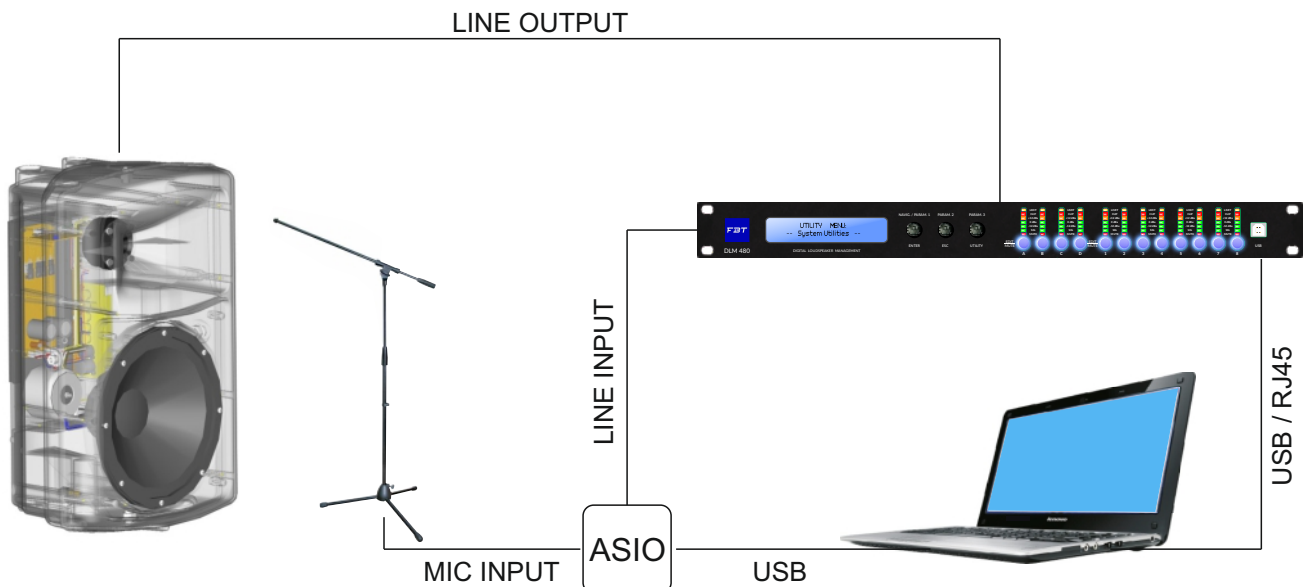
## PREFACE

AEQ ( Auto EQ ) is an application for performing acoustic correction of loudspeaker and room responses using DSP based approaches. This tool allows to perform an impulse response measurement of speaker or room and then to design the optimal equalization filter. Filter can be designed in terms of magnitude and phase responses exploiting FIR and IIR structures. The equalization results can be easily analyzed using the listening tool environment integrated in the AEQ software. In this case it is possible to detect the best audio quality produced by the different equalization filters generated in the AEQ procedure. Finally, the filter can be easily loaded in any FBT processor or amplifier machine.

AEQ is therefore a powerful measurement system allowing to automatically adjust measurement parameters and calculate the proper coefficients for IIR and FIR filter design; the AEQ automatic equalization algorithm allows a "one-key" measurement of a system Impulse response, Magnitude response, Phase response and gives the possibility to modify the Magnitude response flattening it or matching a target response so as to linearize the Phase response.....and all that on the overall measured band or sub portions of it. For this "job" AEQ can use IIR filtering, FIR or a mixed IIR+FIR combination, all based on the resources of the unit where from AEQ has been activated: AEQ is available on the DLM Speaker Management System.

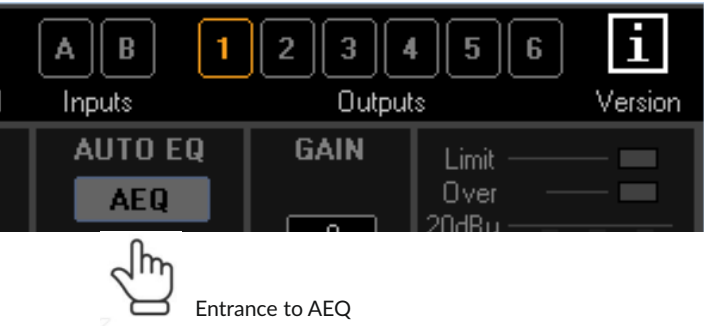
### PRECAUTIONS:

- Prepare an "ASIO" sound card and measurement microphone
- AEQ needs to call the ASIO driver of the sound card; if other measurement software is used at the same time, other devices need to be adjusted to the "wave" driver
- AEQ needs to use FIR filter, need to switch EQ/frequency division mode with FIR system test diagram:

