

# Mirror Station Adjustment Manual

## Introduction

Most speakers in the field of car audio are usually sold as a single item, and function as "Speakers" only after they are installed by the specialty store. It is greatly different from the speaker for home audio which is installed in the enclosure from the beginning.

A speaker unit before the installation has its own unique characteristic of material and shape. Therefore, the design of enclosure and the capacity that are able to make the best use of it are necessary. An appropriate installation with understanding the feature of the speaker unit accurately and considering the in-vehicle acoustic characteristic and the back ground noise is the fastest way to bring out the best out of the speaker.

Because there are various restrictions inside the car compared with the listening room, the adjustment in accordance with the in-vehicle acoustic characteristic by the processor is indispensable to create the best sound field.

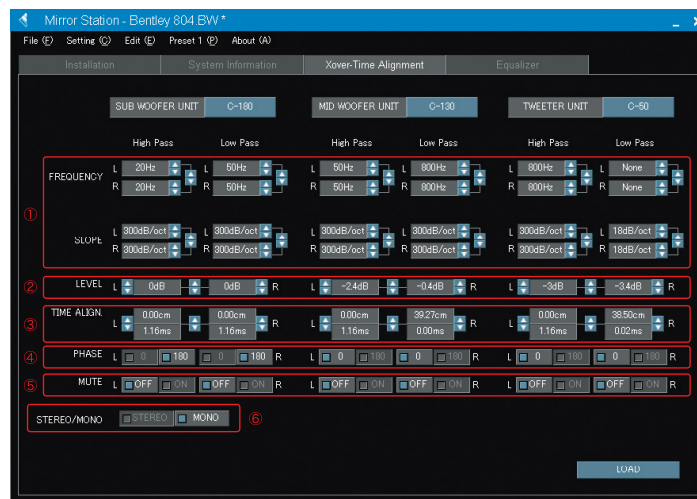
BEWITH's SIEG - Car Audio Analyzer measures the impedance characteristic and in-vehicle transmission frequency characteristic of the speakers easily and accurately. This is indispensable for the dealers to bring out the potential of the speaker units.

Also, referring the measurement result of SIEG results in an appropriate adjustment of BEWITH's DA converter with digital processor AZ-1 and AZ-2 in a short time.

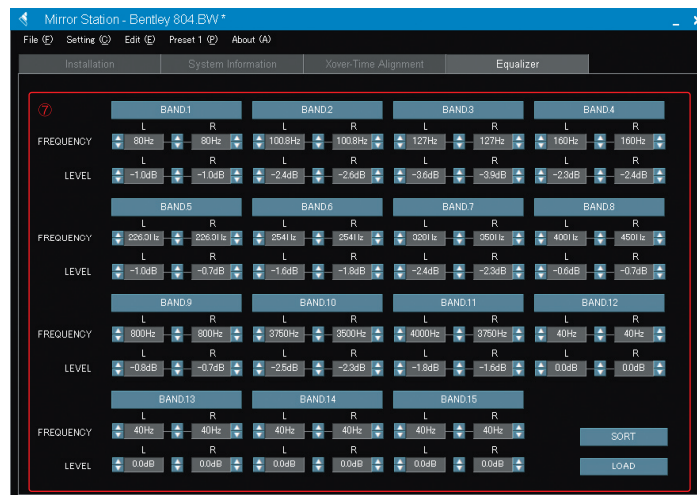
## Adjustment items of Mirror Station

Settings of Mirror Station are as follows.

- ① **Crossover setting between the units** : capable of adjusting L and R individually  
**Cut-off frequency** : choose 53 points from 10 to 20 kHz or none  
**Slope** : choose from 6 of -12 to -300 dB/oct.
- ② **Level adjustment** : adjusted at every 0.1 dB step from 0 to -24 dB
- ③ **Time alignment** : 0 to about 5m (0 to 14.70msec), at 0.77cm step (0.22msec step)
- ④ **Phase setting** : 0° or 180°...change the phase in each unit
- ⑤ **Mute** : set in each unit
- ⑥ **STEREO/MONO setting of Subwoofer**



- ⑦ **Equalizer** : choose 15 from 59 bands in 40 to 20 kHz  
 At every 0.1 dB step from 0 to -12 dB capable of adjusting L and R individually



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# The adjustment of Mirror Station

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## 1. Preparation of Mirror Station

### [ Necessary equipments ]

- PC for adjustment
- 2 USB cables (for the connection to SIEG and to Mirror Station)
- Audio source (a standard signal: 1 kHz 0 dB, Pink noise)
- Voltmeter
- Oscilloscope

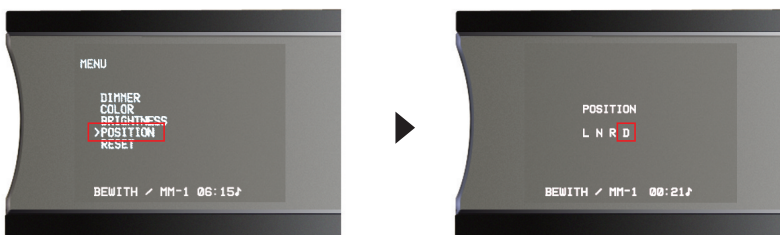
### [Preparation]

- Adjust the seat and set the listening position.
- Pull the USB cable connected to the Mirror Station up to the front seat.
- The audio source should be stopped or pull the CF out from MM-1 (for protection of the speakers).
- Check the display of the MM-1 for preset number, input source, and volume.

