

Owner's Manual

M/S - 2150 X
True Digital Amplifier



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WARNING

TO REDUCE THE RISK OF FIRE OR ELECTRIC SHOCK, DO NOT EXPOSE THIS APPLIANCE TO RAIN OR MOISTURE.

	<div style="background-color: black; color: white; padding: 5px;">CAUTION</div> <div style="border: 1px solid black; padding: 5px;">RISK OF ELECTRIC SHOCK DO NOT OPEN</div>	
<p>CAUTION: TO REDUCE THE RISK OF ELECTRICAL SHOCK, DO NOT REMOVE COVER. NO USER-SERVICEABLE PARTS INSIDE. REFER SERVICING TO QUALIFIED PERSONNEL.</p>		



The exclamation point within an equilateral triangle is intended to alert the user to the presence of important operating and maintenance (servicing) instructions in the literature accompanying the product.



The lightning with arrowhead symbol within an equilateral triangle is intended to alert the user to the presence of "Dangerous Voltage" within the product's enclosure that maybe of sufficient magnitude to constitute a risk of electrical shock to a person.

Important Safety Instructions

1. Read these instructions entirely before installing or operating this equipment.
2. Keep these instructions.
3. Heed all warnings.
4. Do not use this equipment near water or allow it to become wet.
5. Do not block any ventilation openings. Install in accordance with the manufacturer's instructions.
6. Do not install near any heat sources such as radiators, heat registers, stoves, or other appliances (including amplifiers) that produce heat; doing so may damage the unit and present a fire hazard.
7. Do not defeat the safety purpose of the polarized or grounding-type plug. A polarized plug has two blades with one wider than the other. If the provided plug does not fit into your outlet, consult an electrician for replacement of the outlet to one that is polarized. To protect against electrical shock, match the wide blade of the polarized plug to the wide slot in the outlet and fully insert the plug.
8. Protect the power cord from being walked on or pinched, particularly at plugs, convenience receptacles, and the point where they exit the equipment. Do not use this unit with a damaged cord or plug.
9. Only use attachments/accessories specified by the manufacturer.
10. Unplug this equipment during lightning storms or when unused for long periods of time.
11. Refer all servicing to qualified service personnel.

Cleaning and Maintenance

1. Always unplug the unit from the electrical outlet before cleaning.
2. Do not use abrasive cleaners. Simply wipe the exterior with a clean soft cloth. A small amount of nonabrasive cleaner may be used on the cloth to remove excessive dirt or fingerprints.

“Note” symbol

The >note<  symbol indicates information very useful or essential to daily operation.

Acknowledgments

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

IMPORTANT!



Registration

Please record your serial number here for future reference. You will need this for future upgrades or should you ever require service on your M/S 2150.

M/S - 2150 X serial number: _____

Optional modules installed:

ADC analog input _____

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Unpacking the M/S-2150 X

Carefully remove the M/S-2150X and accessory kit from the carton and check for shipping damage. Contact both the shipper and TacT Audio immediately if the unit shows any sign of damage from rough handling. All TacT Audio equipment is carefully inspected before leaving our factory.

KEEP SHIPPING CARTON AND PACKING MATERIALS for future use or in the unlikely event that the unit needs servicing. If this unit is shipped without the original packing, damage could occur and void the warranty.

Accessories

You should find the following items in the accessory kit:

- one AC mains cord
- RJ11 data cable
- RJ11-to-RS232 adapter
- 15' RS232 cable
- CD-rom with software
- remote control
- 2 AAA batteries
- one manual

Operating voltage

The M/S-2150 X amplifier is configured for either 110 or 220/240 volt operation. The operating voltage is clearly marked on the outside of the box and also on the rear panel beneath the AC mains connector.

BEFORE CONNECTING THE POWER, MAKE SURE THAT THE LABEL INDICATING THE VOLTAGE MATCHES THE VOLTAGE FOR YOUR COUNTRY

The M/S-2150 X has three operating modes:

- **OFF** AC mains power is cut off, either via the front panel mains switch, or by unplugging the amplifier from the wall outlet.
- **STANDBY** The unit is powered but all outputs are muted and the display is off. The amplifier uses very little current and is "idling" or "sleeping". Use the remote "STANDBY" button to toggle between ON and STANDBY.
- **ON** Everything is powered and ready to use.

Introduction

Congratulations on your purchase of your M/S 2150X. You have now acquired the most advanced stereo amplifier ever developed!

How does it work?

The digital input is taken to the central processor where it is reformatted into a pulse width modulated signal of extreme precision. The pulse rate is measured at precisely 384,000 pulses per second. Each pulse can have 256 different widths, with the narrowest pulse being a mere 10 nanoseconds wide. The clock frequency therefore is 98 MHz. The central processor uses proprietary patented algorithms (Equibit) to arrive at exactly the right combination of pulse widths produce a highly accurate waveform. This is the most fundamental departure from conventional amplifiers. TacT defines the waveform mathematically - we are not trying to follow or emulate a waveform by using feedback or feed-forward.

Once the decision of the duration of the pulse is made the central processor controls FET-switches at the output with extreme precision. Voltage and current are drawn from the power supply and fed to the speakers.

The level of playback is controlled by adjusting the voltage of the power supply. As this voltage is switched directly to the speakers, it is of paramount importance that the power supply be totally free of ripple and noise. For TacT digital amplifiers, a switch mode power supply of extreme precision with ripple rejection of more than 135 dB has been developed. At full volume (voltage) the TacT M/S 2150 X delivers 58 volts, equivalent to 150 Watts into 8 ohms. To reduce the volume the voltage of the power supply is reduced. This means that the volume control is no longer part of an active circuit.

Why hasn't anybody thought of it before?

Why has this not been done before? - Well, try to switch 58 volts DC 384,000 times per second without creating even a whisper of noise at a distance of 1" from the tweeter! Only in the past few years has it been possible to create a fully digital "amplifier".

Features:

- Ultra high precision DA conversion
- Upsampling to 384,000 Hz before conversion
- Full resolution at -30 dB
- Software upgradeable DSP section
- All floating point processing
- 192kHz/24bit AD converter
- Digital pre-amplification with 24-bit resolution at a playback level of -39 dB!
- Output of 2x300W into 4 Ohm load, with extreme load tolerance
- NO feedback or feedforward locally or globally is utilized in the signal path

Dynamic Room Correction

M/S-2150 X is designed to support full range and subwoofer Dynamic Room Correction (DRC). All software necessary to perform this task is built into each M/S-2150 X. However M/S-2150 X does not have built in microphone preamp and it does require an external digital microphone preamp such as BOZ RCS-16M. With RCS-16M up to 16 channels of DRC can be performed. Each M/S-2150 X channel can be configured as main (full range) or subwoofer channel. After measurements are completed RCS-16M is no longer needed and it could be permanently disconnected from the system.

Dynamic Room Correction (DRC)[®] is new technology developed by Tact Audio Inc. over past two years. This groundbreaking brings the science and art of Room Correction, and specifically Tact room correction products, to yet another level.

When we introduced our first RCS system (the Tact-2.2 in the late 90's) we were fully aware that we were embarking on a long term research process in the new exciting field of room acoustics correction. As a result of this research effort we brought to the market products such as Tact-2.0 S two channel RCS preamp, the Tact-2.2 X two channel preamp with RCS on two main and two subwoofer channels, and the TCS MKII ten channel theater correction system. All these systems offer RCS technology not found in any other product on the market. Our continued research combined with enormously valuable feedback from our customers has resulted in this new technology that we named Dynamic Room Correction (DRC)[®].



Why do we call it Dynamic Room Correction (DRC)?

The reason we call it DRC is that the target curve used to compute correction filters dynamically changes with the master level control. In another words, for every 0.1 dB of level change the system uses a new target curve to compute room correction filters. What makes this dynamic is that all computations and adjustments are done on the fly without any interruption to the music you listen to.

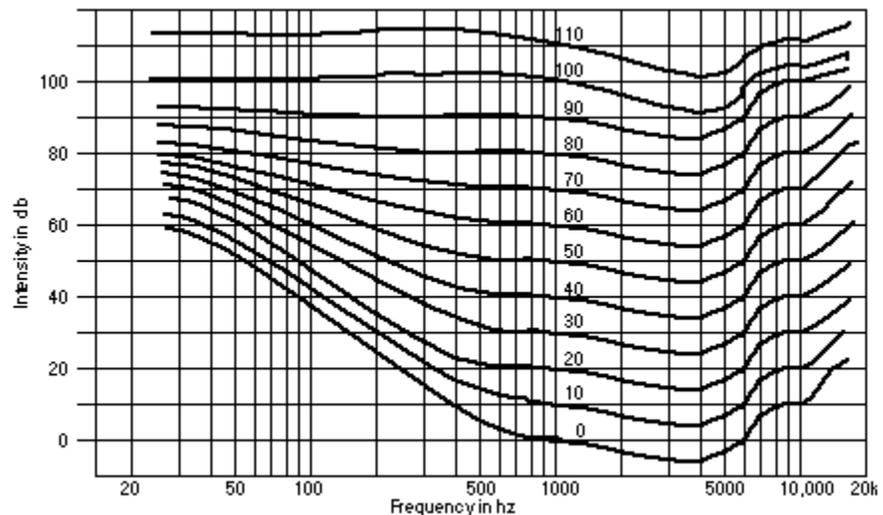


Why do we need Dynamic Room Correction (DRC)?

It is well known fact that humans do not here all frequencies at the same level. It is also known that our ears are more sensitive to frequencies between 2000 and 5000 Hz than to frequencies bellow 2000 Hz and above 5000 Hz. In addition to this our hearing sensitivity changes with sound pressure level (SPL). This human hearing property was first discovered and experimentally confirmed by Fletcher and Munson at Bell Laboratories in 1933 and later refined by Robinson and Dadson in 1956. Their work resulted in a family of equal loudness curves (contours), widely known as Fletcher-Munson equal loudness curves. A sample of Fletcher-Munson loudness curves is shown in the figure bellow.

On the graph bellow there are 12 curves numbered from 0 to 110. These numbers represent the loudness level in **phons**. A Phon is a unit used to describe the loudness level of a given sound. The reason for introducing the loudness unit is that two sounds with the same SPL (dB) do not necessarily have the same perceived loudness. Phon is equal to SPL in decibels at 1000 Hz. For example, 80 phons means as loud as 80 dB, 1000 Hz tone.

Equal loudness curves represent the SPL that different frequencies need to have in order to be perceived as two tones of equal loudness. For example, a 200 Hz tone at SPL of 50 dB will have the same perceived loudness as a 1000 Hz tone at SPL of 40 dB. In this case both 200 Hz and 1000 Hz tones have a loudness of 40 phons, and they both belong to the 40 phons equal loudness curve.



Fletcher-Munson equal loudness curves

As it can be seen from the graph, in comparison to frequencies between 2000 and 5000 Hz, it is intrinsically harder for us to hear very low frequencies (below a few hundred Hz) and to a lesser extent very high frequencies (above 7000 Hz). At higher listening levels this difference gradually becomes smaller and smaller and curves become flatter.

Traditional Tact room correction systems use one target curve that allows for full range 20-20,000 Hz room corrections. Once selected, the same target curve (same set of correction filters) was used at all listening levels. This approach did not take in account the fact that our sound perception, as described by Fletcher-Munson curves, is frequency and level dependent. Many of our customers have realized this fact and they have used the nine correction presets (available on all our RCS products) to program 2.0 S, 2.2 X and TCS MKII with nine different target curves each corresponding to a different listening level. In this way they were able to take into account the equal loudness curve effect by switching to new target curves as the master level changes.

Thus for a number of reasons it is clear that we need a room correction system that will perform room acoustics correction and at the same time dynamically change the target curve (correction filters) as the system listening level changes.



How does it work?

Dynamic Room Correction (DRC) offers a very sophisticated way of handling a multi target curve approach to solving equal loudness curve problem. The system is based on one reference target curve and eight additional target curves called dynamic target curves. The reference target curve is used to perform basic reference room correction. Dynamic target curves are labeled 0, -6, -12, -18, -24, -30, -36 and -42 dB and are combined with the reference target curve to obtain the final target curve used to calculate correction filters.

For example, if the master level reads -10.3 dB (89.6 on the relative readout) the system will use the -6 dB and the -12 dB dynamic target curves and by interpolation will calculate a target curve corresponding to -10.3 dB. After that the system will combine the 10.3 dB target curve with the reference curve to obtain the final target curve that is then used to calculate the correction filters. New correction filters are loaded into the signal path as the music is playing and the new correction takes effect in a split of a second. The same process repeats again for any new master level setting.



What is the purpose of the computer interface?

With a DRC system, a computer is used only as a graphical user interface (GUI) and serves no other purpose. All calculations are performed inside the DRC processor. Target curves, measurements and other correction parameters are filed inside DRC flash memory. This approach will allow us to offer other GUI devices besides window based personal computers.



After target curve modification is made how long does it take for the new correction to be engaged?

Another main advantage of DRC technology is the elimination of the correction filters calculation and programming step. If you are current Tact user you are aware that, after the room measurement was completed and target curve was selected, you had to go through relatively long process of programming your RCS device with correction filters before being able to listen to the new correction. With the DRC technology when you make a change to the target curve, or select a new one, you click on the GUI 'Calculate' button to instantly calculate and engage new correction filters.

This new feature allows you to make small adjustment while you are listening to your favorite track and instantly here the changes you made. In this way without any interruption to the music you can make your system sound perfect down to the smallest details.

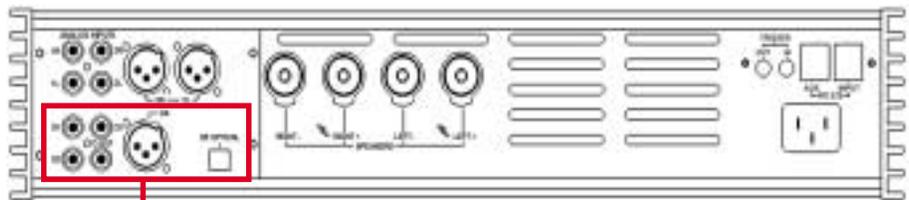
M/S-2150 X Connections

Digital input

The M/S-2150 X amplifier has 5 digital inputs:

- three RCA (S/PDIF) (D1, D2, D3)
- one AES/EBU (XLR) (D4)
- one TosLink (S/PDIF) (D5)

All of the digital inputs support PCM audio data with sampling rates from 32kHz to 96kHz/16-24 bits, however, the **AES/EBU and RCA/coaxial inputs support up to 192kHz.**



Digital Input Section

Analog input (optional ADC module)

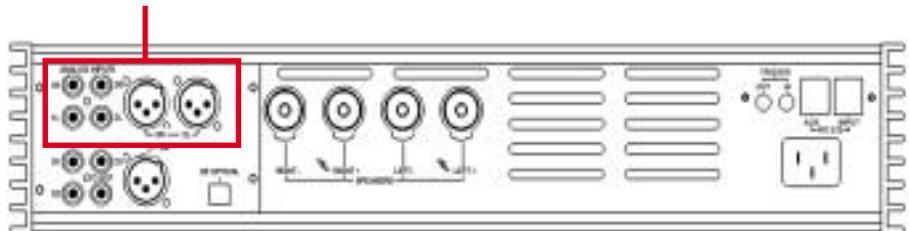
The M/S-2150 X amplifier has 3 stereo analog inputs with the optional ADC module installed:

- two analog stereo single ended (RCA) (A1, A2)
- one analog stereo balanced (XLR) (A3)



NOTE: A/D conversion is always performed at 24-bits/96kHz.