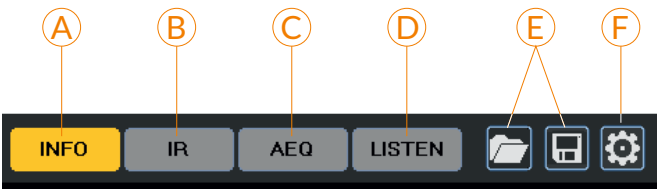
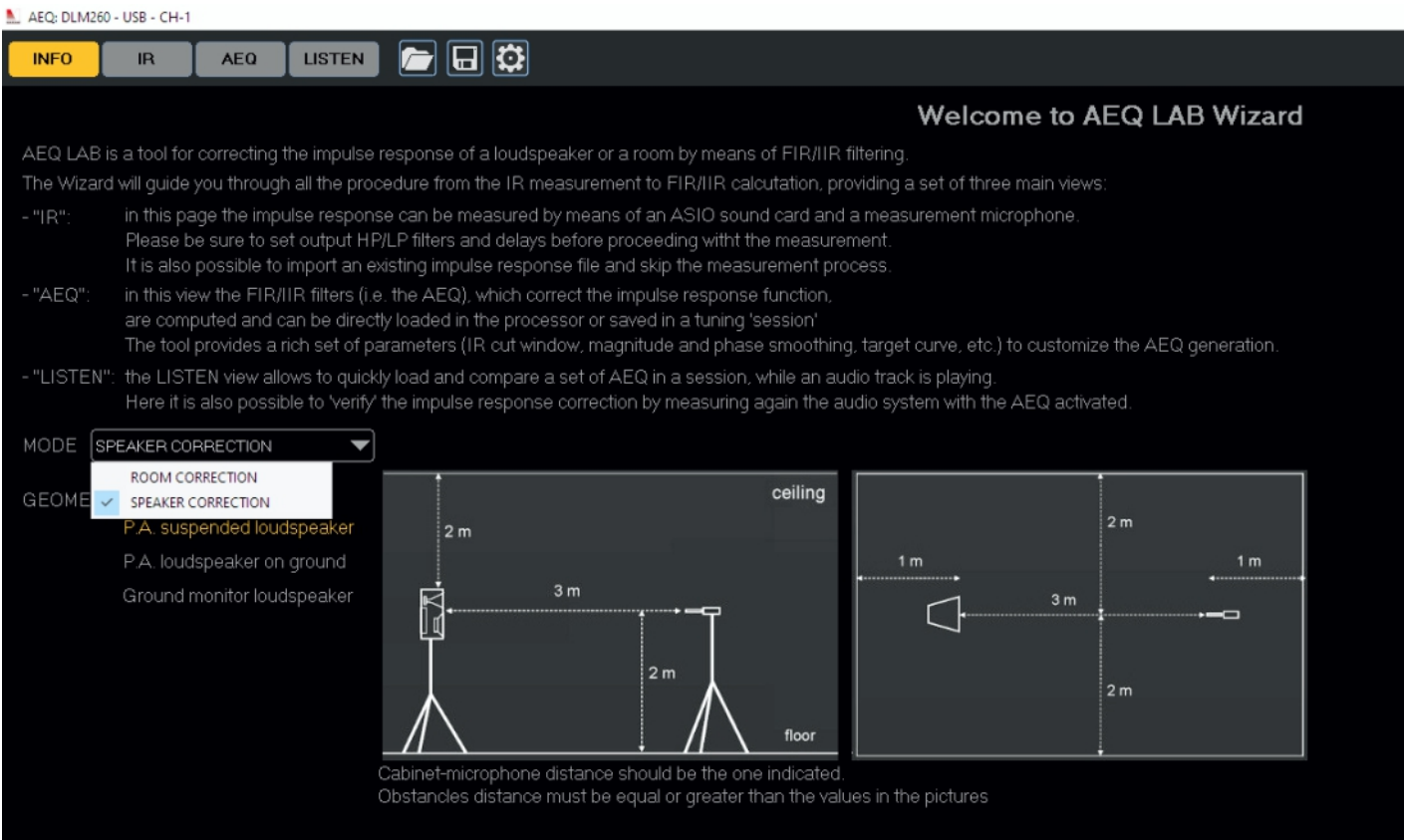


PREFACE

Using the PC Control Software "call" the AEQ function on the desired channel



AEQ Wizard: Info



- A\_ INFO: Information page, AEQ and introduction to use, switching modes
- B\_ IR: System impulse response measurement and import of external measurement data
- C\_ AEQ: Auto EQ parameter configuration
- D\_ LISTEN: Listen to the comparison
- E\_ RECALL/SAVING: AEQ project
- F\_ Settings

## MODE SELECTION

- Room correction: the AEQ will work on its automatic processes considering the equalization of a large environment as a room
- Speaker correction: the AEQ will work on its automatic processes considering short distances from source and measurement point

## SPEAKER CORRECTION

MODE **SPEAKER CORRECTION**

ROOM CORRECTION

☒ **SPEAKER CORRECTION**

P.A. suspended loudspeaker

P.A. loudspeaker on ground

Ground monitor loudspeaker

### P.A. pendant speaker measurement

Cabinet-microphone distance should be the one indicated.  
Obstacles distance must be equal or greater than the values in the pictures

MODE **SPEAKER CORRECTION**

GEOMETRY:

P.A. suspended loudspeaker

**P.A. loudspeaker on ground**

Ground monitor loudspeaker

### P.A. floor standing loudspeaker measurement

Cabinet-microphone distance should be the one indicated.  
Obstacles distance must be equal or greater than the values in the pictures

MODE **SPEAKER CORRECTION**

GEOMETRY:

P.A. suspended loudspeaker

P.A. loudspeaker on ground

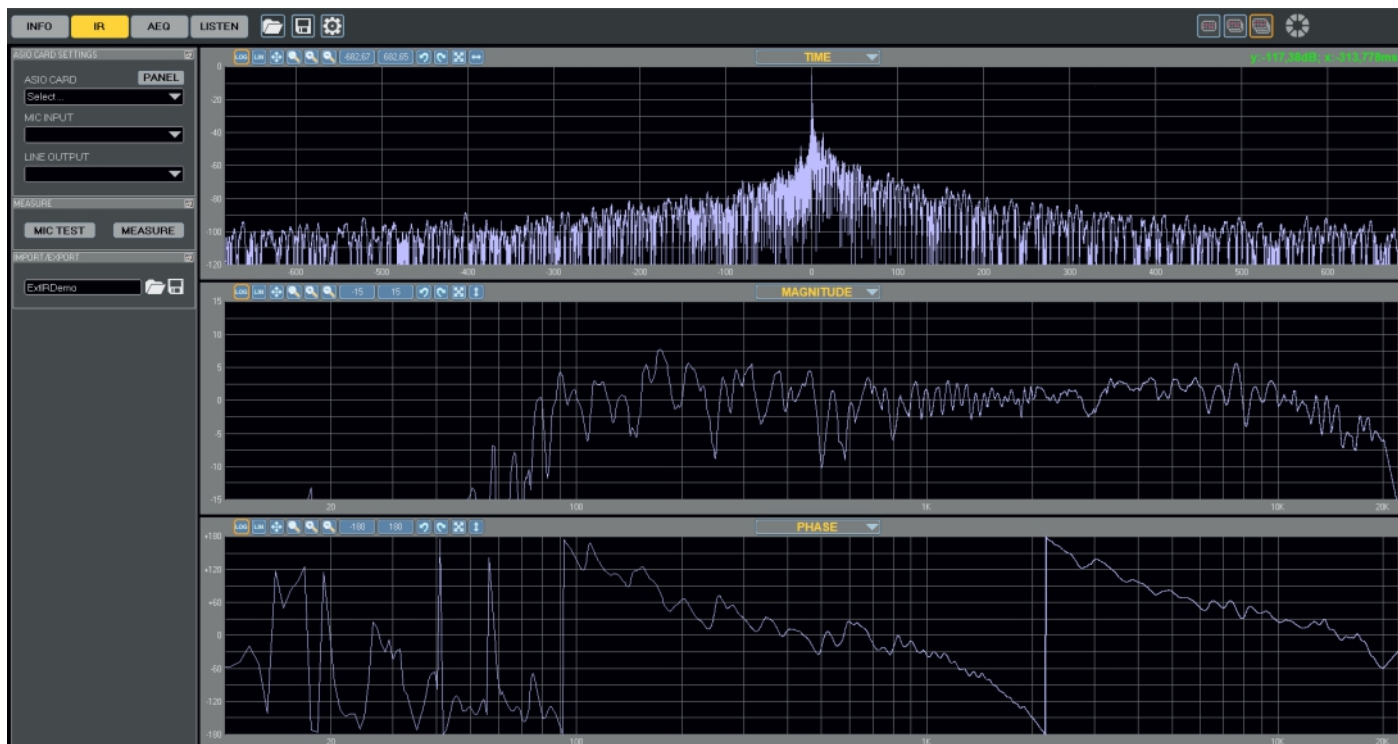
**Ground monitor loudspeaker**

### Floor return speaker measurement

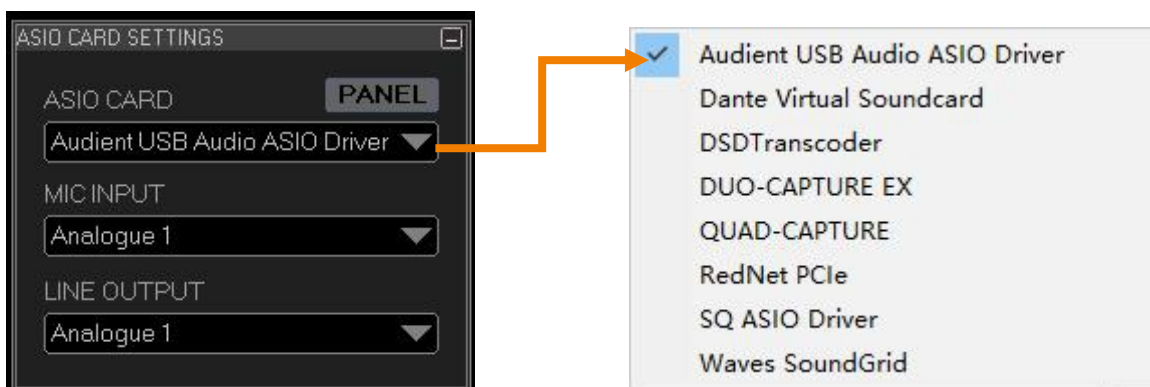
Cabinet-microphone distance should be the one indicated.  
Obstacles distance must be equal or greater than the values in the pictures

- The three options in speaker calibration are measurement guides. The distance from the speaker to the microphone and the distance from obstacles must be the guide value to ensure better IR data
- Switching between the three configurations does not affect the algorithm, which only depends on the selected MODE. The purpose of the three configurations is to give advice on the best setting for getting a successful result, given the specific measurement to proceed with.

## AEQ - Measurement page: IR



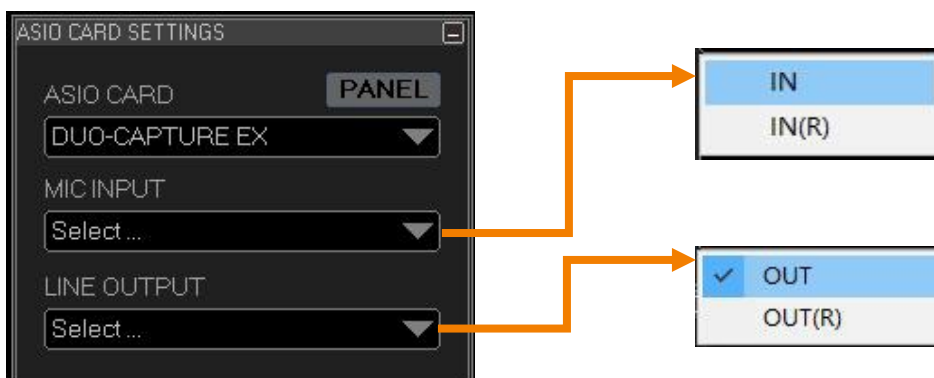
## Sound card choice



The AEQ function needs to call the ASIO driver of the sound card. When the ASIO driver is installed correctly on the computer, the PC software will automatically detect the ASIO sound card device, and then select the corresponding sound card.

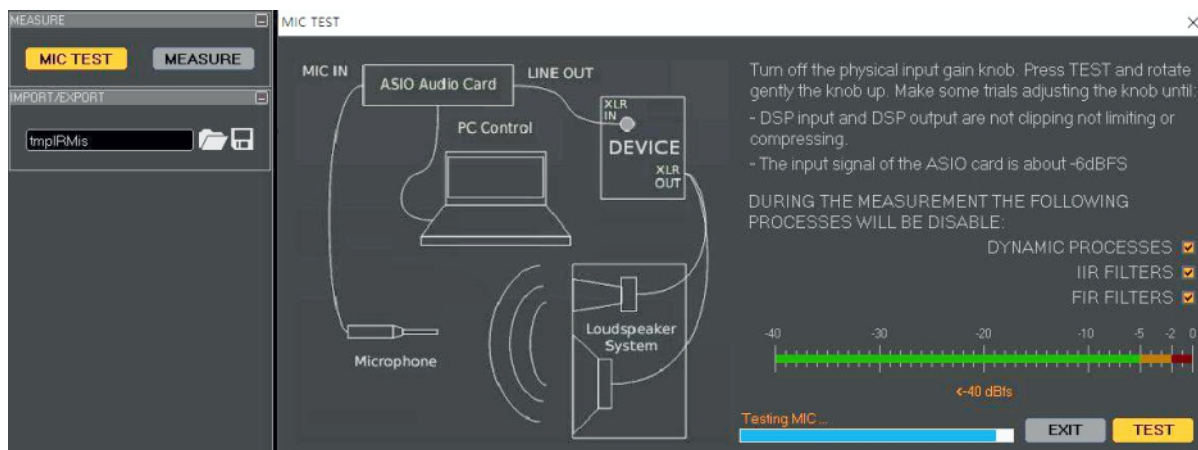
Click "PANEL" to quickly open the configuration program of the sound card ASIO.