The display of the preset number and the input source will disappear after a while.

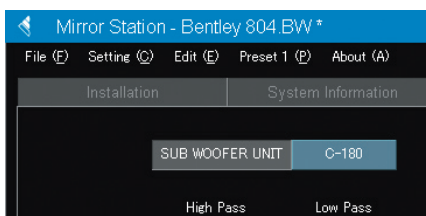


- Set the MM-1 to “D” (digital output) at [POSITION] setting in [MENU].



- Load “Mirror Station” program on your PC and connect the USB cable. Refer to the manual for the installation of the software and drive, or connection method. Choose a Serial port at [Port] setting of [Setting] menu. When it is connected properly, 2 COM cables are displayed. Choose one that has larger number. Now it is ready to use.

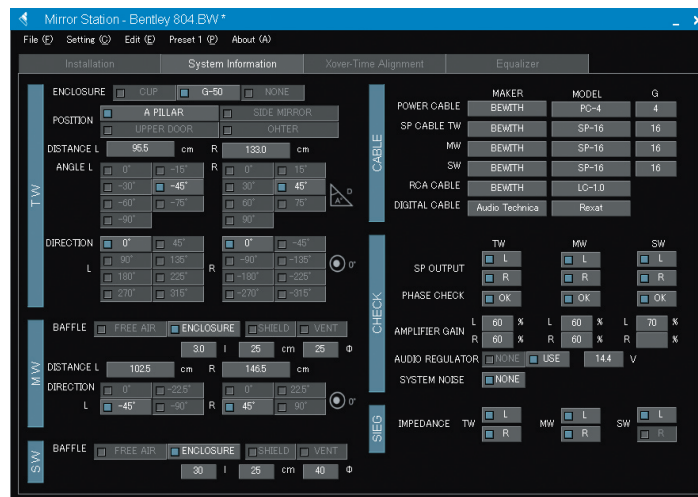
※Please refer to the manual for operating the equipment and software.



## 2. Input of installation information

Click [Installation] and [System Information] to input each item. You can also input data before or after the adjustment because it does not affect directly to the adjustment.

Because the customer data is very important for the communication between the customers and the dealers, and also between the dealers and us, we recommend that you input and save specific data of the customers.



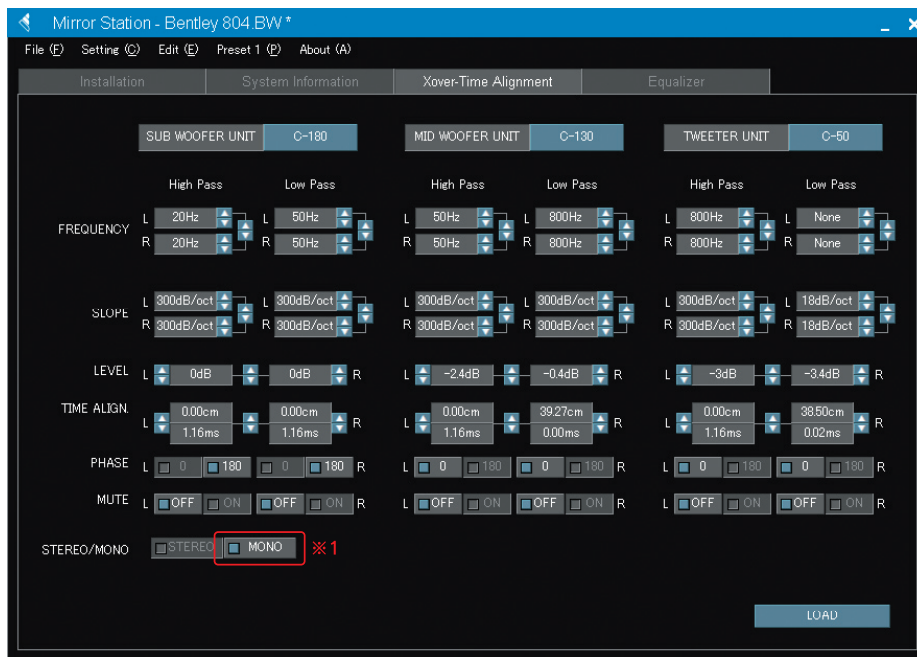
※1. Click yes at [MM-1] in [Installation] menu for synchronizing the power on to both MM-1 and Mirror Station. In this case, click [Load System Settings] for loading data to Mirror Station. Otherwise, the setting would not be changed. Also, wiring the [Remote Out] of the MM-1 Smart Interface to the [Remote In] of the Mirror Station is necessary.

※2. If an error comes up when clicking [Load System Settings] or [LOAD], the right [Port] has not been selected. Please make sure the wiring is correct and Mirror Station is powered on and select the right port.