Analog Input Section



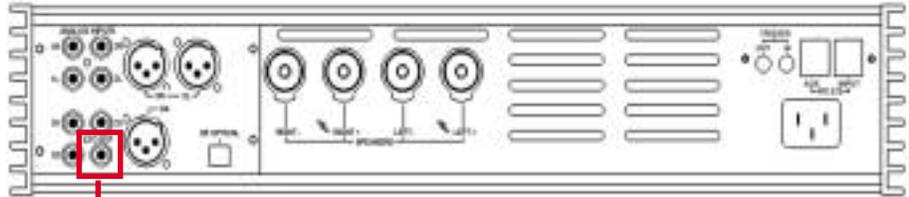
NOTE: The optional ADC module is required for analog inputs.

Digital output

The M/S 2150 X amplifier has a digital pass through. The digital input signal is passed to the digital output without processing or volume control. The sampling rate is the native sampling frequency of the input.



NOTE: that this output is not active when analog input is selected.



Digital Output

RS-232 interface ports

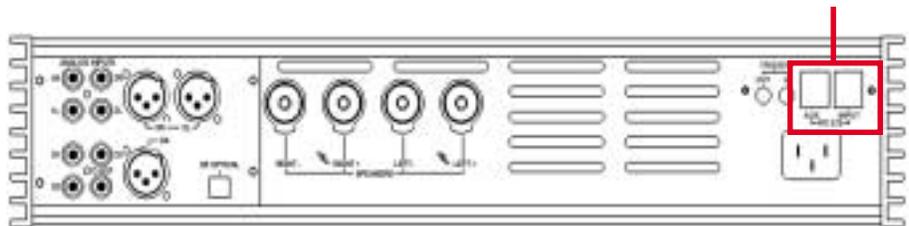
The M/S 2150 X has two RS232 interface ports:

- INPUT
- AUX

Use the **INPUT** port for communication with your Tact master controller or Personal Computer.

Use the **AUX** port to connect to other TacT products. This port should always be connected to INPUT port of another device.

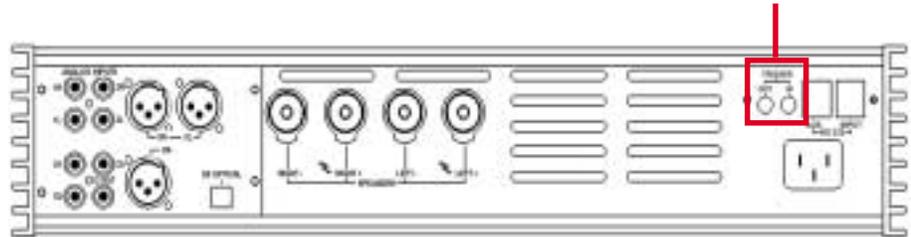
RS-232 Interface Ports



Trigger outputs

The M/S-2150 X has a trigger “IN” and “OUT” to provide on and standby control from a trigger device and to pass the trigger signal to another device.

Trigger Connectors

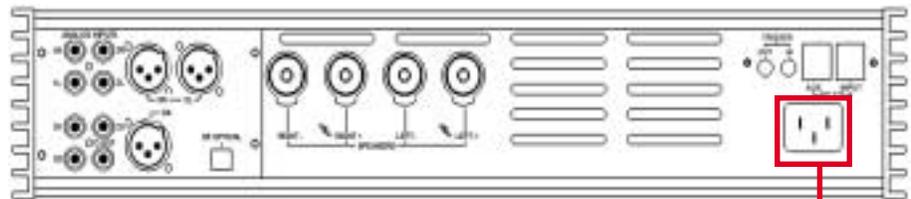


AC mains input



Connect the M/S-2150 X to the AC mains wall socket.

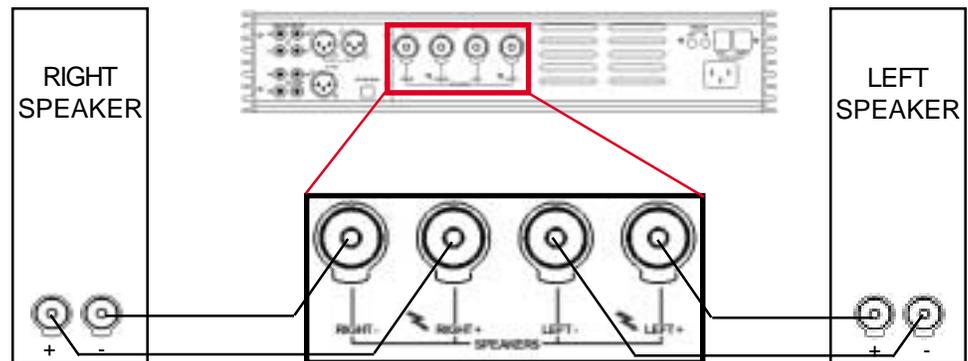
CAUTION: Use the supplied IEC mains cable, or a 3-prong grounded cable only.



AC Main Input

**Speaker output
(normal operation)**

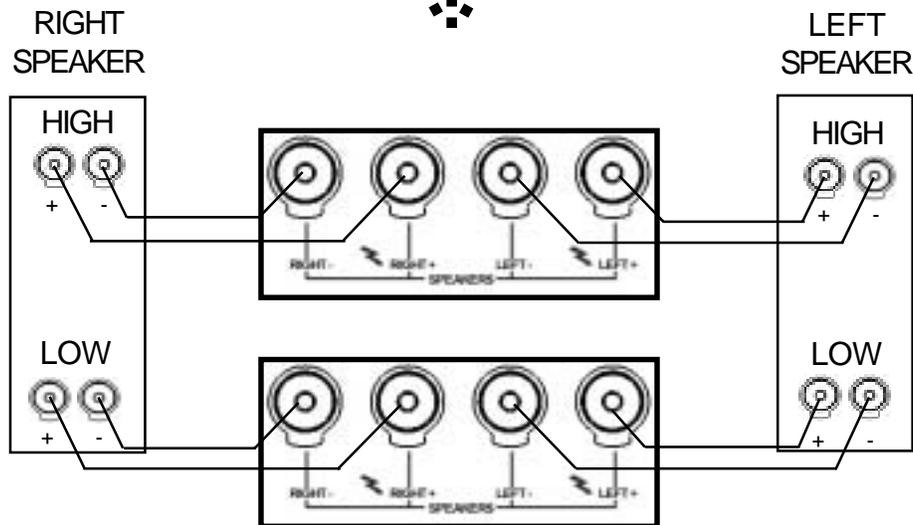
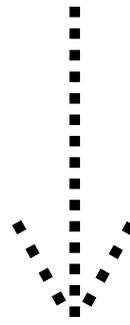
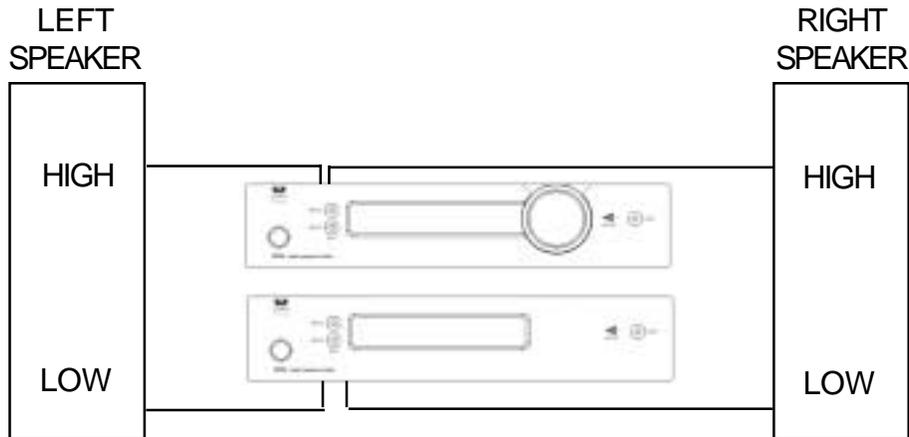
The M/S-2150 X amplifier has one pair of high quality speaker terminals. These terminals will accept both spade- and banana-plugs. When connecting your speakers, please make sure that the RED/HOT terminal is connected to your speakers' POSITIVE terminal and the BLACK/COLD terminal is connected to your speakers' NEGATIVE terminal.



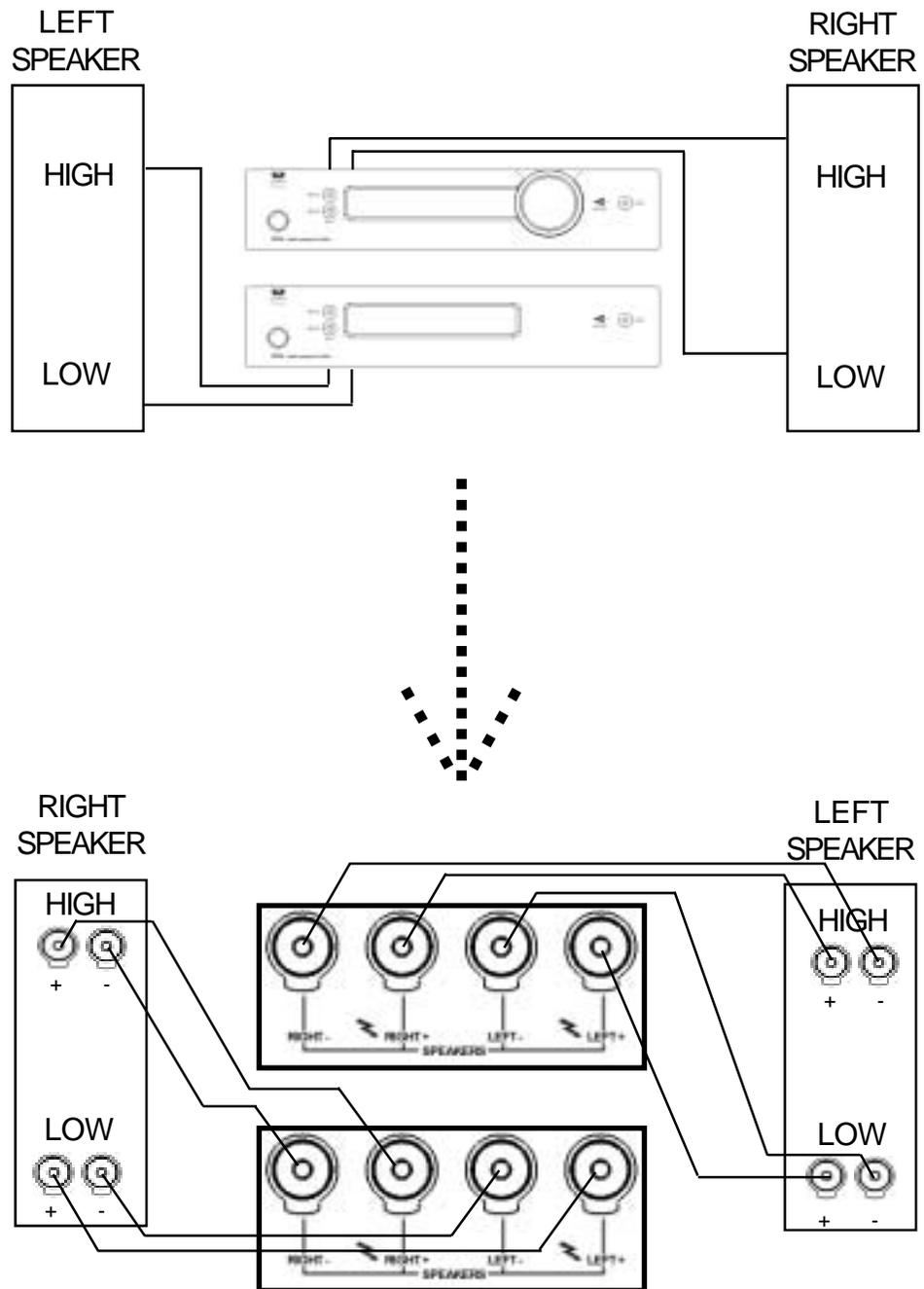
**Speaker output
(Biamped operation)**

If you are using two or more M/S-2150 X amplifiers, and your speakers allow for multi-amping, you can configure the system to run in biamped, tri-amped or multi-amp mode. This type of setup allows for one amplifier channel to drive a specific driver or frequency region. The most commonly used setup is biamped (two channels to each speaker: high and low frequency range). The following are two examples of making a biamped connection:

Horizontal Biamping



Vertical Biamping

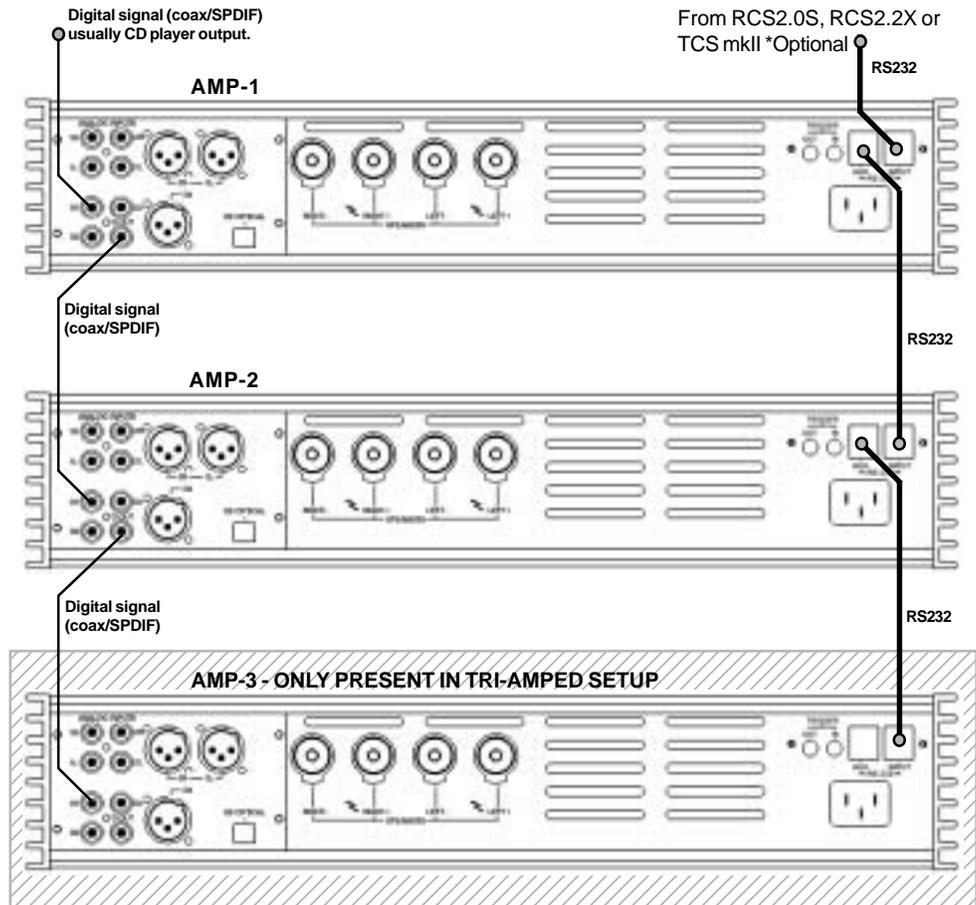


Biamping - continued

When two or more M/S-2150 X amplifiers are configured in a bi-/tri-amped setup, both the signal and the RS232 TacT System Bus must be daisy chained between the amplifiers.

The same signal flow is applicable for both horizontal and vertical bi-amping.

From source

M/S-2150 X
Configurations

With its advanced DSP control, the M/S-2150 X can enable digital crossovers package (high-pass, low-pass and band-pass) making it possible to configure M/S-2150 X amplifiers to virtually fit any loudspeaker system.