When the sound card is connected correctly need to select input and output channels



## AEQ - Measurement page: IR System measurement

### MICTEST

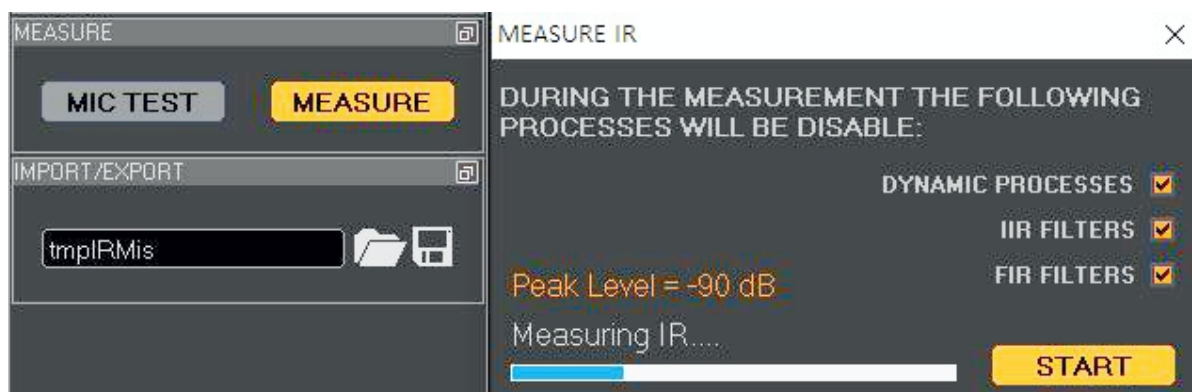


Select MIC TEST to test and adjust the output of the audio system and microphone acquisition; as setup, follow the simple diagram showing the right connection (the dynamic processes, IIR filter and FIR filter of the current channel will be disabled by default during the measurement process).

**Test suggestion:** first adjust the output of the sound card to the minimum and click "TEST" to gradually increase it (since a sweeping sine wave will be emitted during the measurement process, it can be adjusted to the acceptable range of the human ear).

**Adjust to a suitable loudness:** during the process observe the microphone acquisition level meter; the acquisition signal has no remain between -20 / -6dBfs, and the maximum has not to exceed the yellow area, adjust the microphone input gain of the sound card appropriately and then confirm with "TEST".

### SYSTEM MEASUREMENT



Click MEASURE to enter the measurement

Click START to start the measurement, the blue progress bar ends and the measurement is completed

### IR IMPORT AND SAVE

Click IMPORT to import the saved IR pulse data or third-party measurement software to measure the IR pulse data

Click EXPORT to save the current IR pulse data to the local



If fast automatic calculation is required, after the measurement is completed, you only need to select the corresponding mode (IIR, FIR, FIR+IIR) in the AEQ page-AEQ item; select the MAGNITUDE and PHASE to be processed and then insert the device.



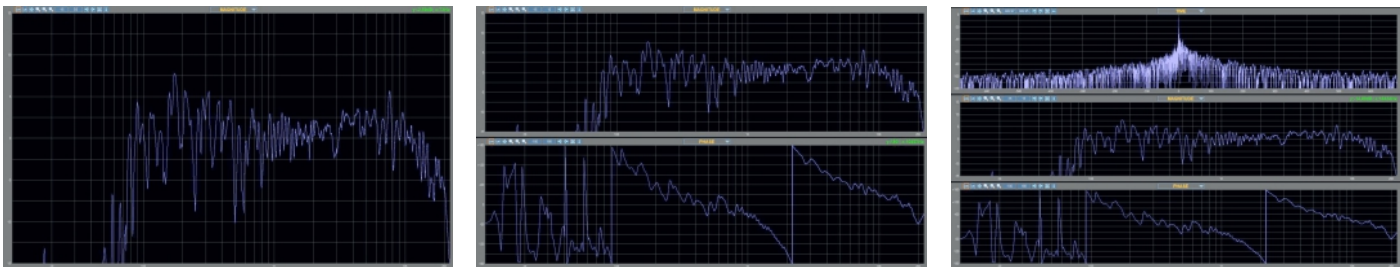


# AEQ - Measurement page: IR - Windows

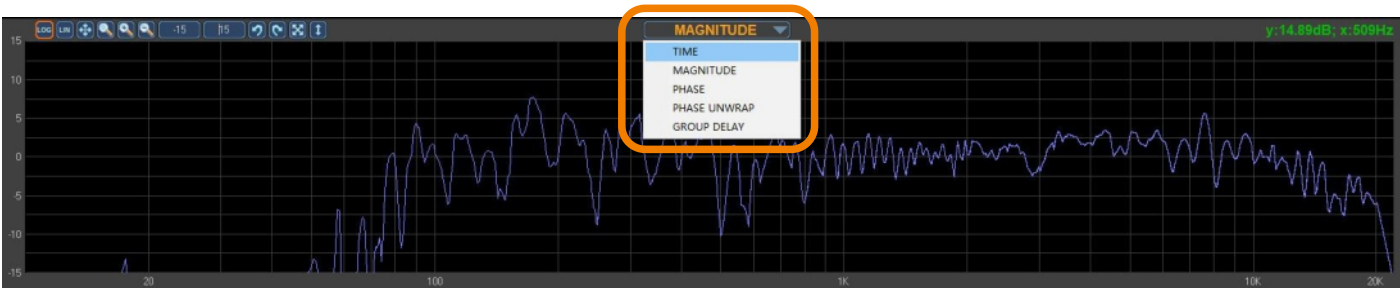
## MULTI-WINDOWS SWITCHING



Select the display window in the upper right corner: single window, double window, triple window.



## IR PULSE DISPLAY WINDOW CONTENT SWITCHING



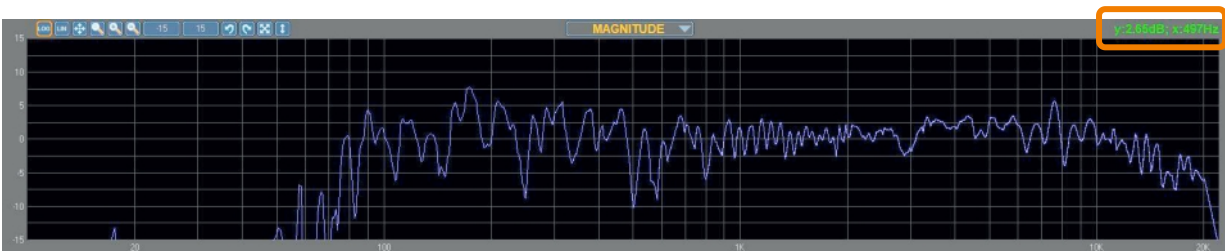
**TIME:** Time window  
**MAGNITUDE:** Magnitude response  
**PHASE:** Phase response  
**PHASE UNWRAP:** Phase unwrap  
**GROUP DELAY:** Group delay