### 3. Xover Frequency Setting

After making sure the CF is pulled out, turn on everything again and click [Xover-Time Alignment]. Choose appropriate slope value that is close to frequency slope value recommended for the speaker unit. Left and Right channels usually have the same value.

At STEREO/MONO setting, click [STEREO] for 1 SW, and click [MONO] for 2 SWs. After inputting the information, click [LOAD] to load data to the Mirror Station.



\*Caution! Please make sure of High Pass frequency setting for TW. Inputting too low frequency sound to TW may cause damage of the speaker unit depending on the volume.

※1 When setting SW to [MONO], left and right channels of SW outputs the same signal. When using both outputs of left and right channels for the bridge wiring of one SW, it is necessary to adjust both channels even if it is set to [MONO].

### 3. Xover Frequency Setting (with BEWITH speakers)

■ Cross point for tweeters and mid-woofers → **800 Hz**

■ Standard of the cross point for mid-woofers and sub-woofers (with 3-way system) → **40~63 Hz**

- Mid-woofer without enclosure → 63Hz
- Mid-woofer with smaller enclosure than 3-liters → 50Hz
- Mid-woofer with larger enclosure than 3-liters → 40Hz

\*Using SIEG, an appropriate cross point can be determined by measuring how much low frequency sound the mid-woofer can reproduce after the installation.

\*After adjusting high pass frequency of mid-woofer to 20 Hz, reproduce pink noise and measure FFT.

\*The sound from the back of the vehicle is hard to hear by setting low pass frequency of sub-woofer as low as possible.

■ High pass filter setting for sub-woofer (with 3-way system)<sup>※</sup> → **20~35 Hz**

※Standard reproduction frequency for sub-woofer

- Capacity of sub-woofer enclosure (20 liters) → 30Hz
- Capacity of sub-woofer enclosure (30 liters) → 25Hz
- Capacity of sub-woofer enclosure (35 liters) → 20Hz

\*An appropriate duct design is needed for each enclosure.

■ High pass filter setting for mid-woofer (with 2-way system) → **20 Hz**

#### ■ Setting when video image is inputted

When cut-off slope is steep (-300dB/oct.), audio may be reproduced slower than the video image because the amount of the operation of Mirror Station increases. Adjusts the setting shown below in this case;

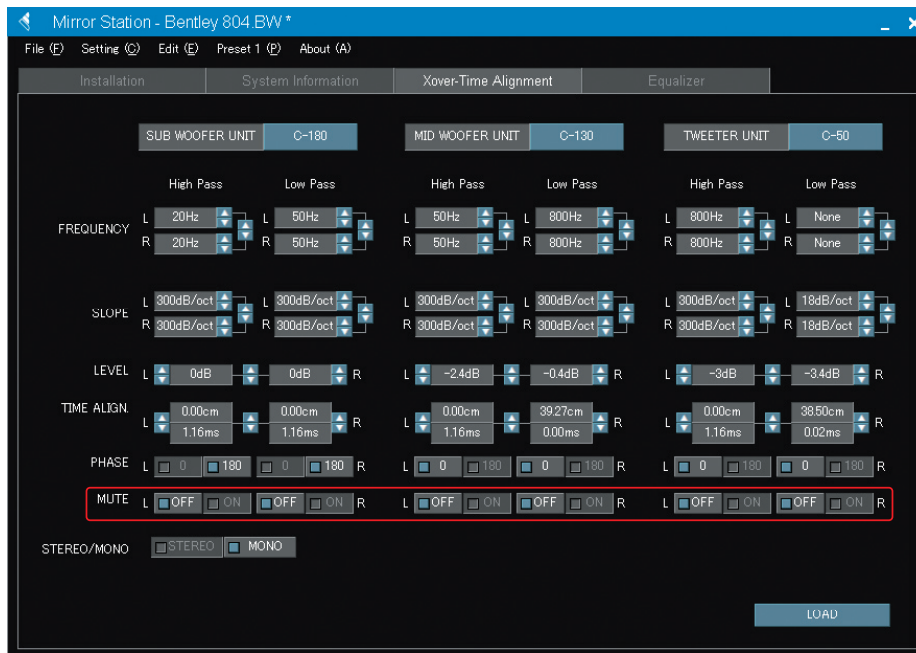
- Cut-off slope : HighPass → **-12dB/oct.**  
LowPass → **-18dB/oct.**

\*Because this data will be useful to preset the data when the video image is reproducing along with the audio, save it in another Preset data. (The presets of Mirror Station can be selected in each input system.)

## 4. Confirming the connection

Confirm all 6 channels (L and R for each TW, MW, and SW) of amplifier and the speakers are connected properly.

Turn the Mirror Station's volume down enough. Click [OFF] at all the MUTE except one channel. Play pink noise or some music and turn the volume up gradually. Make sure the sound comes out from the corresponded speaker. Next, click [ON] of the MUTE and click [OFF] of one of other channels. Check the sound of the speaker and repeat the check on all other channels. Also, noise check is necessary on each channel.