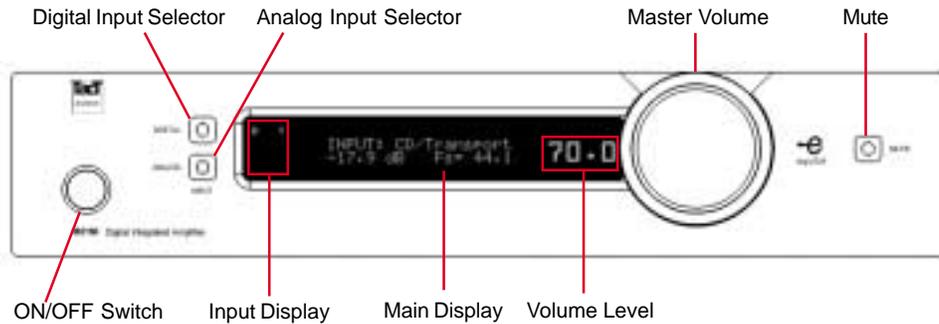
Examples of how a TacT active system can be configured:

1) Active two-way. The M-2150 X operates as master amp (control unit) and the S-2150 X operates as normal/slave amp. M-2150 X has a DSP-based high-pass filter and drives the high-section of the 2-way loudspeaker system. S-2150 X has a low-pass filter and drives the bass-section of both loudspeakers.

2) Active three-way. Amp 3, M-2150 X (master unit) is set to implement a high-pass filter and drives the tweeter section. Amp 2 (normal/slave), S-2150 X is set to implement a band-pass filter and drives the midrange section. Amp 1 (normal/slave), S-2150 X is set to implement a low-pass filter and drives the bass section.

Front Panel Controls

The front panel controls on the 2150 X amplifier will allow you to control all of the amplifiers main features. All secondary options are controlled with menus using the remote control or the supplied software. The exclusive “TacT wheel” is the master volume control. (The wheel is only available on the M-2150 X)



ON/OFF

Use the “ON/OFF” switch to toggle between ON and OFF operation. (Standby mode can be selected only through the remote control)

Master volume

The master volume is controlled by turning the large volume wheel. The green numbers on the left side of the wheel will change as you turn the wheel - this is your master volume level indicator. Master level is displayed on the **Volume Level** display and on the **Main Display**. **Volume Level** display shows master level in relative numbers with 99.9 corresponding to the maximum level and 0.0 corresponding to the minimum level. **Main Display** shows master level in dB's with 0 dB corresponding to the maximum level and -99.9 dB corresponding to the minimum level. The wheel sensitivity, maximum volume and other settings can be found in the “OPT” menu. S-2150 X master volume can be controlled only by the supplied remote control. M/S-2150 X master volume can be controlled via RS232 connection.

Mute

Use the “MUTE” button to mute or un-mute during playback. The master level indicator will switch to “-” in Mute mode. You can still adjust the master volume while the unit is in Mute mode - the master level indicator on the **Main Display** will show current master level in dB's.

Digital input selector

Press the “DIGITAL” button to select the digital input. This is a toggle switch, and pressing it multiple times will toggle through all of the five digital inputs. The selected input will be displayed in the input display portion of the display screen.

Analog input selector

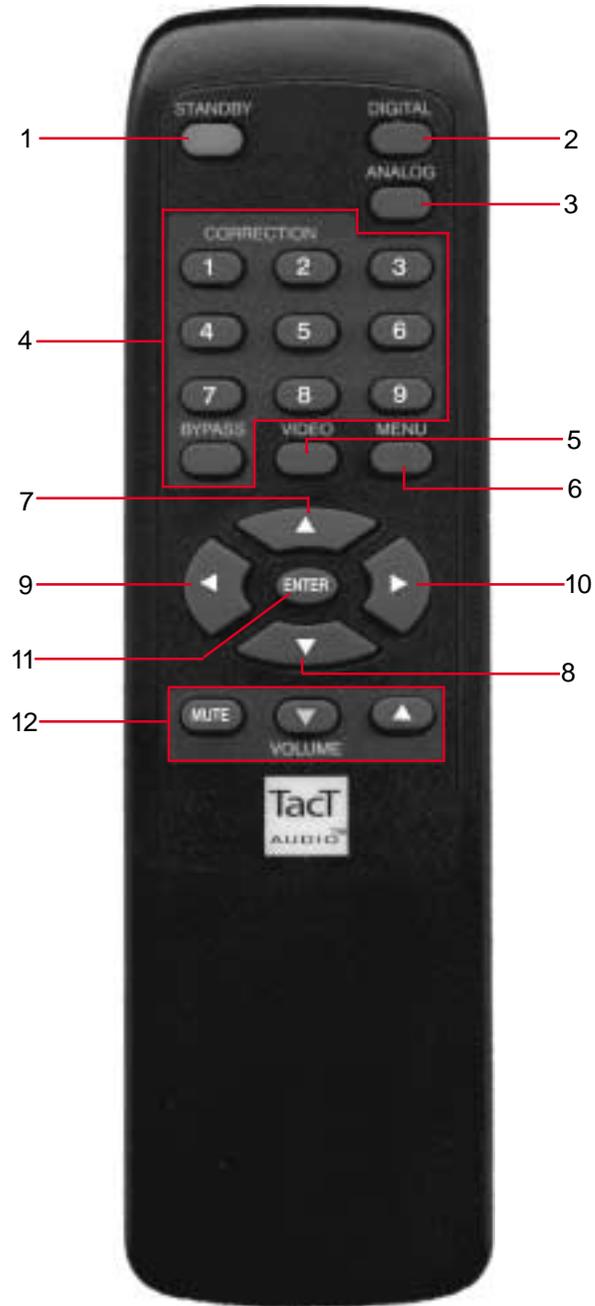
Press the “ANALOG” button to select the ANALOG input. This is a toggle switch, and pressing it multiple times will toggle through all of the three analog inputs. The selected input will be displayed in the input display portion of the display screen.



NOTE: The optional ADC module is required for analog inputs.

Remote Control

The remote control is used to access the front panel display controls and menus.



1 - STANDBY

The STANDBY button will turn the M/S 2150 X “ON” or it will place it into “STANDBY” mode. When in standby mode, the unit is placed into a low power “idling” state. The standby button is also used to save changes that were made in the menu editing parameters. By placing the unit into standby the current settings are saved.

2 - DIGITAL

The DIGITAL button will scroll sequentially, allowing the selection of one of the 5 digital inputs.

3 - ANALOG

The ANALOG button will scroll sequentially, allowing the selection of one of the 3 analog inputs.

4 - CORRECTION block

The CORRECTION block buttons are inactive with this unit.

5 - MENU

The MENU button will switch the front panel display from the status screen to the main menu screen.

6. VIDEO

The VIDEO button is inactive with this unit.

7. UP

The UP navigational button is used to select menu options and/or change their values.

8. DOWN

The DOWN navigational button is used to select menu options and/or change their values.

9. LEFT

The LEFT navigational button is used to select menu options and/or change their values.

10. RIGHT

The RIGHT navigational button is used to select menu options and/or change their values.

11. ENTER

The ENTER button will select the menu option currently marked by the blinking cursor or is used to enter an edited parameter.

12. VOLUME Block

The VOLUME block consists of three buttons.

The “MUTE” button will mute/un-mute all enabled channels.

The “UP” button will increase the master volume level

The “DOWN” button will decrease the master volume level.

Front Panel Display

Main screen

When the M/S-2150 X amplifier is turned ON and the system loading sequence has completed, the amplifier will display the main screen.

Main Screen

1

2

MODE menu option is set to **CRO** mode. M/S-2150 X operates in crossover mode. **CRO** menu option is enabled and **RCS**, **MSR**, **DRC** and **DOPT** menu options are disabled.

RCS or RCS-SUB Mode

3

4

MODE menu option is set to **RCS** or **RCS-SUB** mode. M/S-2150 X operates in room correction mode. **CRO** menu option is disabled and **RCS**, **MSR**, **DRC** and **DOPT** menu options are enabled. **DRC** menu option is set to **OFF**

RCS or RCS-SUB Mode

5

MODE menu option is set to **RCS** or **RCS-SUB** mode. M/S-2150 X operates in room correction mode. **CRO** menu option is disabled and **RCS**, **MSR**, **DRC** and **DOPT** menu options are enabled. **DRC** menu option is set to **ON**

1 - Displays mode and preset selection as set in the **MODE** and **DRC** menu. This field displays CRO if CRO mode is selected. It will display RCS if RCS or RCS-SUB mode is selected and DRC menu option is set to OFF. It will display DRC if RCS or RCS-SUB mode is selected and DRC menu option is set to ON.

2 - Displays current parametric equalizer preset.

3 - Master level in dB

4 - Input sampling frequency indicator.

Main screen Selecting Presets

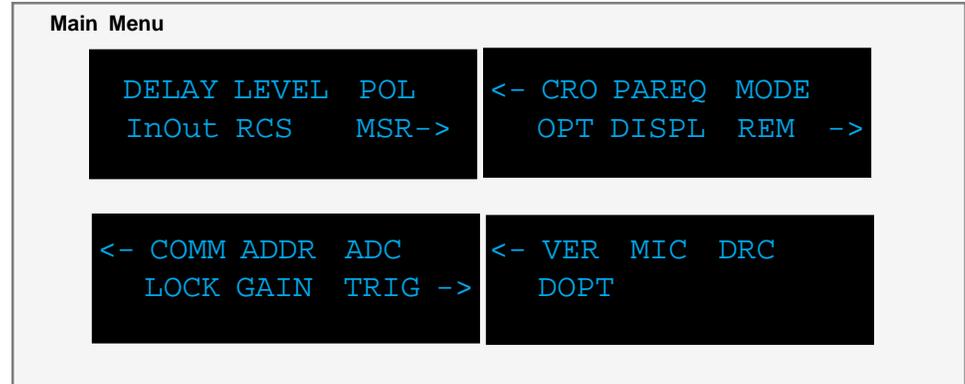
Use remote control LEFT and RIGHT buttons to place the screen pointer, labeled with “>” character (field 5), into field 1 for CRO or RCS/DRC preset selection or into field 2 for ParEq preset selection. When screen pointer is placed in field 1 then use remote control **CORRECTION** buttons to select CRO, or RCS/DRC preset. When the screen pointer is placed in field 2 use remote control **CORRECTION** buttons to select ParEq preset.

M/S-2150 X can support either room correction or crossover feature. Room correction and crossover features can NOT be used at the same time.



MAIN menu

The Main menu of the M/S 2150 X has three pages of general menu selections.



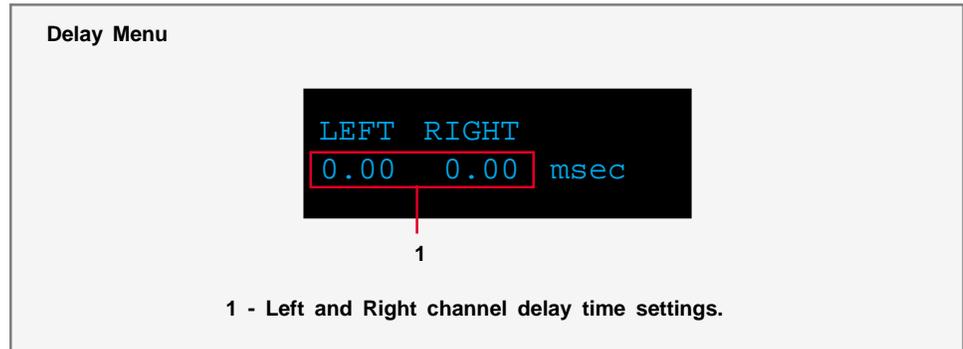
The remote control is needed to enter the amplifiers Menu selection pages. Press the **MENU** button to enter the amplifiers menu section. Use the **LEFT** and **RIGHT** buttons to highlight an option with the selection cursor. To enter a highlighted option press the **ENTER** button. Once you are in a menu option use the **MENU** button to go back one step (from sub-menus) or to return to the main screen.

**Saving Menu Settings**

Custom settings that are made to any of the menu selections may be permanently saved by placing the M/S-2150 X into standby mode. If you make changes to any of the menu items and turn the unit off before placing it into standby mode all settings will be lost. To place the M/S-2150 X into standby mode press the red "**STANDBY**" button on the remote control.

DELAY menu

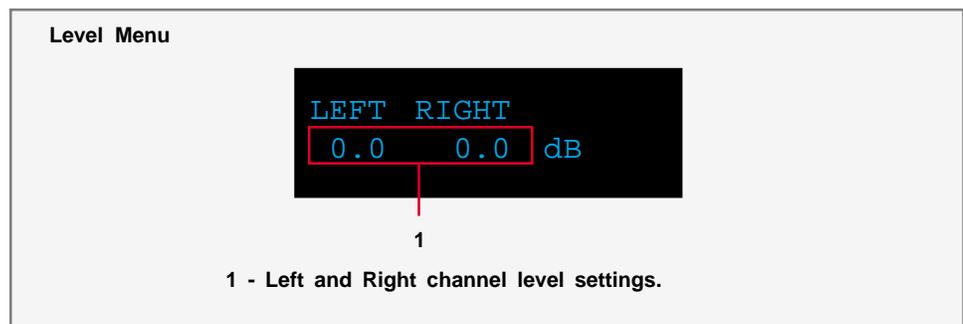
The Delay menu controls the system's time alignment. The system's time alignment can be adjusted by changing the delay time for the left and right outputs independently.



Use **LEFT** and **RIGHT** navigational buttons to highlight an option and use **UP** and **Down** buttons to change its value. The maximum delay time value that can be set is 31.95 msec (0.03195 seconds). Sound waves travel a distance 1 foot for approximately 1 msec. A unique delay time can be assigned to each crossover and correction preset. In the CRO mode delay times can be adjusted manually. In the RCS/DRC mode delay times can be adjusted manually or automatically as set in **DOPT** menu. In any operating mode delay time resolution is approximately 10.42 micro seconds (0.00001042 seconds).

LEVEL menu

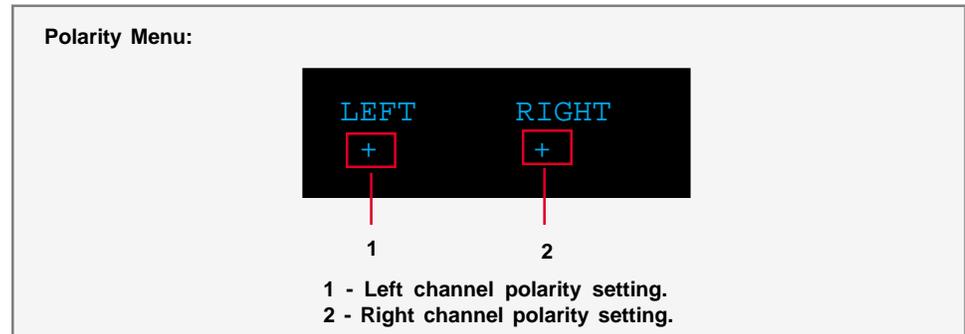
The Level menu controls channel balancing. You can adjust the system's balance by changing the attenuation for the left and right output signals independently.



Use the **LEFT** and **RIGHT** navigational buttons to highlight an option and use the **UP** and **Down** buttons to change its value. A unique channel level can be assigned to each crossover and correction preset. Channel level can be changed in steps of 0.1 dB.

**POL menu
(Polarity)**

Use this menu to set channel polarity. Each channel can be set to + (non inverted) or - (inverted) polarity.