## WINDOWS ADJUSTMENT



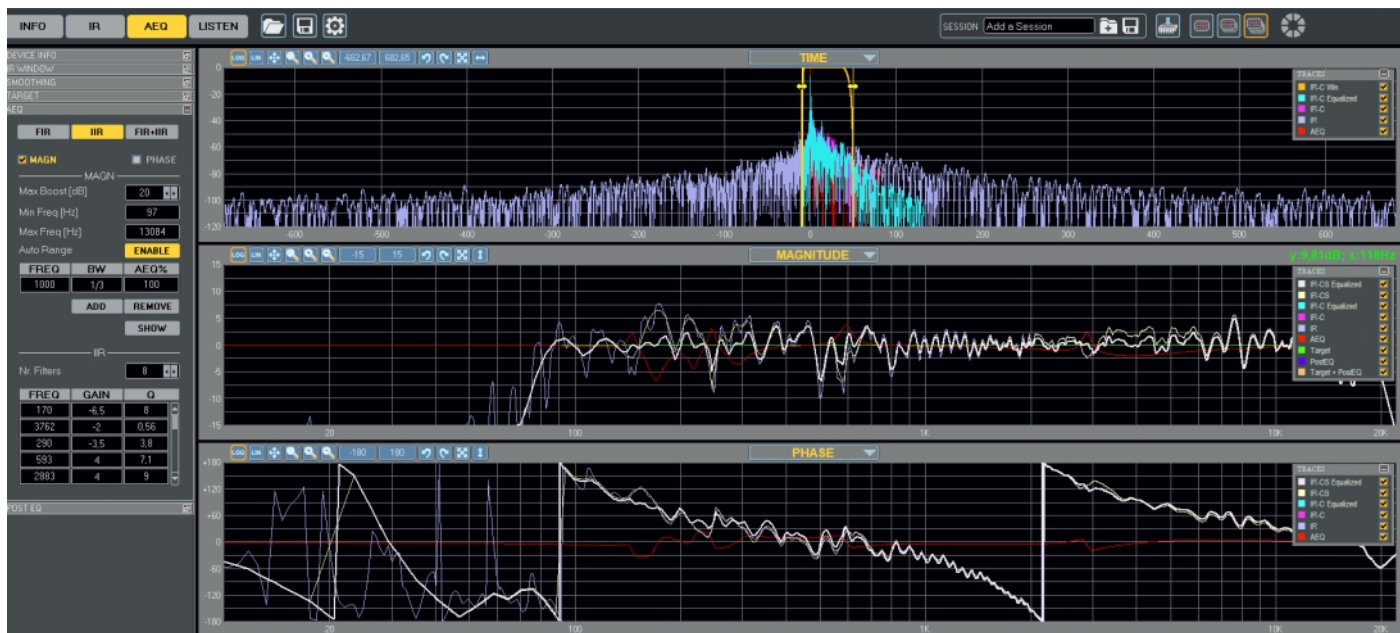
In the upper left corner of each window multiple types of adjustments are provided and the window parameters can be zoomed for better observation.

## DISPLAY OF INFORMATION



In the upper right corner of each window the position information of the current mouse position is prompted.

## AEQ - Configuration page: AEQ configuration



### DEVICE INFO: Channel info

**CHANNEL:** The current channel name

**IIR:** Max number of available PEQ segments

**FIR:** Max number of available FIR taps

DEVICE INFO

Channel

Inp CH-A

IIR

Max 17 PEQ

FIR

Max 512 Taps

### IR WINDOW: Impulse response time window

**CUT START:** Start cutting

**CUT STOP:** End the cut

**LENGHT:** Cut lenght

**TAPER:** Cut taper

**AUTO WIN:** Automatic windowing

IR WINDOW

Cut Start

-5

Cut Stop

5

Length

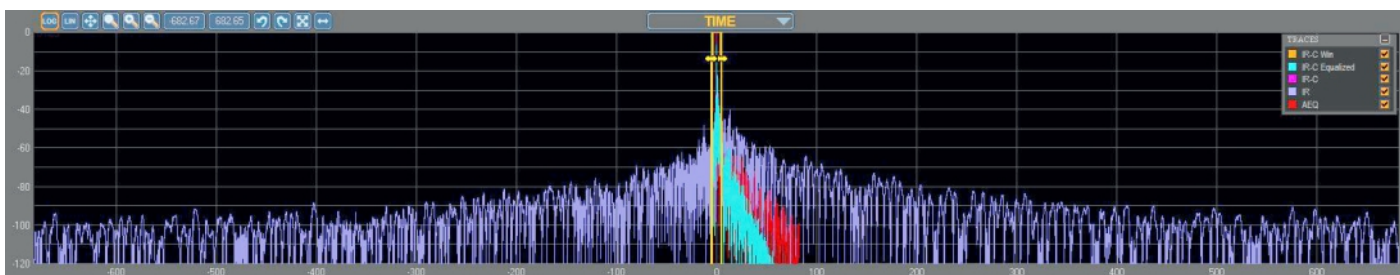
10

Taper

15

Auto Win

ENABLE



Used in conjunction with the time window, the range in the time window can be dragged and the impulse response can be manually windowed; the reflected sound pulse visible to the naked eye can be avoided, the accuracy can be improved and the reflected sound can also be taken into account as required. Non-experienced users can consider, use the automatic windowing function, and turn on AUTO WIN "ENABLE" to enable the automatic windowing process.



## AEQ - Configuration page: AEQ configuration

### MULTIPLE TYPES OF CURVES IN THE SAME WINDOW

**IR:** Raw Impulse Response Curve

**IR-C:** Impulse response curve after windowing (CUT)

**IR-CS:** Windowed and Smoothed Impulse Response Curves

**TARGET:** Target (magnitude) curve

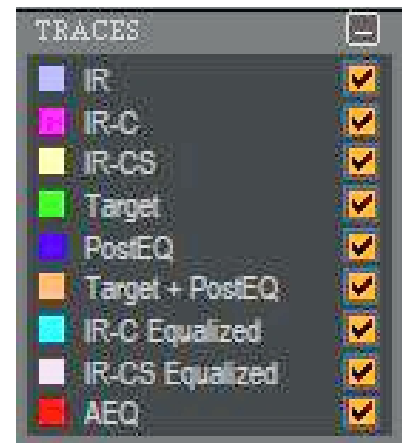
**POST-EQ:** Post-Equalization to be added to target curve