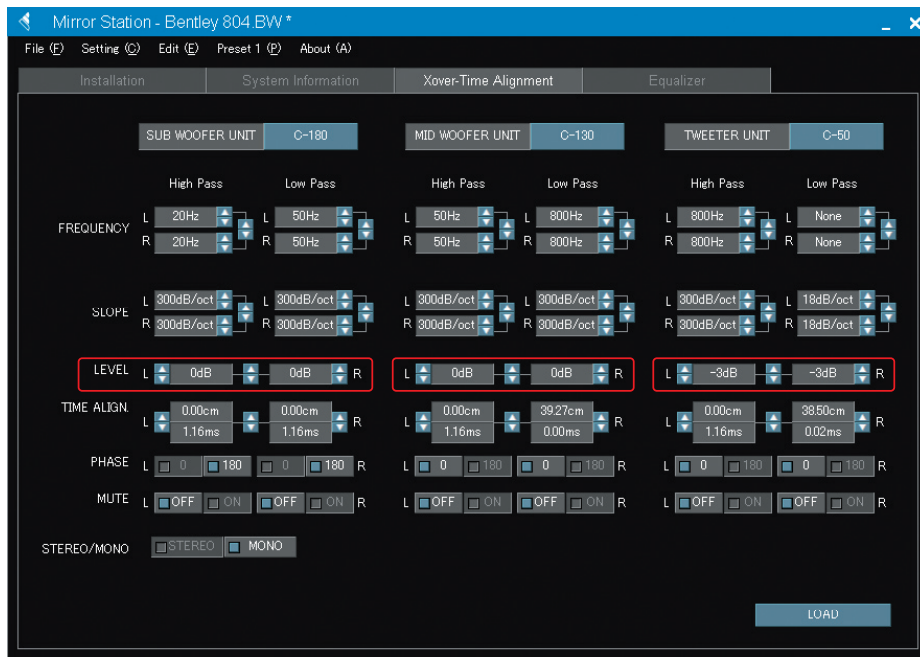


\*Please follow the instruction shown below for protecting the speakers when reproducing the sound.

- (1) Pull out the CF before turning on the power.
- (2) Confirm the volume is set low and the MUTE is on before inserting the CF.
- (3) Reproduce the sound source and turn the volume up gradually.

## 5. Adjustment of Level balance

Click [OFF] of all channels MUTE and play music. Adjust the level balances of the TW, MW, and SW. In this case, set the levels of right and left are the same.



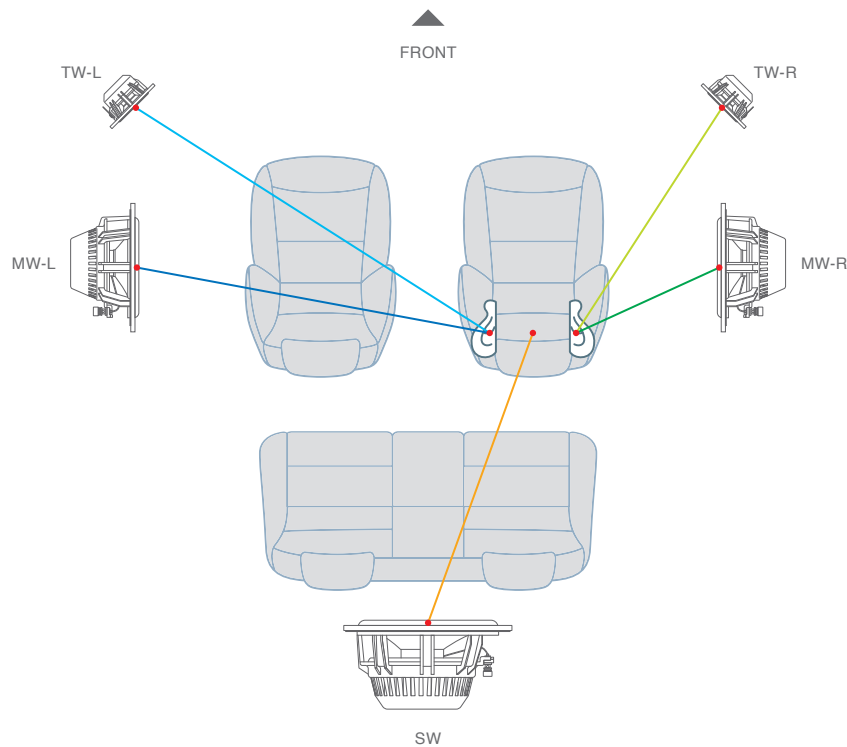
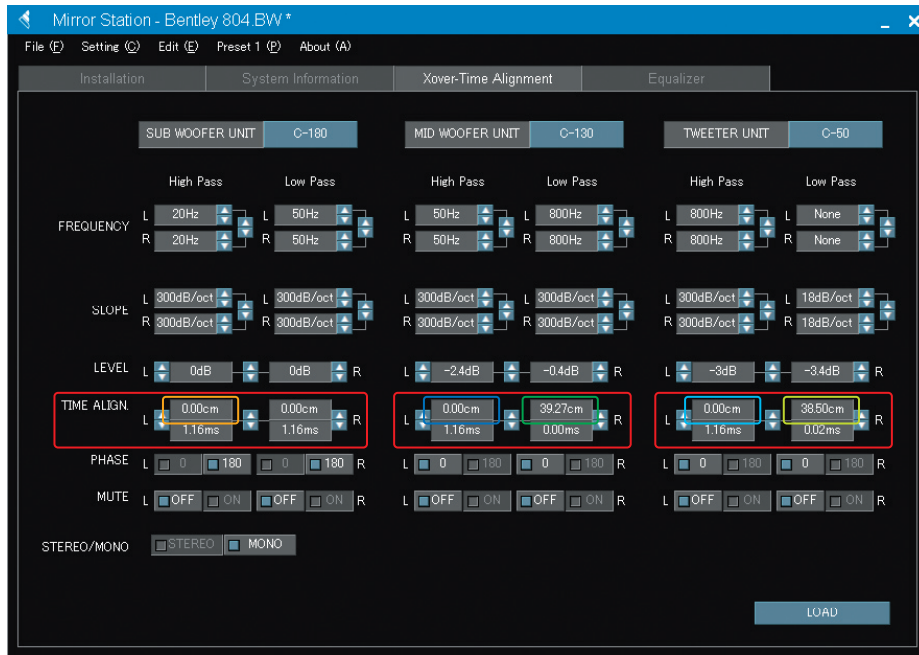
\*Before adjusting time alignment, adjust approximate levels among tweeters, mid-woofers, and sub-woofers.