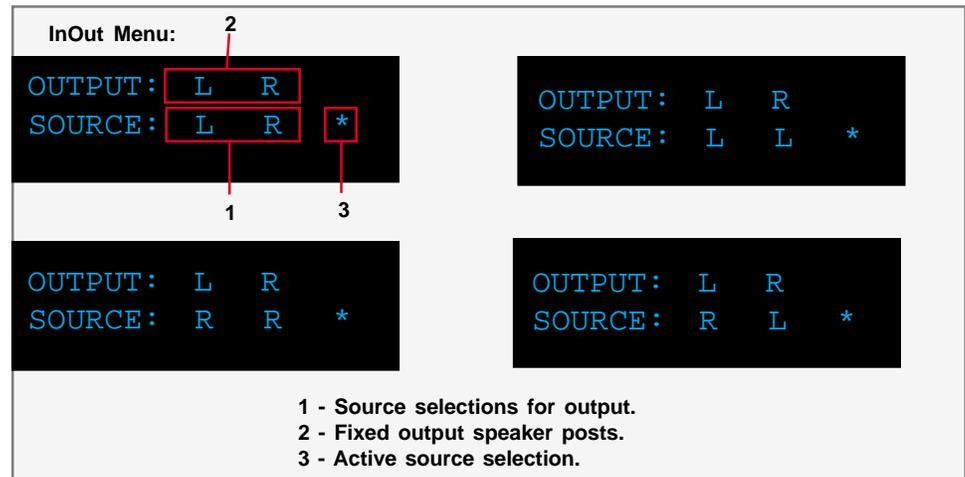


To highlight an option use the **LEFT** or **RIGHT** buttons. To selected highlighted option use the **UP** , **DOWN** of **ENTER** buttons. A unique channel polarity can be assigned to each crossover and correction preset.

InOut Menu

Use this screen to set M/S-2150 X internal signal routing. Use **UP** and **DOWN** buttons to scroll through four possible input source combinations. To select displayed option press **ENTER** button. Active selection is indicated by "*" displayed next to it. This feature is useful for systems that use multiple of amplification channels per loudspeaker.

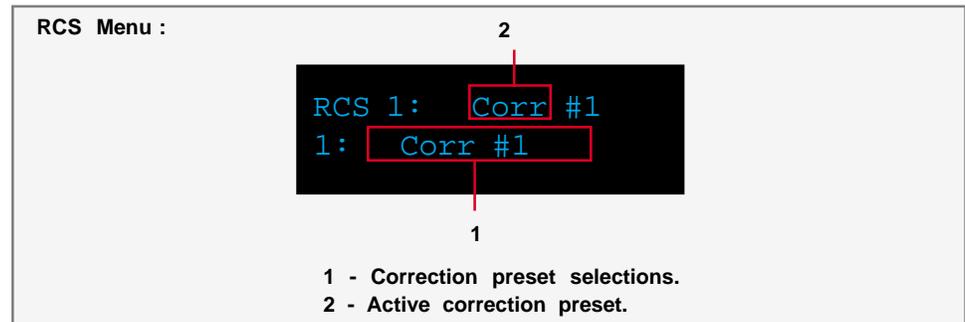
The figure bellow lists all four possible combinations of the input signal assignment to output channels.



The first screen, going from left to right, assigns left input to left output and right input to right output channel. Second figure assigns left input channel to both left and right output channels. Third figure assigns right input channel to both left and right output channels and the fourth figure assigns right input to left output and left input to right output channel.

RCS Menu

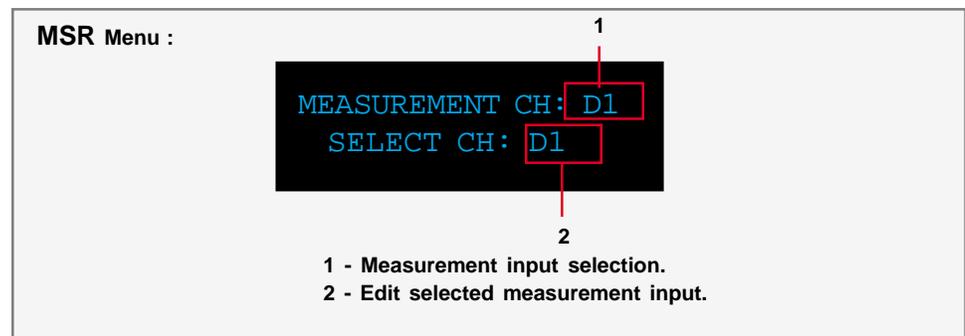
Use this menu to select one of the correction presets. M/S-2150 X offers 9 correction presets as well as bypass. This screen is enabled only if RCS or RCS-SUB mode is selected (see **MODE** menu). Correction names are user programmable from M/S-2150 X windows based application program..



Use the “UP” and “DOWN” buttons to scroll through all possible options. To select displayed option press “ENTER” button.

MSR menu

Use this menu to select digital microphone input. Digital microphone input is normally connected to one of BOZ RCS-16M digital outputs. If microphone is not used set this option to “---”. In order to avoid positive feedback from the microphone input, selected microphone input can not be used as standard digital input signal..



Use the “UP” and “DOWN” buttons to scroll through all possible options. To select displayed option press “ENTER” button.



To avoid the possibility of getting positive feedback, after the measurements are completed disconnect microphone from M/S-2150 X input. Positive feedback can result in excessive output signal level that could potentially damage connected loudspeaker system.

CRO menu

The CRO menu is used to select CRO presets and edit their values. You can select BUTT (Butterworth filter type) or BUTTSQ (Butterworth squared filter type) and edit HP, LP or BP filters. This menu is only accessible when CRO mode is selected (see MODE menu option).

CRO Menu :

```
CRO: Bypass
1: Preset #1  EDIT
```

To enable this screen set MODE menu screen to CRO option.

Use **LEFT** and **RIGHT** buttons to place screen cursor over Preset nad EDIT options.

Use **UP** and **DOWN** buttons to scroll through all possible CRO presets. To select/engage displayed preset press **ENTER** button. Selected CRO preset will be displayed on the first line of the screen.

For more details on how to use CRO screen please refer to M/S-2150 X Crossover Package section.



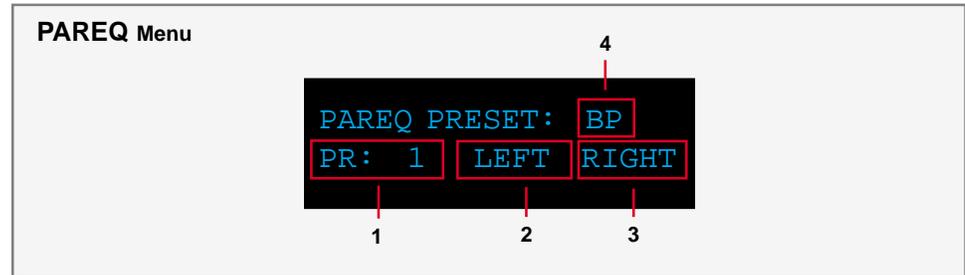
If M/S-2150 X is not used to provide active crossover filtering CRO menu option should always be set to BYPASS.



This menu option is disabled if in **MODE** menu option **RCS** or **RCS-SUB** mode is selected.

PAREQ

Parametric EQ menu is used to apply up to twelve bands of parametric equalization per output channel.



Use **LEFT** or **RIGHT** buttons to move the screen cursor to fields 1,2 and 3.

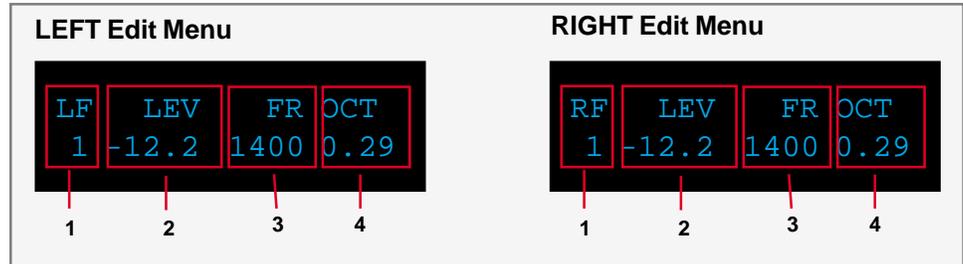
- 1** - When the screen cursor is in this field use **UP/DOWN** buttons to scroll through all possible ParEq presets. To select/engage displayed ParEq preset press **ENTER** button. Selected ParEq preset will be displayed in field 4.
- 2** - When the screen cursor is in this field press **ENTER** button to edit left channel ParEq parameters of the ParEq preset displayed in field 1. This option is disabled if BP is displayed in field 1.
- 3** - When the screen cursor is in this field press **ENTER** button to edit right channel ParEq parameters of the ParEq preset displayed in field 1. This option is disabled if BP is displayed in field 1.
- 4** - This field displays current/active ParEq preset.



ParEq feature can simultaneously run with the crossover and room correction package. To disable ParEq select **BYPASS (BP)** for ParEq preset.

PAREQ Editing

To edit ParEq parameters in ParEq MENU screen select LEFT to edit left channel parameters or RIGHT to edit right channel parameters. Depending on the selection one of the following screens will be displayed:



Use **LEFT** or **RIGHT** buttons to move the screen cursor to fields 1,2,3 and 4.

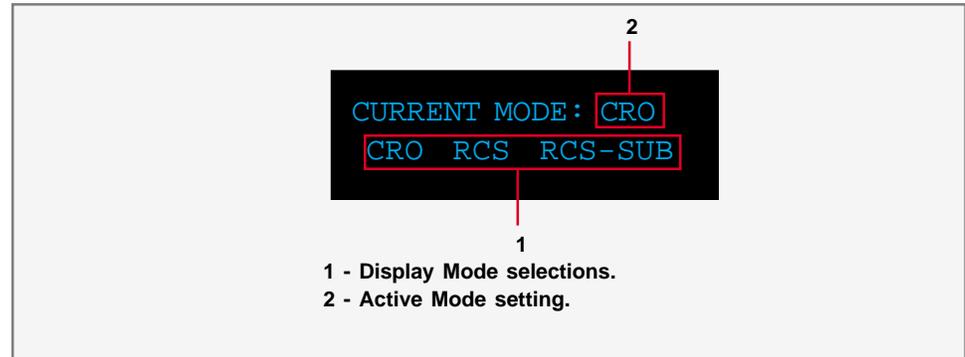
- 1 - When the screen cursor is in **LF/RF** (**LF**-left channel filter, **RF**-right channel filter) field use **UP/DOWN** buttons to scroll through all 12 ParEq filters. Note that as you scroll through the filters, ParEq parameters in fields 2,3 and 4 will keep changing as they display parameters that correspond to filter number as displayed in field 1.
- 2 - **LEV** field displays signal gain/attenuation that corresponds to the filter number as displayed in field 1. Filter level can be set anywhere between +12.0 dB to -18.0 dB in increments of 0.1 dB. If this field is set to 0 dB that particular filter has no effect on the audio signal. Positive values greater than 0 dB in this field indicate that that particular filter will amplify audio signal at and around filter frequency as set in field 3.
- 3 - **FR** field displays filter frequency that corresponds to the filter number as displayed in field 1. Filter frequency can be set anywhere between 15 Hz and 20 KHz with resolution of 1 Hz. If LEV parameter is set to 0 dB the value of this field is irrelevant.
- 4 - **OCT** field displays filter width given in octaves. Octave parameter is calculated as 1/Q-factor.



It is possible that in some cases ParEq filter settings can cause the system to enter audio signal clipping region. Audio signal clipping will produce harmonic distortions that could be quite audible. The probability of this happening increases with the amount filter **LEV** parameter. Clipping can occur only if **LEV** parameter is positive (signal gain). Clipping cannot occur if **LEV** parameter is set to negative values (attenuation).

Mode menu

The Mode menu allows for selection of M/S-2150 X operating mode. If RCS mode is not used the unit should always be set to CRO mode.



Use the **LEFT** and **RIGHT** buttons to highlight the desired option and select it by pressing the **ENTER** button.

**OPT menu
(Options)**

The options menu is designed to control the systems maximum signal level **MAXLEV**, signal detection threshold **DTHR** and wheel speed **WH**.

NOTE: Wheel speed is only available on the M2150 X.

Options Menu

- **Max Level** controls the system's maximum signal level. For example: if this option is set to -3.0 dB, the volume control and output can not go above -3.0 dB.

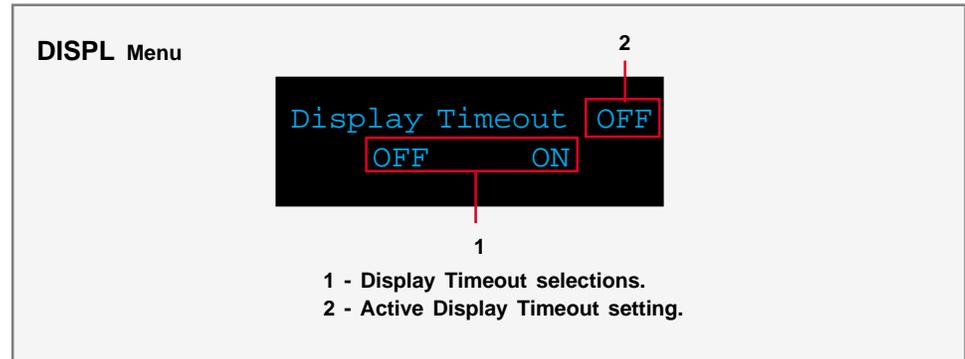
- **DTHR** sets the signal detection threshold. If the absolute value of the Left or the Right channel signal goes above this threshold the red signaling dot will be displayed on the front panel below the master volume display. This feature can be used to indicate signal presence on either channel or to indicate near clipping condition. To use it as signal presence indicator set **DTHR** to a value close to -90.0 dB. To use it as near clipping indicator set **DTHR** to a value close to 0.0 dB.

- **WH** option sets the wheel sensitivity. The maximum speed is 10 and minimum speed is 1. For example if the speed is set to 1, the volume increase is slower than if set to 10. To turn the wheel off, set the speed setting to "--". This setting is located one step below "1" the minimum speed.

To select/highlight an option use the **LEFT** or **RIGHT** buttons. To modify a selected option use the **UP** and **DOWN** buttons.

**DISPL menu
(Display)**

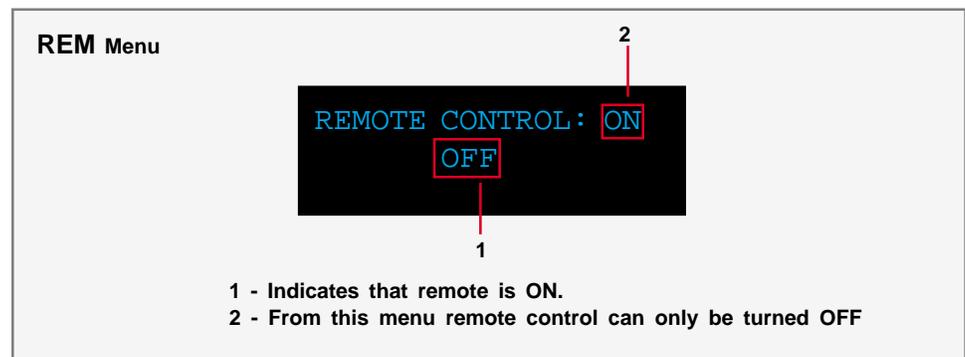
The display menu controls the display Time-Out feature. This option is used to turn the front panel display **ON** or **OFF**. When this option is set to **ON** the front panel timer will turn the front display off if the front panel has not been accessed for more than 10 seconds. To wake the display, simply turn the wheel or push any button either the front panel or the remote control. When this option is set to **OFF** the display will remain lit whenever the unit is on.



Use the **LEFT** and **RIGHT** buttons to highlight the desired option and select it by pressing the **ENTER** button.

**REM menu
(Remote)**

The remote menu allows for disabling the remote control. Once the remote control is disabled the unit can only be controlled from the front panel. An alternate way to enable or disable the remote control is to press the front panel **"ANALOG"** and **"DIGITAL"** buttons simultaneously- this can be used to change the remote control state without entering the REM menu.