**TARGET+POST EQ:** Target curve + post-equalization

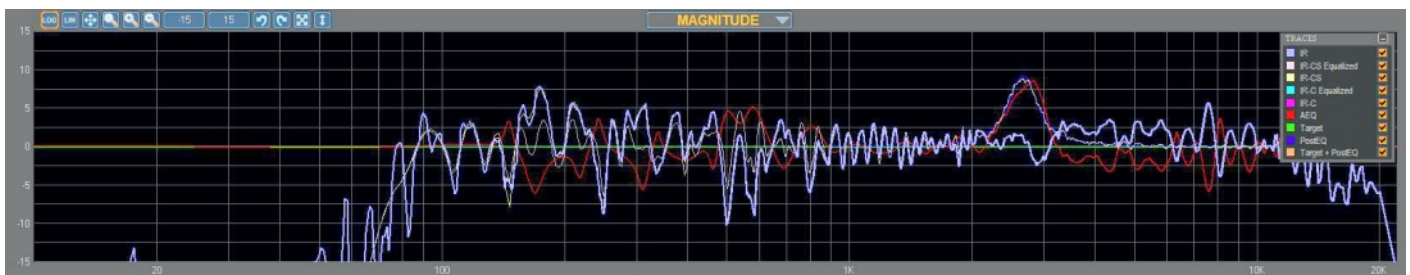
**IR-C EQUALIZED:** Windowed curve of final equalized system output

**IR-CS EQUALIZED:** Windowed and smoothed curves of the final equalized system output

**AEQ:** Automatic equalization calculation processing curve



Click the curve name to put the curve on top and the curve will be displayed in bold in the drawing area.



Un-check "tick" to hide unwanted curves



Click "-", you can abbreviate the small window



**SETTINGS:** You can debug the layout and color of the curves

**PLOT LAYOUT:**

**RESET:** Restores the view layout

**TRACES COLOR:** Freely set different curve colors

**RESET:** Restore curve color

**CLOSE:** To close the page

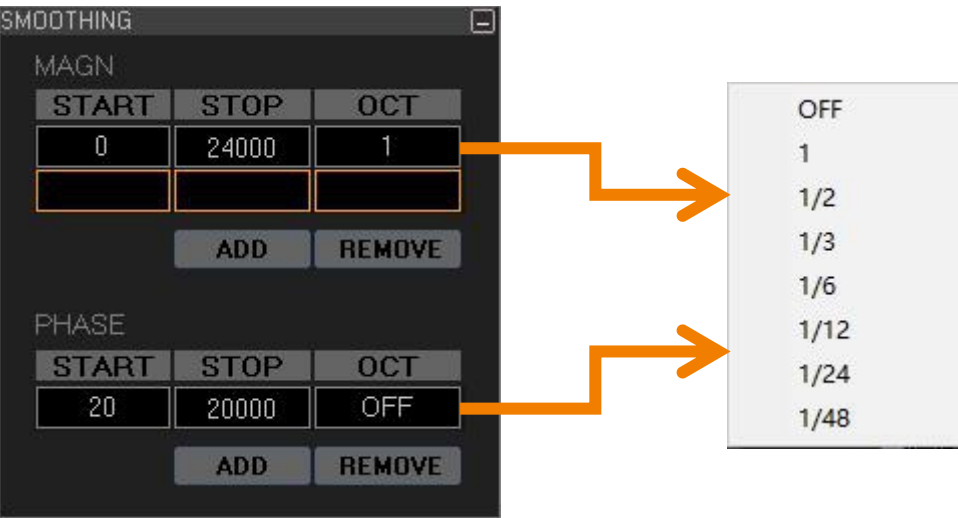
**CANCEL:** Cancel the setting

**APPLY:** App settings



AEQ - Configuration page: AEQ configuration

SMOOTHING: SMOOTH THE IR CURVE



Smoothing can perform smoothing or multi-segment smoothing on the Magnitude and Phase response curves.

- MAGN: Magnitude
- PHASE: Phase
- START: Smoothing start point
- STOP: Smoothing end point
- OCT: Degree of smoothing ; OFF - 1/48 per octave
- ADD: Can add multi-segment smoothing
- REMOVE: Removes the selcted smoot.

TARGET CURVE DESIGN



Target curve design, design the system target curve you want, and then generate the curve that fits the target through the AEQ operation to obtain the curve the user wants.

- A\_Level: Overall level boost
- B\_Segments: Switch the target curve preset, the system default to 2 groups of presets
- FLAT: Flat curve
- AUTO: Automatic curve ( the algorithm will target an optimized curve following the shape of the measured original one); new preset can be saved via function "SAVE" (E).

# AEQ - Configuration page: AEQ configuration

## TARGET CURVE DESIGN

**C. PRESET:** Preset parameters can be inserted, the overall boost/attenuation of the mid-high frequency can be performed and multiple segments can be added at the same time (similar to boosting or attenuating a high shelving filter)

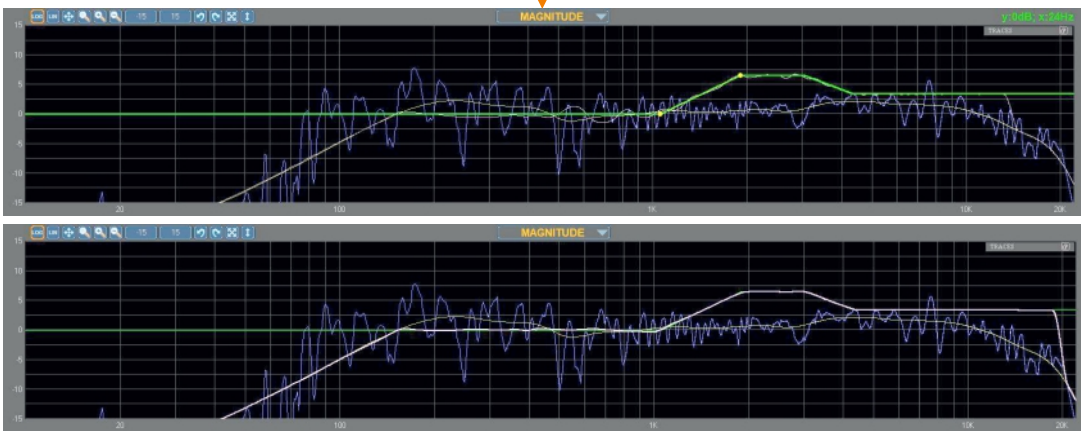
PRESET

START	STOP	dB/Oct
1057	1903	7.7
3026	4331	-6

ADD

REMOVE

According to the preset design it can be seen that the green Target curve changes, and the final output curve (pink) changes according to the Target curve at the same time.