First, set the tweeter at -3dB, play music and adjust the level by ear. At this point, the levels of right and left are the same.



## 6. Adjustment of Time alignment

Measure the distance to each unit. Choose a near numerical value at every 0.77cm steps in [TIME ALIGN.]. The distance should be measured from the left speaker unit to left ear, the right speaker unit to right ear. When using only one SW, measure the distance from SW to the center of your head.



## 6. Adjustment of Time alignment

### ■ Time alignment adjustment

First, determine the center between the listening position and the location where you want the sound image at.

Generally, the point is set at between in front of the driver's seat and the center of the dashboard. There is a difficulty that the sound field on a side (right side in case of right steering wheel) near the window narrows when making the center in front of the driver's seat.

In the car which has depth of dashboard, make the point at the center of the dashboard. In the car that the windshield is close to the dashboard, set the point close to the driver.

### ■ The definition of Time Alignment

It adjusts the differences of the distance of each speaker by correcting the time of the reproduction. In accordance with this adjustment, it creates the system like home audio system which has equal distances from stereo speakers to the listening point.

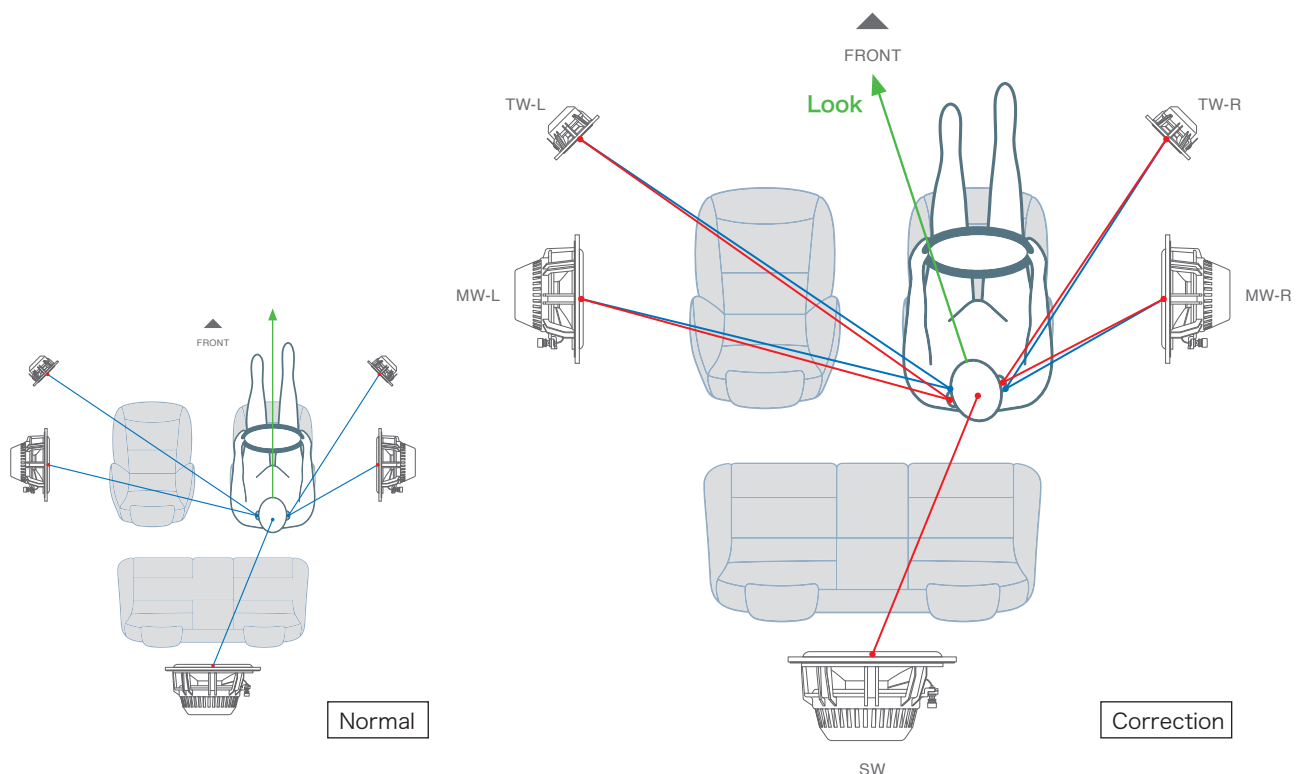
### ■ The way to gather the sound image in the area between the listener's face and the center of the car.