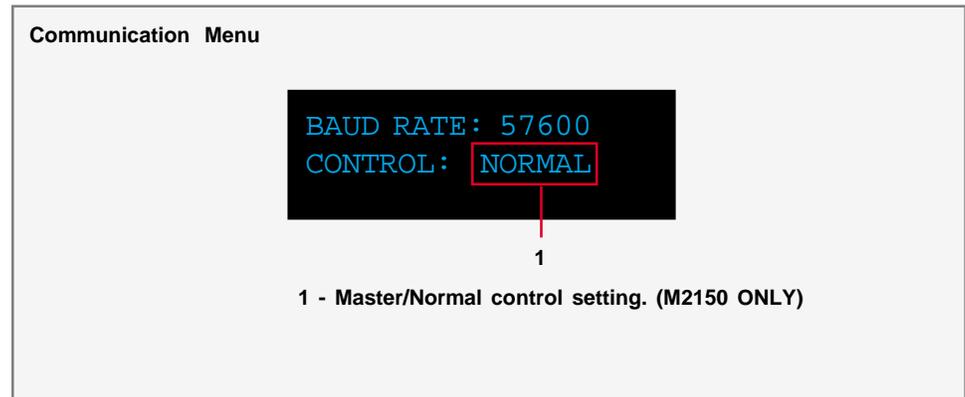
Press **ENTER** button to disable remote control.

Remote control is automatically disabled when M/S-2150 X detects an incoming RS232 signal.



COMM menu (Communication)

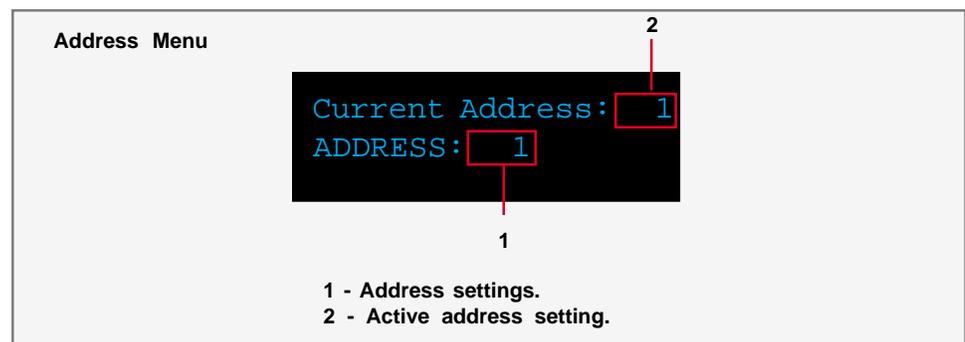
Use this menu to enable MASTER or NORMAL communication mode. In the MASTER mode M/S-2150 X will send master volume and mute changes as well as standby/ON status to all M/S-2150 X units connected to AUX RS232 port. Note that only one unit can be configured as MASTER and all others must be configured as NORMAL units - slaves.



Use the **ENTER** button switch between MASTER and NORMAL. M/S-2150 X has fixed baud rate of 57600.

ADDR menu (Address)

To each M/S-2150 X unit connected to the same RS232 control chain a unique device address has to be assigned. Device address can be set to any number between 1 and 255. Factory default device address setting is "001"



Use **UP** and **DOWN** buttons to select desired device address and then press **ENTER** button to select it.

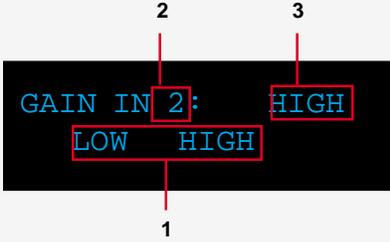


To permanently save device address in M/S-2150 X internal memory you must place M/S-2150 X into stand by mode.

ADC menu (ADC module optional)

The M/S-2150 X may be equipped with an optional state of the are Analog to Digital Converter. To further enhance the converter's performance, the system offers two selectable gain values for the ADC input stage. These two values may be assigned to each input independently.

ADC Menu



1
2
3

1 - Assignable gain values.
2 - Input channel currently selected.
3 - Active gain setting for selected input channel.

LOW = -6.0dB in reference to 0.0dB. Input sensitivity: 2.2volts
HIGH = 0.0dB in reference to 0.0dB. Input sensitivity: 4.4volts.

To select an analog Input (2) use the **ANALOG** selector button found on the M/S-2150 front panel or on the remote control to scroll to the input you would like to edit. Use **LEFT** and **RIGHT** buttons to highlight desired option and then press **ENTER** to select it.

LOCK menu

The lock menu allows a lock to be set to prevent entering the M/S-2150 editing menus without unlocking the M/S-2150 X with the lock code. By default the M/S-2150 X is unlocked and all menus can be accessed and inputs can be changed without entering a lock code. When the unit is locked, the only menu option that can be entered is the **LOCK** menu to unlock the unit. Once the lock code is entered you will be able to use the M/S-2150 X menus until the lock code is entered again to lock the M/S-2150 X.

Lock Menu



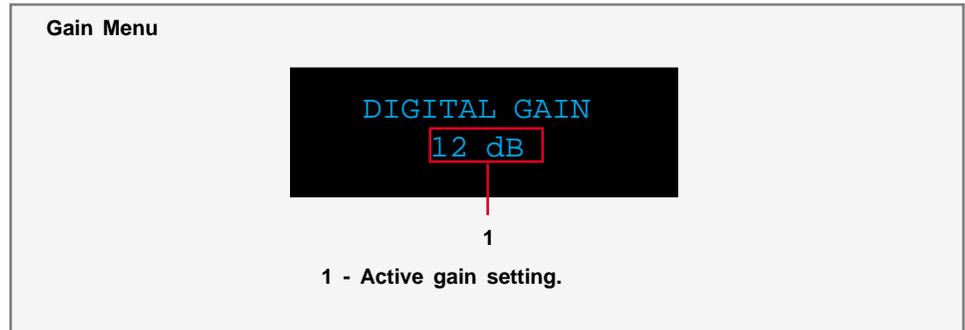
1
2
3

1 - Lock code.
2 - Active lock state.
3 - Set button.

To lock or unlock the M/S 2150 X enter the lock code "1-2-3-4" by using the **LEFT** and **RIGHT** remote control buttons to select each digit and use the **UP** and **DOWN** buttons to select the desired number from 0 to 9 . Once the code is entered select the **SET** option and then press the **ENTER** button to unlock or lock the unit. The active lock state will be displayed in the active lock state portion of the screen.

GAIN menu

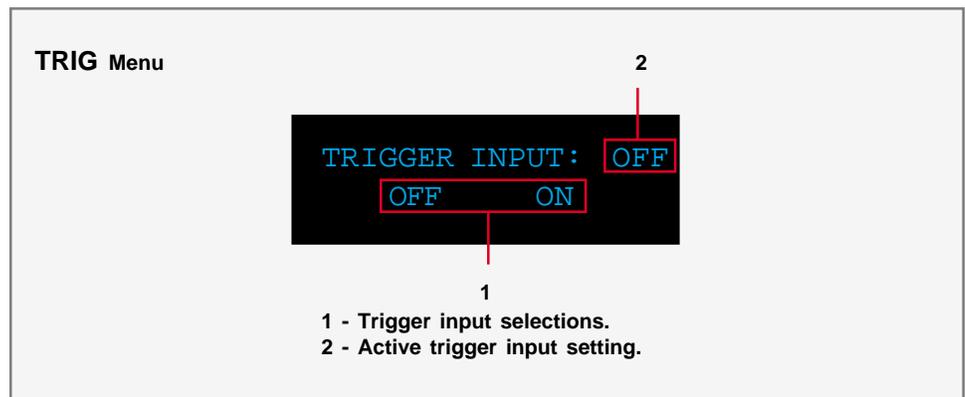
The gain menu is designed to select the amount of digital amplification applied to audio signal. Digital gain can be set from 0 to 18.0 dB in increments of 0.1 dB. These feature should be used in cases with low audio signal levels - CD's that are not fully modulated (do not cover full signal range). Increasing the amount of digital gain does not increase M/S-2150 X output power. It will only give sufficient boost to the input signal so that it covers entire M/S-2150 X output power range.



To set **DIGITAL GAIN** use **UP** and **DOWN** buttons. Selected gain is immediately activated.

TRIG menu

The trigger menu is used to control the behavior of the M/S 2150 X amplifier when a trigger signal is detected. When **TRIGGER INPUT** is set to **ON** and a trigger signal is detected the amplifier will turn **ON**. The amplifier will switch to **STANDBY** mode if there is no trigger signal detected. When the input trigger is set to **OFF** the unit will not respond to a trigger signal. However, the trigger signal will still be passed through the Trigger OUT terminal on the rear panel.



Use **LEFT** and **RIGHT** buttons to highlight desired option and then press - **ENTER** to select it.

Tact M/S-2150 X Software

The M/S-2150 X is more than just an amplifier. With powerful features such as level balancing, time alignment, and assignable electronic crossovers, you can customize and build the amplifier system that you need, whether your system is biamped, triamped or more. When in CRO mode M/S-2150 X does not require computer interface. However, when in RCS mode M/S-2150 X requires computer interface via RS232 communication port.

Each of Tact's amplifiers employ an RS232 in and out connection for control from any RS232 based controller. Complete instructions for using the M/S-2150-X software can be found in the online help available in the software.

System requirements

Your computer system must meet the following minimum requirements:

- An IBM compatible PC with Pentium 1000 MHz, 512 MB Ram & 100 MB free hard disk space or better
- Microsoft Windows 2000 or XP
- Operating system regional setting must be set to "English (United States)"
- Microsoft Windows-compatible graphics-card and monitor with screen resolution 800x600 or better
- CD-ROM drive
- Microsoft windows compatible 2- or 3- button mouse
- Standard RS-232 serial port with DB-9 connectors or USB RS232 adapter

Software Installation

Follow the steps below to install the M/S-2150 X Software:

- 1** - Start windows and insert the TacT software CD into your CD-ROM drive.
- 2** - Double-click on the **My Computer** icon on the desktop.
- 3** - Double-click on the CD icon to launch the CD browser.
- 4** - Double-click on "**Tact-2150 X vx.x.exe**" and follow the instructions.

Start The M/S-2150 X software

To start the software go to the Windows **Start** menu, select **Programs** then **Tact-2150 X** and click on the **Tact-2150 X** icon. You should now see the M/S-2150 X main screen.

**Connect your
M/S-2150 X to your
Computer**

Your M/S-2150 X must be connected to your computers serial port in order for it to communicate with your computer when you run the M/S-2150 X software. Please follow the steps below to connect your M/S-2150 X to your computer.

- 1 - Connect the RS 232 **Input** jack on the back of the M/S-2150 X to your computers serial port using the supplied cables and adapters. Your computer must have a standard RS 232 serial port with a DB 9 connector.



NOTE: If you have any other Tact digital amplifiers please disconnect their RS232 connection at this time.

- 2 - Turn on your M/S-2150 X.

- 3 - Turn on your computer and start the M/S-2150 X System Software.



NOTE: You may receive a communication error message. Please close the message window and proceed to the next step.

- 4 - Select the **Com** button on the main software screen to open the communication window.

- 5 - Click on **Help** button for further instructions.



NOTE: If you are still not passing the communication test you may not have a COM port installed on your computer or you may have another device such as a modem or hand held PC that may be sharing the COM port on your computer. If you have another Tact equipment attached it may be set to the same address. The M/S 2150 X requires a valid COM port that is not being used by any other devices.



NOTE: You will only have to select the communication port once. The next time you run the M/S 2150 X correction software it will remember your settings.

Specifications

Power (RMS. per channel) 8 ohm	2 x 150W
Power (RMS. per channel) 4 ohm	2 x 300W
Output current (peak, per channel)	>50 A
Signal-to-noise ratio (A-weighted)	>110dB
Dynamic range (20 Hz - 20 kHz)	>130dB
THD+N (all power levels 20Hz-20kHz)	<0.01%
Digital resolution	16-24 bit
Linearity (-120dB)	+ - 0,2dB
Dimensions (WxHxD)	450x140x420 mm 17.7x5.5x16.5 in.
Weight (shipping)	18 kg / 37 lbs

M/S-2150 X Crossover Package

Tact Audio Inc.
201 Gates Road
Little Ferry, NJ 07643
USA

V1.0

INTRODUCTION

M/S-2150 X crossover filter (CRO) package is designed to support computer less digital filter design using only front panel display CRO menu option. The crossover filter design is based on infinite impulse response (IIR) implementation. All crossover filters are implemented as digital IIR Butterworth filters.

Butterworth filters are all-pole filters characterized by the magnitude-square frequency response

$$|H(\Omega)|^2 = 1 / (1 + (\Omega/\Omega_c)^{2N})$$

where Ω_c is -3 dB frequency (cutoff frequency) and N is the filter order.

M/S-2150 X CRO filter package support low-pass (LP), high-pass (HP) and band-pass (BP) filter design. Filter order can be set from 1 to 12 in steps of one. Minimum filter cutoff frequency is 10 Hz and maximum filter cutoff frequency is 24 KHz. The filter cutoff frequency can be placed anywhere between 10 Hz and 24 KHz with 1 Hz resolution.

COR filters are characterized by two parameters: filter cutoff frequency and filter order. Low-pass filters are characterized by:

- FL – low-pass filter cutoff frequency and
- LO – low-pass filter order

High-pass filters are characterized by:

- FH – high-pass filter cutoff frequency and
- HO – high-pass filter order

Band-pass filter are characterized by:

- FL – low frequency section cutoff frequency
- FH – high frequency section cutoff frequency
- LO – low frequency section filter order
- HO – high frequency section filter order

Since M/S-2150 X is a two-channel power amplifier a crossover filter can be assigned to each output channel. Both Left and Right channels support LP, HP and BP filters with a cutoff frequency set to any value between 10 and 24000 Hz with 1 Hz resolution. Filter order, which determines the filter slope, can be set to any value from 1 to 12 with increments of 1 for each channel independently. The filter slope is calculated as

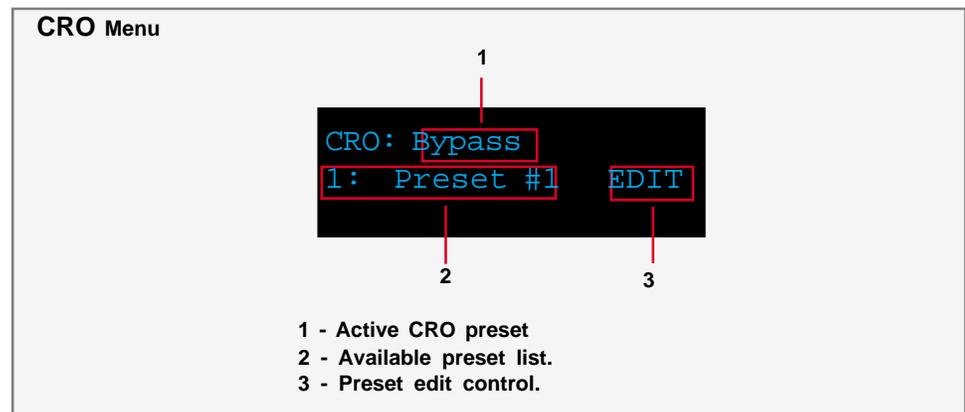
$$\text{Filter Slope} = \text{Filter Order} * 6 \text{ (dB/Octave)}$$

The CRO package is designed for applications such as:

- Subwoofer CRO design
- Multi way loudspeaker design

Entering CRO Package

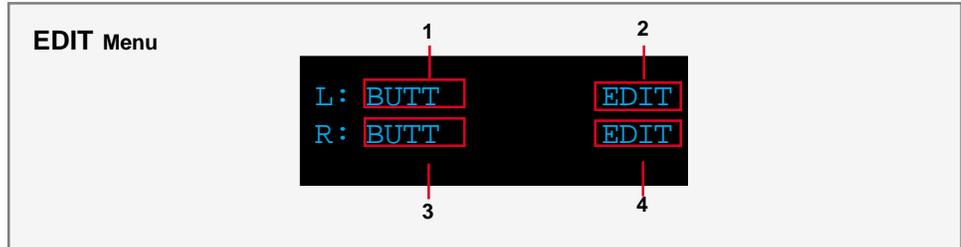
To access the **CRO** option enter the main menu screen and scroll to the right to place the cursor on **CRO** and then press enter. This action will display the **CRO** menu.