**D. PEQ:** Design the target curve in PEQ mode, when the current PEQ is selected, you can drag the drawing area to modify the frequency band and gain

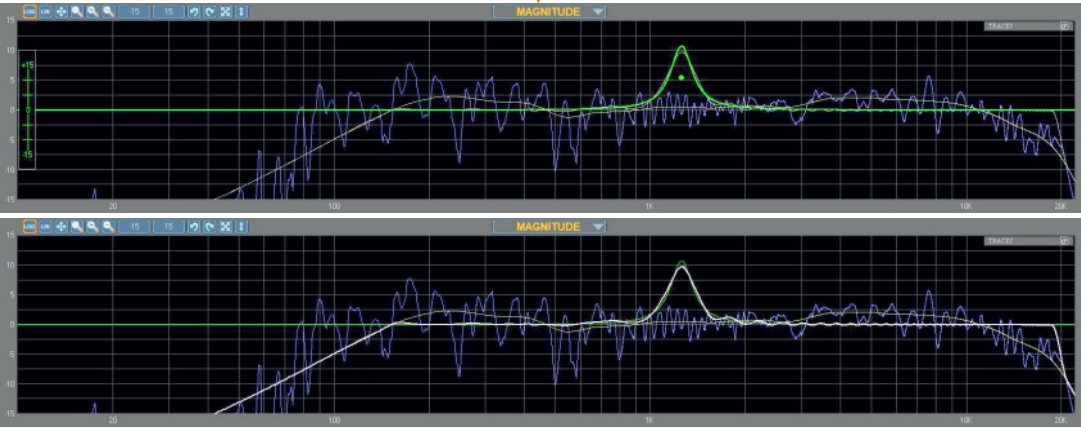
PEQ

FREQ	GAIN	Q
1256	10.7	5

ADD

REMOVE

Adding the PEQ design it can be seen that the green target curve changes and the final output curve (pink) changes according to the Target curve at the same time.



**E. SAVE:** After the design is completed the target curve can be saved and the preset can be quickly selected and switched in "B" SEGMENTS.

## AEQ - Configuration page: AEQ configuration

### AEQ CALCULATION ADJUSTMENT

If you need fast automatic calculation, you only need to select the corresponding mode, turn on "AUTO" and then plug in the device.



**A\_ MODE SWITCHING:** FIR/IIR/FIR+IIF optional, enabling FIR requires external EQ/Frequency division mode to use FIR filters (for example EQ mode: 17 PEQ+FIR can be used, 31 PEQ can not be used FIR).

**B\_ ONLY CHECK MAGN:** AEQ only operates on the Magnitude, not the phase:

**ONLY CHECK PHASE:** AEQ only performs arithmetic processing for phase, not Magnitude;

**CHECK MAGN +PHASE:** AEQ performs arithmetic processing on Magnitude and phase at the same time.

Note: In IIR mode, only MAGN can be checked and IIR can only process Magnitude.

AEQ - Configuration page: AEQ configuration

AEQ CALCULATION ADJUSTMENT

C\_ MAGNITUDE PART

MAGN

1

Max Boost [dB]

20

2

Min Freq [Hz]

172

Max Freq [Hz]

10419

Auto Range

ENABLE

FREQ	BW	AEQ%
1162	1	0
1375	1/2	0

ADD

REMOVE

3

4

SHOW

- 1\_ MAX BOOST: The maximum boost range of AEQ operation
- 2\_ AEQ PROCESSING RANGE: Open the Auto Range system to automatically select the range or manually design the range
- 3\_ You can select multiple ranges that do not need AEQ processing in the AEQ calculation range, such as the orange zone range shown in the figure
- 4\_ Open SHOW; open the AEQ range line in the drawing area; you can drag to select



D\_ PHASE PART

PHASE

1

Min Freq [Hz]

323

Max Freq [Hz]

9642

Auto Range

ENABLE

FREQ	BW	AEQ%
864	1	0
613	1	0

ADD

REMOVE

2

3

SHOW

- 1\_ AEQ PROCESSING RANGE: Open the Auto Range system to automatically select the range or manually design the range
- 2\_ You can select multiple ranges that do not need AEQ processing in the AEQ calculation range, such as the orange zone range shown in the figure
- 3\_ Open SHOW; open the AEQ range line in the drawing area; you can drag to select



E\_ FIR: Modify FIR taps or reduce FIR operation delay

FIR

Taps

512

Minimum Phase

☐

Linear Phase

☐

Latency [ms]