It is possible to bring the sound image close to the center by correcting time alignment when the distance from each unit to the ear is measured.

By inputting the measurements of the distance from an ear to each speaker, the sound image would be centered in front of the listener's face theoretically if all the sound levels reach to the ear equally. In localizing it in the center of the windshield, it results in better sound by correction mentioned below.

Though the face is turned to the front and it measures generally, whole body is turned to the center of the aimed location when the correction. By this method, the correction is possible to reduce the distances to -3 to -5 cm in the close speakers, and increase the distance to +3 to +5 cm in farther speakers (total 6 to 10 cm).

It is desirable to carry out the actual measurement with 2 persons to get precise value.

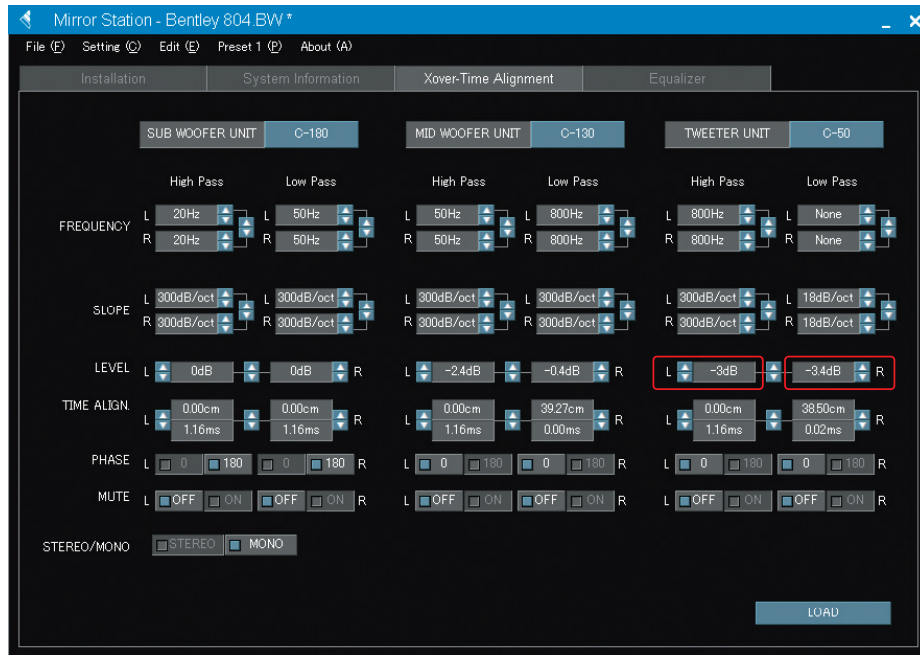


## 7. Precise adjustment of left and right level

Adjust the level between left and right speaker unit to localize the sound image in front.

First, click [OFF] of both TW's L and R at the MUTE. Play music and cut down the level of the channel which has larger level than the other. Adjust both levels equally by listening and adjust MW and SW as well.

Next, play music with all the channels and adjust whole balance.



## 7. Precise adjustment of left and right level

### ■ The adjustment of left and right levels

There are many sound senses which are included in the sound source and it is impossible to adjust or newly create them. It is important to localize the sound on the aimed location in the sound field. If it is not enough, the sound image would become unstable in high and low frequency ranges and blur.

### ■ A procedure of level adjustment

The adjustment utilizes the monaural sound source, and adjusts each level of tweeter and mid-woofer. And it sets the monaural source (the center of the sound field) in an aimed location. Finally, adjust and confirm all the sound.

When the adjustment of the mid-woofer is difficult, it is easier to adjust by increasing the High pass frequency temporarily. As well as tweeter adjustment, it is easier to adjust by making the Low pass slope gradual. (DO NOT make the low pass slope lower than -18dB/oct. for the tweeter's safety.)

At first, the level between the listener and closer speaker is of course high. So you have to adjust it by shifting the sound image gradually to the aimed point. If the adjustment would be finished before the sound image reaches to the aimed point (especially with tweeters), each sound is set in different locations. To avoid this matter, set the sound image in a little far place from the aimed location and adjust it back to where it should be.