This screen shows that there is no crossover filter selected therefore both Left and Right channel will output full range signal. Place the cursor next to field 2 and use **UP** and **DOWN** buttons to scroll through all possible CRO presets. Note that when this field displays **Bypass** edit control (field 3) is not visible. To select/engage displayed preset press **ENTER** button. Selected CRO preset will be displayed in field 1.

Editing CRO Preset

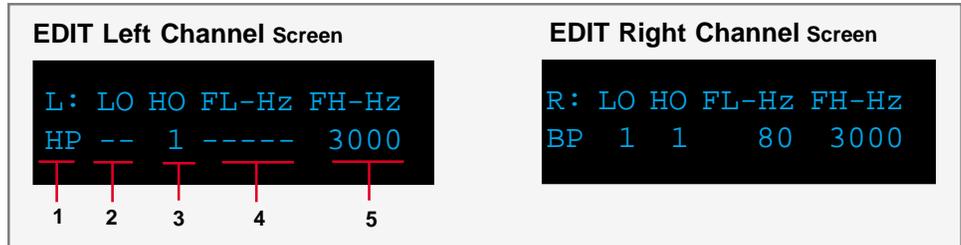
To edit CRO preset #1 scroll through field 2 until **Preset #1** is displayed. Place cursor over **EDIT** (field 3) and then press **ENTER** button. The following screen will be displayed:



Field 1 and 3 display left and right channel crossover filter assignment. To change this field place the cursor next to it and press **ENTER** button. This field can display **BYPASS**, **BUTT** and **BUTTSQ** options. When **BYPASS** is displayed **EDIT** field (2/4) is not visible. When **BUTT** (Butterworth filter type) is displayed and when **EDIT** option is entered Butterworth filter design screen for selected channel will be displayed. When **BUTTSQ** (Butterworth squared filter type) is displayed and edit option is entered Butterworth squared filter design screen for selected channel will be displayed.

Editing Filters

When **EDIT** field (2 or 4) is selected Left/Right channel filter edit screen will be displayed.



Use **LEFT/RIGHT** buttons to place cursor over 1,2,3,4 and 5 fields.

1. Use this field to assign filter type to selected channel. Place cursor over this field and by using **UP/DOWN** buttons scroll through all possible filter assignments. **LP** low-pass, **HP** high-pass, **BP** band-pass and **--** no filtering can be assigned to each channel.

2. Use this field to select low-pass filter order for selected filter type. If **BUTT** filter was selected this field could be set to any number between 1 and 12 (first and twelfth order) in increments of 1. If **BUTTSQ** was selected this field could be set to any number between 1 and 6. In **BUTTSQ** case two sections of Butterworth filter are cascaded to form Butterworth squared filter. Therefore **BUTTSQ** filter order of n corresponds to **BUTT** filter order of $2*n$. For example, if **BUTTSQ** filter order is set to 6 then the slope of this filter would be the same as the slope of **BUTT** filter with filter order of 12. This field is also used to set low frequency slope of band-pass filters. CRO package is designed to allow for independent filter order assignment to low frequency and high frequency section of band-pass filters. This field is not enabled if **HP** or **--** option in field 1 was selected.

Editing Filters Continued

3. Use this field to select high-pass filter order for selected filter type. If **BUTT** filter was selected this field could be set to any number between 1 and 12 (first and twelfth order) in increments of 1. If **BUTTSQ** was selected this field could be set to any number between 1 and 6. In **BUTTSQ** case two sections of Butterworth filter are cascaded to form Butterworth squared filter. Therefore **BUTTSQ** filter order of n corresponds to **BUTT** filter order of $2*n$. For example, if **BUTTSQ** filter order is set to 6 then the slope of this filter would be the same as the slope of **BUTT** filter with filter order of 12. This field is also used to set high frequency slope of band-pass filters. CRO package is designed to allow for independent filter order assignment to low frequency and high frequency section of band-pass filters. This field is not enabled if **LP** or "--" option in field 1 was selected.

4. Use this field to set low-pass filter cutoff frequency. Filter cutoff frequency can be set to any value between 10 and 24000 Hz in increments of 1 Hz. This field is also used to set lower cutoff frequency of band-pass filters. This field is not enabled if **HP** or "--" option in field 1 was selected.

5. Use this field to set high-pass filter cutoff frequency. Filter cutoff frequency can be set to any value between 10 and 24000 Hz in increments of 1 Hz. This field is also used to set higher cutoff frequency of band-pass filters. This field is not enabled if **LP** or "--" option in field 1 was selected.

Measurement Samples

Figures 1 through 6 show actual frequency response measurements of low-pass and high-pass filters with various cutoff frequency and filter order. These curves are real measurements and not a result of a computer simulation.

Measurement Sample 1

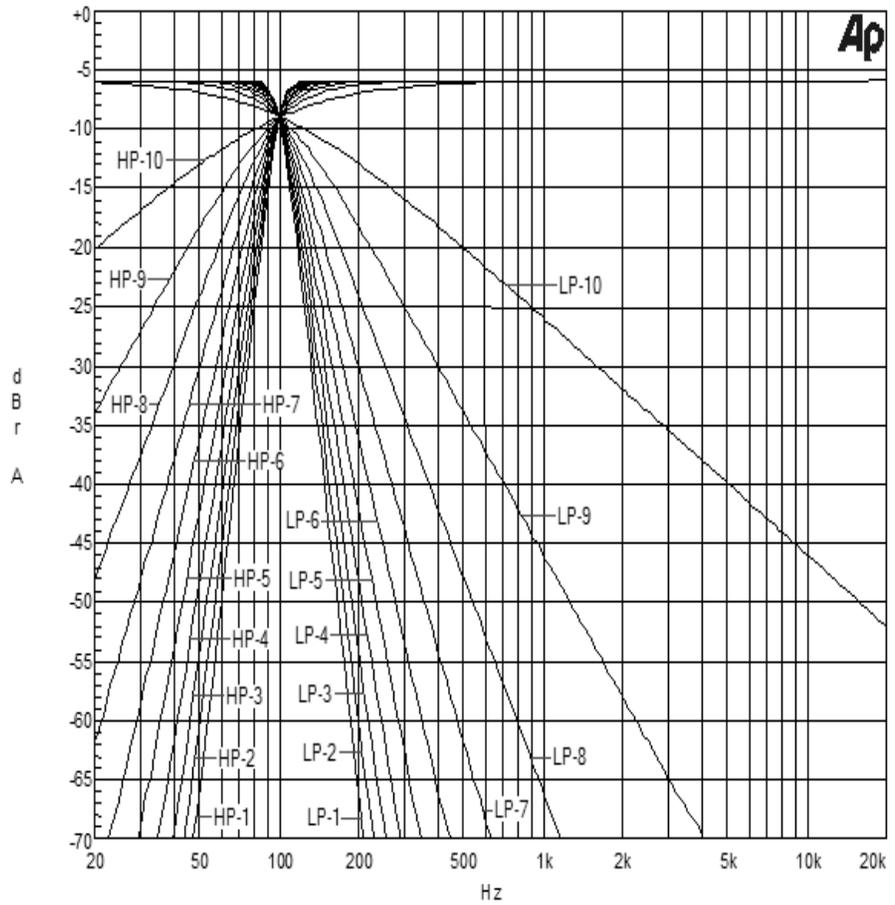


Fig 1 Left/Right channel frequency response. Output signal level at -6 dB which is equivalent to 37.5 W into 8 Ohms or 70 W into 4 Ohms. Left channel set to BUTT low-pass filter with FL set to 100 Hz and LO set from 1 to 10. Right channel set to BUTT high-pass filter with FH set to 100 Hz and HO set from 1 to 10.

EDIT menu setup for Fig. 1 measurements

EDIT Menu	
L: BUTT	EDIT
R: BUTT	EDIT

L/R channel setup for LP-1 and HP-1 curves

EDIT Left Channel Screen	EDIT Right Channel Screen
L: LO HO FL-Hz FH-Hz	R: LO HO FL-Hz FH-Hz
LP 10 -- 100 -----	HP -- 10 ----- 100

Measurement
Sample 2

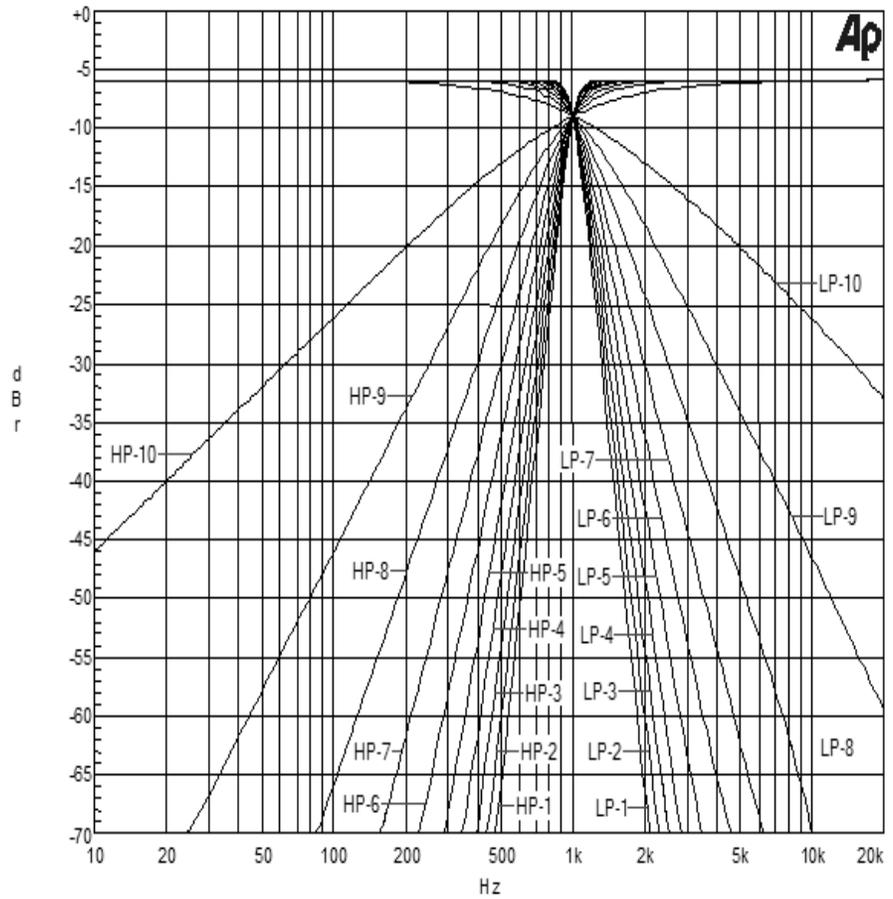
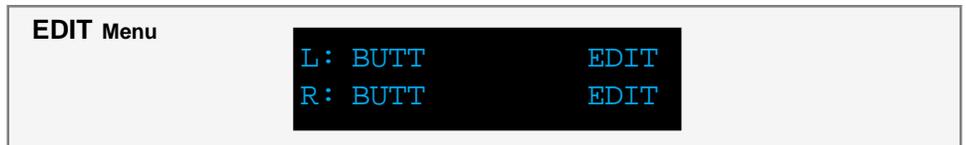
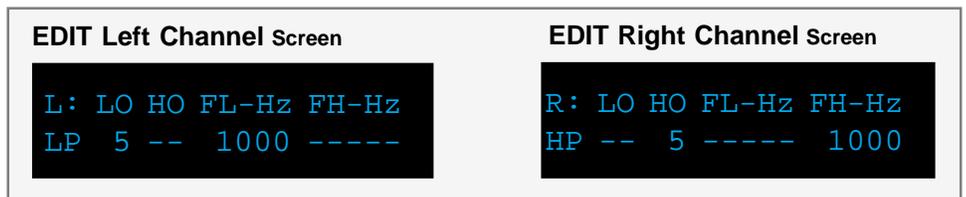


Fig 2 Left/Right channel frequency response. Output signal level at -6 dB which is equivalent to 37.5 W into 8 Ohms or 70 W into 4 Ohms. Left channel set to BUTT low-pass filter with FL set to 1000 Hz and LO set from 1 to 10. Right channel set to BUTT high-pass filter with FH set to 1000 Hz and HO set from 1 to 10.

EDIT menu setup for
Fig. 2 measurements



L/R channel setup for
LP-5 and HP-5 curves



Measurement
Sample 3

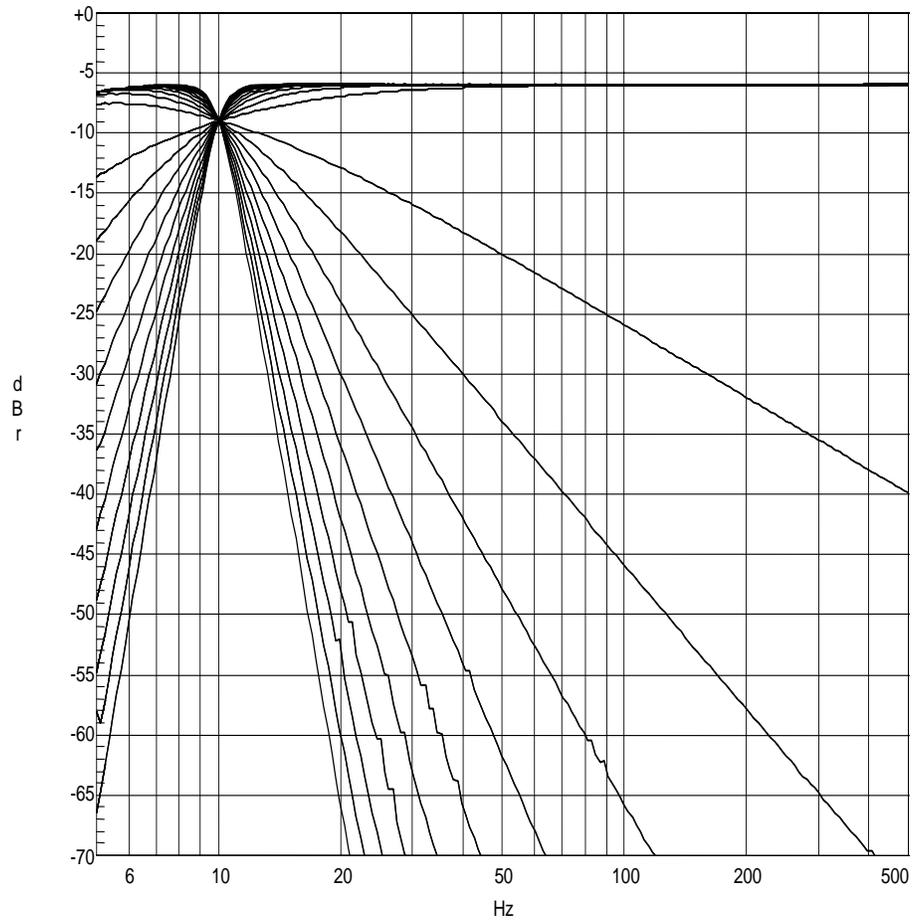


Fig 3 Low-pass and High-pass crossover filters with cutoff frequency of 10 Hz and filter order from 1 to 10. Output signal level at -6 dB equivalent to 37.5 W into 8 Ohms or 70 W into 4 Ohms.