1.25

Auto Latency

ENABLE

Minimize Latency

☒

Minimize Error

☒

F\_ IIR: Modify the number of PEQ segments and IIR

IIR

Nr. Filters

17

FREQ	GAIN	Q
201	-2	1.06
152	1	2.2
233	-1	1
199	0.5	1.8
393	-1	3.4



## AEQ - Configuration page: AEQ configuration and save write

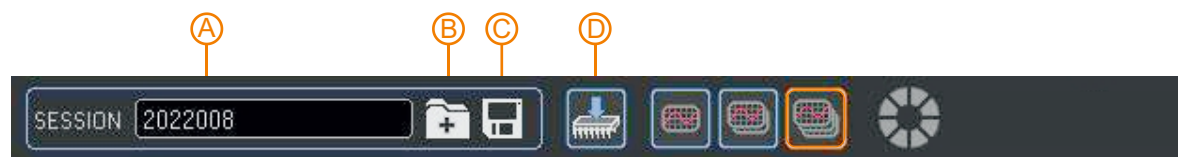
### AEQ POSTEQ



Post EQ can join PEQ after FIR processing

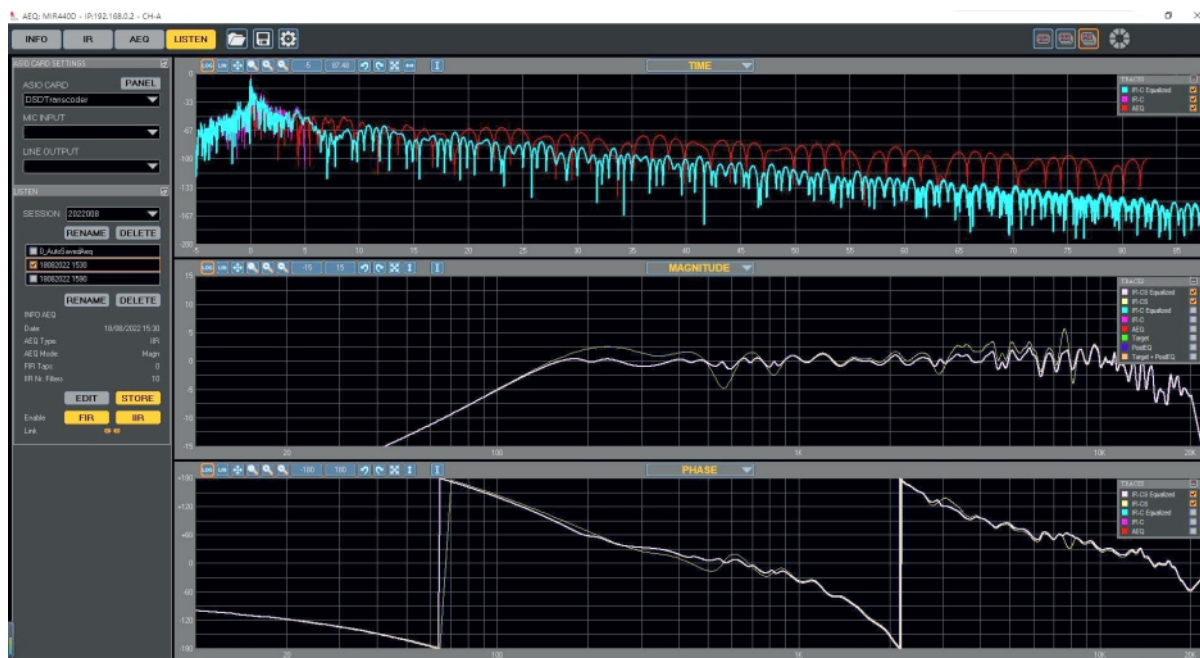


### AEQ: Save and write



- A\_ **SESSION**: Select / switch session
- B\_ Create a new session
- C\_ Presets are saved to the current session
- D\_ The current data is quickly written to the device

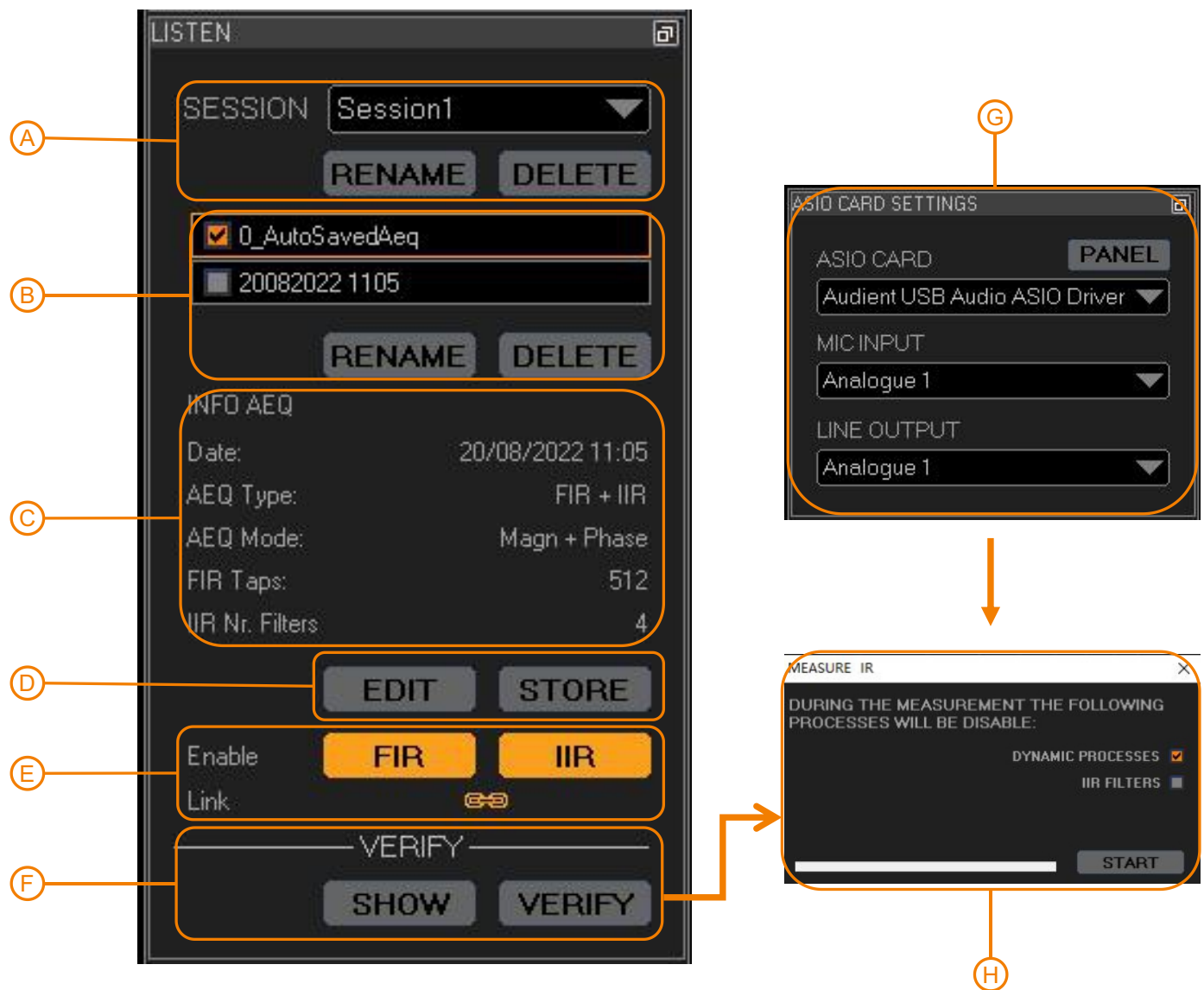
### LISTEN:





# LISTEN

## LISTEN TO THE COMPARISON



- A\_ SESSION:** Select/switch session; **RENAME:** rename session; **DELETE:** delete session
- B\_ Presets in the current session, switchable for comparison; RENAME:** rename presets; **DELETE:** delete presets
- C\_ Currently checked preset information STORE:** apply the currently checked preset; **EDIT:** edit the currently checked preset
- D\_ Currently check the FIR & IIR application selection in the preset and it is selected when it is lit; link: FIR & IIR linkage selection**
- E\_ To verify the measurement click STORE to apply the currently checked preset to the device to perform the verification measurement select sound card and channel for verification measurements**
- F\_ Click START to start measuring the pulse response of the system after application for verification**



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