### ■ How to get the monaural sound source

It is easy to get the monaural sound source from iTunes. Go to Edit, Preferences, Advanced, and choose Importing and select Custom in Setting. A new screen pops up so change Channels to Mono. Select a song you want to convert and go to Advanced. Click Convert Selection to MP3 and convert it to MP3.

## 8. Adjustment of Equalizer

For accurate equalizer adjustment, measure in-vehicle acoustic characteristic by SIEG and refer the result.

Set up the microphone at the listening point (near the ear) and carry out the FFT analysis of reproduced pink noise. Because the pink noise originally has the characteristic of  $-3\text{dB/oct.}$ , it is sure to become a straight line that declines to the right in the graph where the frequency was shown with the logarithm scale of a horizontal axis. (It is about  $-30\text{dB}$  in between  $20\text{ Hz}$  to  $20\text{ kHz}$ .) However, in fact, it would have many peaks and dips because of the in-vehicle and equipment's acoustic characteristic and the condition of installation.



Therefore, search peaks of the frequency band from the result of the FFT analysis, and control them to obtain flat frequency response.

Click [Equalizer] and display equalizer setting menu. Choose the frequency band with the peak and input the level you wish to lower it. Also, click [LOAD] to load data to the Mirror Station.

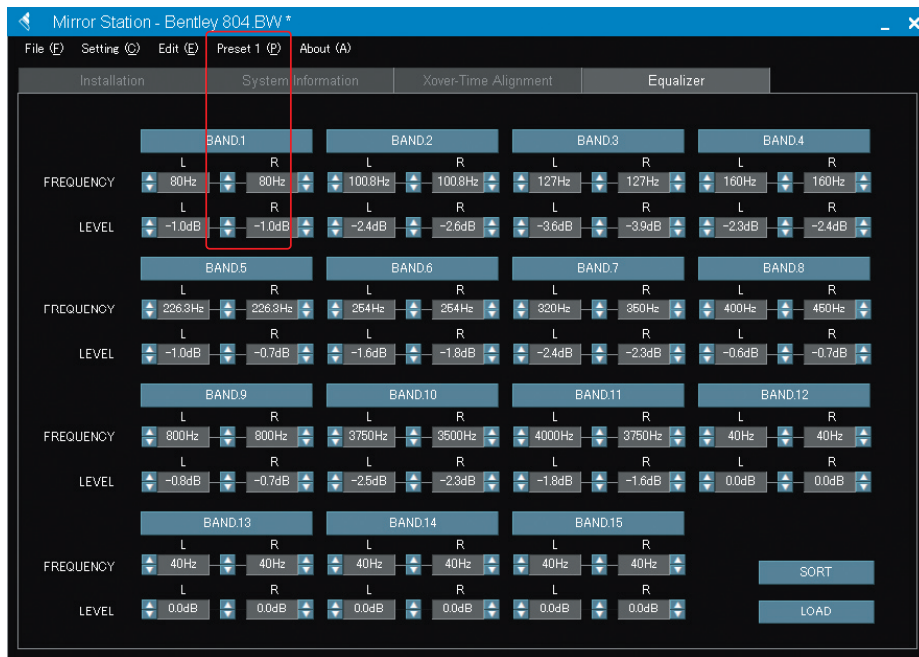


## 8. Adjustment of Equalizer

Repeat the equalizer setting and the measurement by SIEG. After that, readjust the level balance between TW, MW, and SW by playing music.

The Mirror Station is capable of memorizing 5 settings as preset 1 to 5. Save those results and readjust according to the music the customer prefers. ※1※2

When the adjustment is done, save the data to your computer from the Save menu in the File.



※1. Data of "Xover-Time Alignment" and "Equalizer" can be copied and pasted to other Presets by using "Preset Copy" and "Preset Paste" of "Edit" menu. As a result, the work of the input can be reduced.

※2. As it is mentioned before, the Mirror Station can memorize 5 different data. You also can save as many data as you want by creating new files of software on your PC. The results of the measurement and FFT analysis of SIEG are very important data for more advanced and precise adjustment and save much work hours.