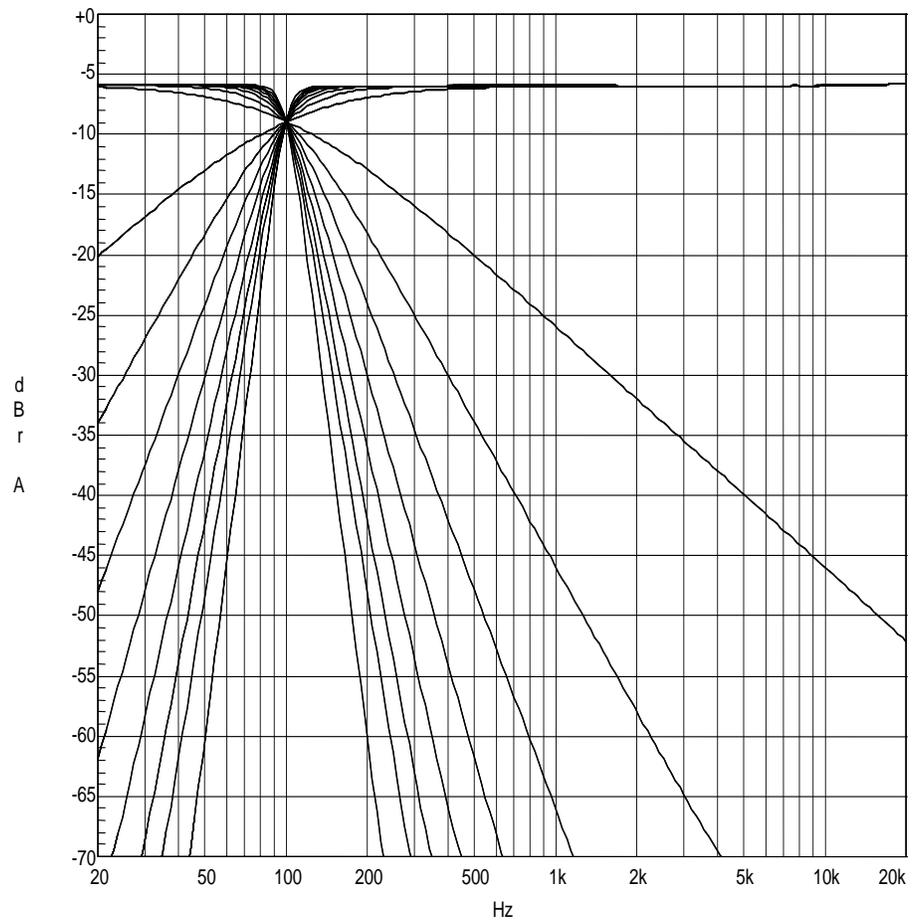
Measurement
Sample 4

Fig 4 Low-pass and High-pass crossover filters with cutoff frequency of 100 Hz and filter order from 1 to 10. Output signal level at -6 dB equivalent to 37.5 W into 8 Ohms or 70 W into 4 Ohms.

Measurement
Sample 5

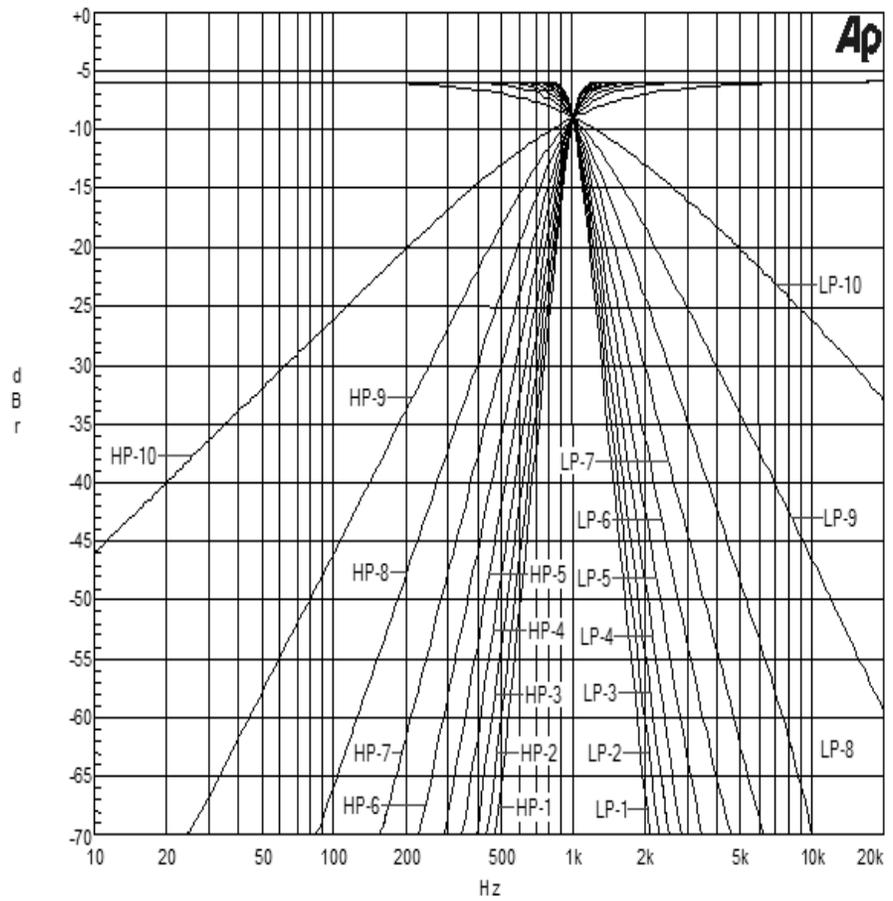


Fig 5 Low-pass and High-pass crossover filters with cutoff frequency of 1000 Hz and filter order from 1 to 10. Output signal level at -6 dB equivalent to 37.5 W into 8 Ohms or 70 W into 4 Ohms.

Measurement
Sample 6

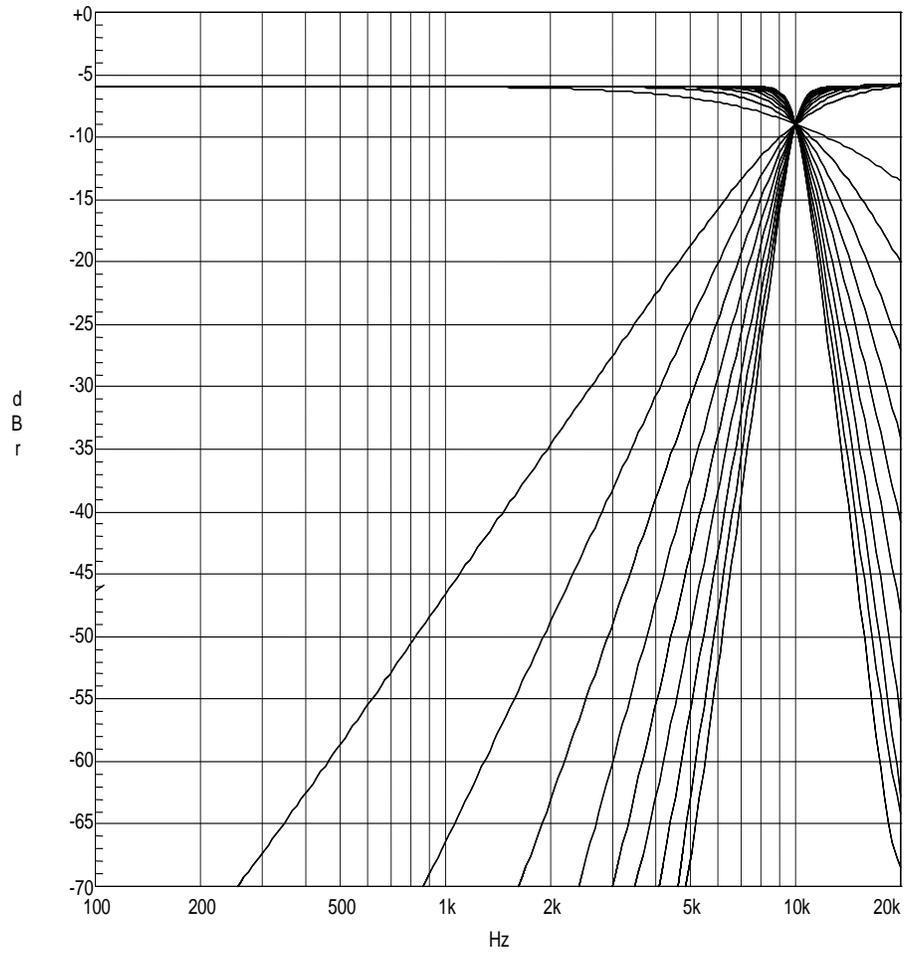


Fig 6 Low-pass and High-pass crossover filters with cutoff frequency of 10 KHz and filter order from 1 to 10. Output signal level at -6 dB equivalent to 37.5 W into 8 Ohms or 70 W into 4 Ohms.

Subwoofer COR Application

Most high-end stereo configurations consist of two main loudspeakers covering frequencies from f_c up to 20,000 Hz, and two subwoofers covering bottom end of the spectrum below f_c . In most applications f_c is set to around 100 Hz but it is not unusual for f_c to extend all the way to around 300 Hz. Properly integrating a system like this one can be quite challenging. When subwoofers are properly integrated with the main speakers it should be seamless and it should not be noticeable that the sound is coming from the subwoofers. M/S-2150 X crossover filter design package combined with level balancing and delay time feature can greatly help to achieve this goal.

To power a system with two main channels and two subwoofers you will need two M/S-2150 X amplifiers. There are two ways of connecting the amplifiers to the speaker system:

1. One amplifier driving both subwoofers and another amplifier driving both main channels. This configuration is referred to as **horizontal bi-amplification**.
2. One amplifier driving left main channel loudspeaker and left subwoofer, and another amplifier driving right main channel loudspeaker and right subwoofer. This configuration is referred to as **vertical bi-amplification**.

Example 1

Horizontal Bi-Amplification

In this configuration M/S-2150 X amplifier labeled as Amp#1 is connected to the main left and right loudspeaker and M/S-2150 X amplifier labeled as Amp#2 is connected to the left and right subwoofer. Connection diagram is shown on pages 15.



Note that digital source (usually processor or transport output) is connected to Amp#1 coax/SPIIDF digital input and Amp#1 digital output is connected to Amp#2 coax digital input. In this way both amplifiers get the same Left and Right channel audio signal.

Example 1

To make sure that both amplifiers will process Left and Right channel check Amp#1 and Amp#2 **InOut** menu options. They should be set as follows:

Amp#1 **InOut** menu

```
OUTPUT:  L   R
SOURCE:  L   R   *
```

Amp#2 **InOut** menu

```
OUTPUT:  L   R
SOURCE:  L   R   *
```

Also make sure that initially for both amplifiers DELAY and LEVEL menu options are set to as follows:

Amp#1 and Amp#2 **DELAY** menu

```
LEFT  RIGHT
0.00  0.00  msec
```

Amp#1 and Amp#2 **DELAY** menu

```
LEFT  RIGHT
0.0   0.0   dB
```

The next step is crossover filter selection for both subwoofers and main channels. The crossover filter selection consists of setting subwoofer low-pass filter cutoff frequency and filter order (filter slope), and of setting main channel high-pass cutoff frequency and filter order (filter slope). Your loudspeaker manufacturer usually recommends these parameters. In this example we assume that crossover frequency is 100 Hz and the filter order is something we want to experiment with. Each M/S 2150 X amplifier supports up to 9 crossover presets. Here we program preset 1 (CRO- 1) with 10-th order filter as shown below.

Left channel Amp#1 **EDIT** menu

```
L: LO HO FL-Hz FH-Hz
HP -- 10 ----- 100
```

Right channel Amp#1 **EDIT** menu

```
R: LO HO FL-Hz FH-Hz
HP -- 10 ----- 100
```

Left channel Amp#2 **EDIT** menu

```
L: LO HO FL-Hz FH-Hz
LP 10 -- 100 -----
```

Right channel Amp#2 **EDIT** menu

```
R: LO HO FL-Hz FH-Hz
LP 10 -- 100 -----
```

Example 1

CRO preset 2 (CRO- 2) for both amplifier is the same as preset 1 except that in preset 2 filter order for both Left and Right channel is set to 9. CRO preset 2 is shown in figure below.

Left channel Amp#1 **EDIT** menu

```
L: LO HO FL-Hz FH-Hz
HP -- 9 ----- 100
```

Right channel Amp#1 **EDIT** menu

```
R: LO HO FL-Hz FH-Hz
HP -- 9 ----- 100
```

Left channel Amp#2 **EDIT** menu

```
L: LO HO FL-Hz FH-Hz
LP 9 -- 100 -----
```

Right channel Amp#2 **EDIT** menu

```
R: LO HO FL-Hz FH-Hz
LP 9 -- 100 -----
```

Repeat the same settings for the remaining presets with decreasing filter order. CRO preset 10 should look like

Left channel Amp#1 **EDIT** menu

```
L: LO HO FL-Hz FH-Hz
HP -- 2 ----- 100
```

Right channel Amp#1 **EDIT** menu

```
R: LO HO FL-Hz FH-Hz
HP -- 2 ----- 100
```

Left channel Amp#2 **EDIT** menu

```
L: LO HO FL-Hz FH-Hz
LP 2 -- 100 -----
```

Right channel Amp#2 **EDIT** menu

```
R: LO HO FL-Hz FH-Hz
LP 2 -- 100 -----
```

To summarize:

- All the presets for Amp#1 are set to high-pass filter for both left and right channel with cutoff frequency (HF-Hz) of 100 Hz and filter order (HO) going from HO=10 for preset 1 (CRO -1) to HO=2 for preset 9 (CRO-9).
- All the presets for Amp#2 are set to low-pass filter for both left and right channel with cutoff frequency (HF-Hz) of 100 Hz and filter order (HO) going from LO=10 for preset 1 (CRO -1) to LO=2 for preset 9 (CRO-9).

Example 1

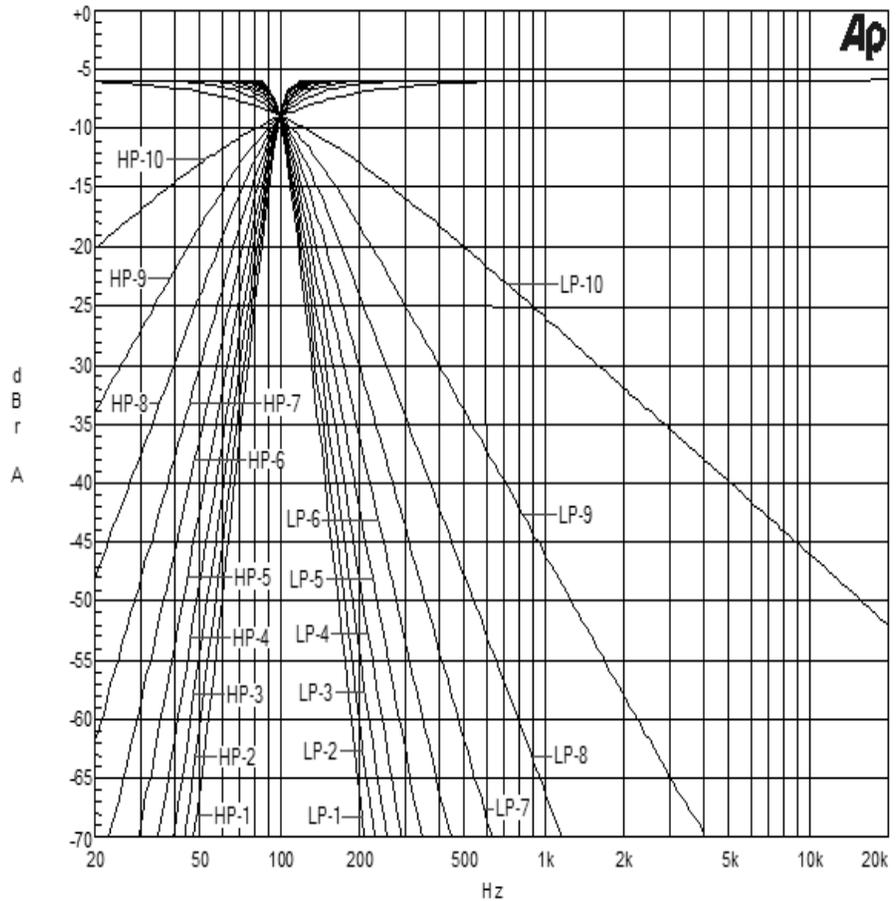


Fig. 7 Amp#1 and Amp#2 Left/Right channel frequency response. Output signal level at -6 dB which is equivalent to 37.5 W into 8 Ohms or 70 W into 4 Ohms.

LP-2, LP-3, ...,LP-10 represent Amp#2 Left/Right channel frequency response with LP-2 corresponding to CRO preset 1 (CRO -1) , LP-3 corresponding to CRO preset 2 (CRO -2) and the last filter LP-10 corresponds to CRO preset 9 (CRO-9).

HP-2, HP-3, ...,HP-10 represent Amp#1 Left/Right channel frequency response with HP-2 corresponding to CRO preset 1 (CRO -1) , HP-3 corresponding to CRO preset 2 (CRO -2) and the last filter HP-10 corresponds to CRO preset 9 (CRO-9).

Example 2

Vertical bi-amplification

In this configuration M/S-2150 X amplifier labeled Amp#1 is connected to the main left and subwoofer left channel. Left channel of Amp#1 is connected to the left subwoofer and Amp#1 right channel is connected to the left main loudspeaker. M/S-2150 X amplifier labeled Amp#2 is connected to the main right and subwoofer right channels. Left channel of Amp#2 is connected to the right subwoofer and right channel of Amp#2 is connected to the right main loudspeaker. Connection diagrams are shown on pages 16.



Note that digital source (usually processor or transport output) is connected to Amp#1 coax/SPDIF digital input and Amp#1 digital output is connected to Amp#2 coax digital output. In this way both amplifiers get the same Left and Right channel audio signal. In this configuration Amp#1 is set to process only left channel audio signal and Amp#2 is set to process only right channel audio signal. Amp#1 and Amp#2 **InOut** menus should be set as follows:

Amp#1 **InOut** menu

```
OUTPUT:  L  R
SOURCE:  L  L  *
```

Amp#2 **InOut** menu

```
OUTPUT:  L  R
SOURCE:  R  R  *
```

Initially DELAY and LEVEL menu options for both amplifiers should be set to 0.00 msec and 0.0 dB respectively.

The next step is crossover filter selection for both subwoofers and main channels. The crossover filter selection consists of setting subwoofer low-pass filter cutoff frequency and filter order (filter slope), and of setting main channel high-pass cutoff frequency and filter order (filter slope). Your loudspeaker manufacturer usually recommends these parameters. In this example we assume that crossover frequency is 100 Hz and the filter order is something we want to experiment with. Each M/S-2150 X amplifier supports up to 9 crossover presets. Here we program preset 1 (CRO- 1) as shown on the next page.

Example 2

Left channel Amp#1 **EDIT** menu

```
L: LO HO FL-Hz FH-Hz
LP 10 -- 100 -----
```

Right channel Amp#1 **EDIT** menu

```
R: LO HO FL-Hz FH-Hz
HP -- 10 ----- 100
```

Left channel Amp#2 **EDIT** menu

```
L: LO HO FL-Hz FH-Hz
LP 10 -- 100 -----
```

Right channel Amp#2 **EDIT** menu

```
R: LO HO FL-Hz FH-Hz
HP -- 10 ----- 100
```

CRO preset 2 (CRO- 2) for both amplifier is the same as preset 1 except that in preset 2 filter order for both Left and Right channel is set to 9. CRO preset 2 is shown in the figure below.

Left channel Amp#1 **EDIT** menu

```
L: LO HO FL-Hz FH-Hz
LP 9 -- 100 -----
```

Right channel Amp#1 **EDIT** menu

```
R: LO HO FL-Hz FH-Hz
HP -- 9 ----- 100
```

Left channel Amp#2 **EDIT** menu

```
L: LO HO FL-Hz FH-Hz
LP 9 -- 100 -----
```

Right channel Amp#2 **EDIT** menu

```
R: LO HO FL-Hz FH-Hz
HP -- 9 ----- 100
```

Repeat the same settings for the remaining presets with decreasing filter order. CRO preset 10 is shown in the figure below.

```
L: LO HO FL-Hz FH-Hz
LP 1 -- 100 -----
```

```
R: LO HO FL-Hz FH-Hz
HP -- 1 ----- 100
```

```
L: LO HO FL-Hz FH-Hz
LP 1 -- 100 -----
```

```
R: LO HO FL-Hz FH-Hz
HP -- 1 ----- 100
```

To summarize:

- All presets for Amp#1 are set to low-pass filter for left channel and to high-pass for right channel. Left channel cutoff frequency (LF-Hz) is set to 100 Hz and right channel cutoff frequency (HF-Hz) is set to 100 Hz.
- Amp#2 CRO presets are identical to Amp#1 CRO presets.

NOTE: After any parameter CRO parameter is changed you must click on SEND option to send that parameter to selected amplifier.

NOTE: In this configuration Amp#1 will process left audio channel only. Amp#1 left output will output low-pass filtered left audio channel and Amp#1 right output will output high-pass filtered left audio channel. Amp#2 will process right audio channel only. Amp#2 left output will output low-pass filtered right audio channel and Amp#2 right output will output high-pass filtered right audio channel.

After all setups are configured Amp#1 and Amp#2 will produce left and right output with the frequency response as shown in **Fig 7**. Note that these curves represent real measurements and they are not result of computer simulation.

Example 2

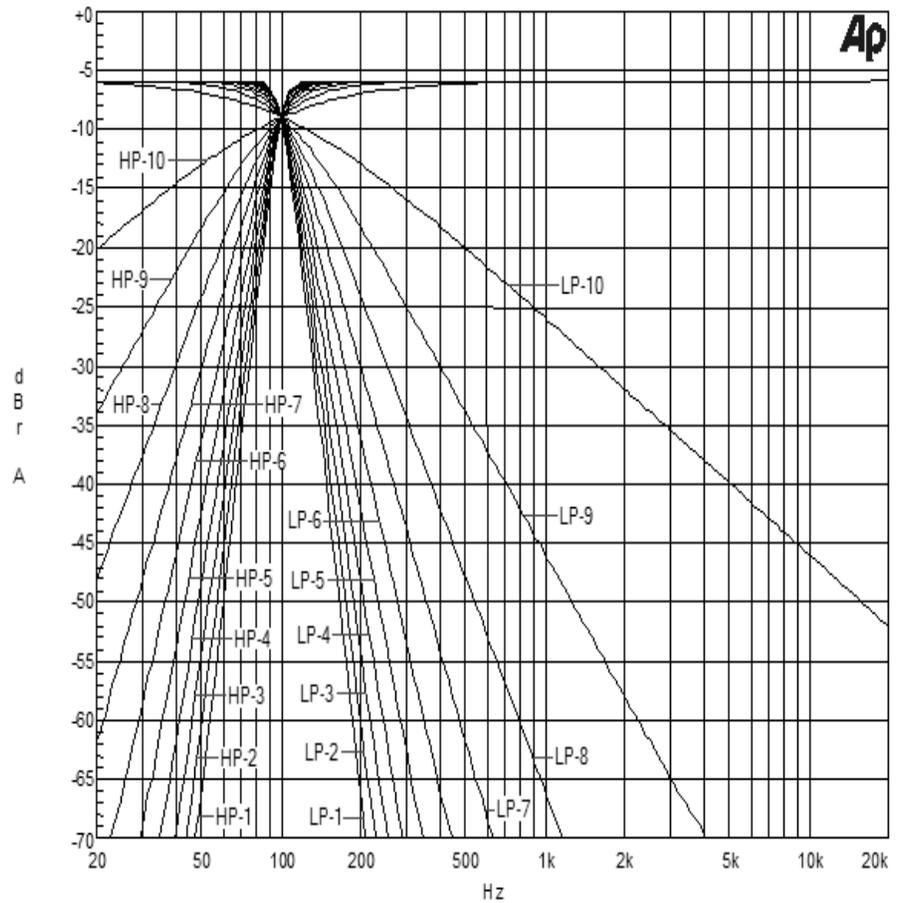


Fig 8 Amp#1 and Amp#2 Left/Right channel frequency response. Output signal level at -6 dB which is equivalent to 40 W into 8 Ohms or 80 W into 4 Ohms.

LP-2, LP-3, ...,LP-10 represent Amp#1 and Amp#2 Left channel frequency response.

HP-2, HP-3, ...,HP-10 represent Amp#1 and Amp#2 Right channel frequency response

LP-2 corresponds to CRO preset 1 (CRO -1) , LP-3 corresponds to CRO preset 2 (CRO -2) and the last filter LP-10 corresponds to CRO preset 9 (CRO-9).

HP-2 corresponds to CRO preset 1 (CRO -1) , HP-3 corresponds to CRO preset 2 (CRO -2) and the last filter HP-10 corresponds to CRO preset 9 (CRO-9).

Example 3

Two-Way Loudspeaker System

There are many advantages to using bi-amplification instead of the standard configuration, where one power amplifier is used to drive one loudspeaker with two or more drivers along with passive crossover networks. In the world of high-end audio in the last few years there has been constant increase in demand for sophisticated DSP based bi-amplification solution. To make bi-amplification available to Tact users M/S-2150 X incorporates crossover package that can place crossover frequency anywhere from 10 to 20,000 Hz with frequency resolution of 1 Hz.

In a two-way loudspeaker system, the base and the midrange signals go to the woofer and signals above the crossover frequency go to tweeter. In a system like this one it is recommended to eliminate passive crossover components and connect the woofer and the tweeter driver to separate channel of amplification with digital crossover filters embedded into each amplifier. In this way each driver is connected directly to the respective power source. There is no component between the power source and the driver that could in any way interfere with the power transfer from the amplifier to the driver. This approach eliminates many abnormalities introduced by passive crossover and one amplifier per channel design.

The driver manufacturers usually recommend crossover frequency. In this example we assume that the crossover frequency is set to 1000 Hz.

Like in the subwoofer case there are two ways of bi-amplifying a two-way loudspeaker system: horizontal and vertical.

Horizontal bi-amplification

In horizontal bi-amplification one amplifier is used to drive both left and right channel woofers, and another amplifier is used to drive both left and right channel tweeter. One M/S-2150 X labeled Amp#1 is used to drive both woofers and another M/S-2150 X labeled Amp#2 is used to drive both tweeters. System connection diagrams are shown on pages 15.



Note that digital source (usually processor or transport output) is connected to Amp#1 coax/SPIDF digital input and Amp#1 digital output is connected to Amp#2

Example 3

To make sure that both amplifiers will process Left and Right channel check Amp#1 and Amp#2 **InOut** menu options. They should be set as follows:

Amp#1 **InOut** menu

```
OUTPUT:  L  R
SOURCE:  L  R  *
```

Amp#2 **InOut** menu

```
OUTPUT:  L  R
SOURCE:  L  R  *
```

Initially DELAY and LEVEL menu options for both amplifiers should be set to 0.00 msec and 0.0 dB respectively.

The next step is crossover filter selection. The crossover filter selection consists of setting woofer low-pass filter cutoff frequency and filter order (filter slope), and of setting tweeter high-pass cutoff frequency and filter order (filter slope). Driver manufacturers usually recommend these parameters. In this example we assume that crossover frequency is 1000 Hz and the filter order is something we want to experiment with. For each M/S 2150 X amplifier it supports up to 10 crossover presets. Here we program preset 1 (CRO- 1) as shown bellow.

Left channel Amp#1 **EDIT** menu

```
L: LO HO FL-Hz FH-Hz
LP 10 -- 1000 -----
```

Right channel Amp#1 **EDIT** menu

```
R: LO HO FL-Hz FH-Hz
LP 10 -- 1000 -----
```

Left channel Amp#2 **EDIT** menu

```
L: LO HO FL-Hz FH-Hz
HP -- 10 ----- 1000
```

Right channel Amp#2 **EDIT** menu

```
R: LO HO FL-Hz FH-Hz
HP -- 10 ----- 1000
```

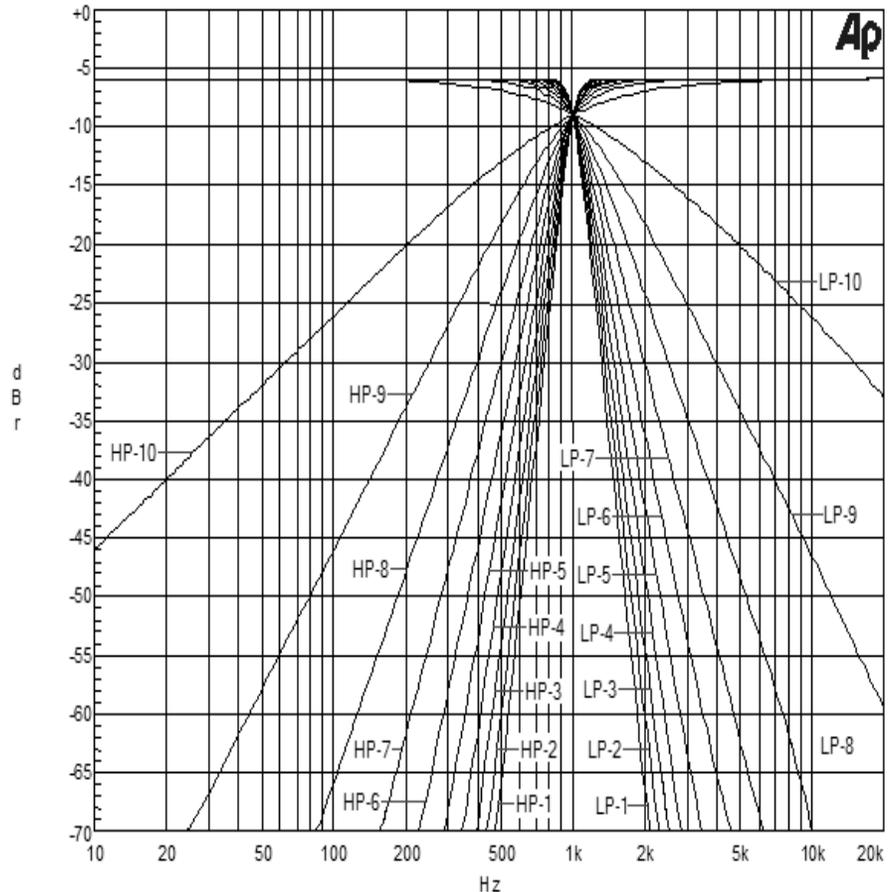
CRO preset 2 (CRO- 2) for both amplifiers is the same as preset 1 except that in preset 2 filter order for both Left and Right channel is set to 9. Repeat the same

Example 3

To summarize:

- All the presets for Amp#1 are set to low-pass filter for both left and right channel with cutoff frequency (LF-Hz) of 1000 Hz and filter order (LO) going from LO=10 for preset 1 (CRO -1) to LO=1 for preset 9 (CRO-9).
- All the presets for Amp#2 are set to high-pass filter for both left and right channel with cutoff frequency (HF-Hz) of 1000 Hz and filter order (HO) going from HO=10 for preset 1 (CRO -1) to HO=1 for preset 9 (CRO-9).

After all setups are configured Amp#1 and Amp#2 will produce left and right output with the frequency response as shown in **Fig 9**. Note that these curve represent real measurements and they are not result of computer simulation.



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