## 8. Adjustment of Equalizer

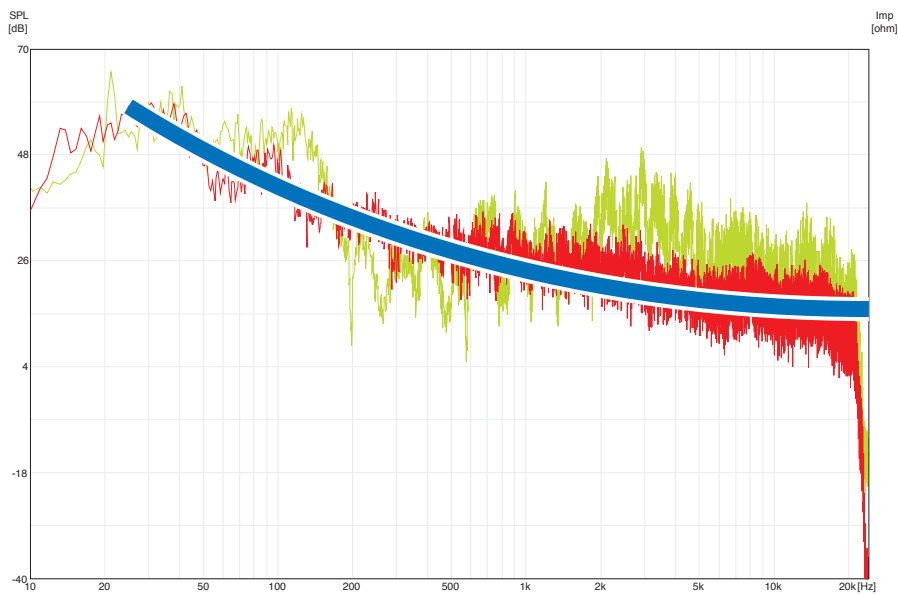
### ■ FFT analysis by SIEG

When you carry out the measurement with SIEG, push down the seat a little and hold the microphone in the area your ear is usually located at. It is desirable to use a microphone holder. Keep holding the microphone until the waveform will be stable.

It is desirable to set the volume of pink noise a little high (the volume of MirrorStation is about 105 to 110, SPL is 80 to 85dB(A) ). It is useful to set the MM-1 as Repeat file.

### ■ The target frequency response

Originally, the pink noise has the characteristic of  $-3\text{dB/oct}$ . It becomes a straight, lower right characteristic in the graph where the frequency (horizontal axis) was recorded by the logarithmic scale. You can actually draw a line to the FFT measurement graph and adjust the frequency. Actually, it is preferable to be euphemistic to downward, and aim at the curve of the arch.



### ■ The procedure of adjustment

Because lower frequency band influences the higher frequency band such as making peaks and wider waveform, adjust the equalizer by starting from lower frequency and up to higher frequency according to SIEG data.

Because of the capacity of the vehicle, a remarkable peak usually shows up at 80 to 160 Hz. Also, other peaks, which you should take measures of, show up at around 200 to 400 Hz and 800 Hz.

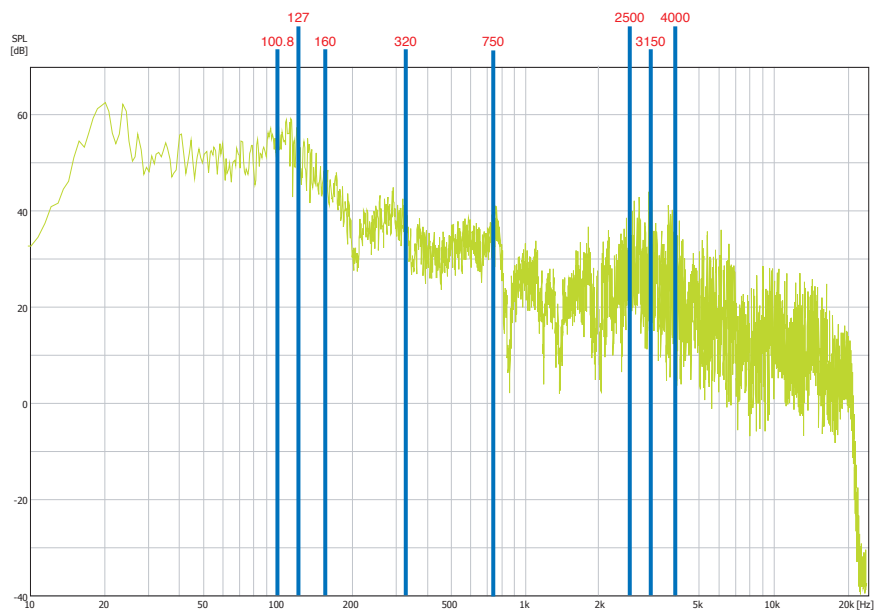
On the other hand, a big dip sometimes shows up at around 500 Hz. Mirror Station cannot adjust it by amplifying. However, in the appropriate attenuation of the peak before and behind that, the dip is naturally canceled or it may become small.

## ■ Adjustable bands

The equalizer of AZ-1 and AZ-2 has 1.0 of Q. Because the bandwidth is wide, the influence might reach the band next to it when one band is changed. When controlling large peak, adjust about 8 bands and use rest of the bands for fine-tuning. It is undesirable to use all 15 bands in the first adjustment.

The adjustments of the basic 8 bands are shown below (when installing the mid-woofer into an enclosure);

- |    |                |      |
|----|----------------|------|
| 1. | <b>100.8Hz</b> | -6dB |
| 2. | <b>127Hz</b>   | -8dB |
| 3. | <b>160Hz</b>   | -3dB |
| 4. | <b>320Hz</b>   | -4dB |
| 5. | <b>750Hz</b>   | -4dB |
| 6. | <b>2500Hz</b>  | -4dB |
| 7. | <b>3150Hz</b>  | -4dB |
| 8. | <b>4000Hz</b>  | -4dB |



After adjusting these 8 bands, carry out fine-tuning. Save the data after the adjustment.

If you need more improvement, it is effective to adjust those 8 bands according to the data after the fine-tuning.