behringer CX2310 High-Precision Stereo 2-Way-Mono 3-Way Crossover User Manual

Contents

behringer CX2310 High-Precision Stereo 2-Way-Mono 3-Way Crossover

Important Safety Instructions

- Terminals marked with this symbol carry an electrical current of sufficient magnitude to constitute a risk of electric shock.

- Use only high-quality professional speaker cables with ¼” TS or twist-locking plugs pre-installed.
- All other installations or modifications should be performed only by qualified personnel.
- This symbol, wherever it appears, alerts you to the presence of uninsulated dangerous voltage inside the enclosure – voltage that may be sufficient to constitute a risk of shock.
- This symbol, wherever it appears, alerts you to important operating and maintenance instructions in the accompanying literature. Please read the manual.
- CautionTo reduce the risk of electric shock, do not remove the top cover (or the rear section). No user-serviceable parts inside. Refer servicing to qualified personnel.
- CautionTo reduce the risk of fire or electric shock, do not expose this appliance to rain and moisture.
- The apparatus shall not be exposed to dripping or splashing liquids and no objects filled with liquids, such as vases, shall be placed on the apparatus.
- CautionThese service instructions are for use by qualified service personnel only.
- To reduce the risk of electric shock do not perform any servicing other than that contained in the operation instructions.
- Repairs have to be performed by qualified service personnel.
    1. Read these instructions.
    2. Keep these instructions.
    3. Heed all warnings.
    4. Follow all instructions.
    5. Do not use this apparatus near water.
    6. Clean only with a dry cloth
    7. Do not block any ventilation openings. Install in accordance with the manufacturer’s instructions
    8. Do not install near any heat sources such as radiators, heat registers, stoves, or other apparatus (including amplifiers) that produce heat.
    9. Do not defeat the safety purpose of the polarized or grounding-type plug. A polarized plug has two blades one wider than the other. A grounding-type plug has two blades and a third grounding prong. The wide blade or the third prong is provided for your safety. If the provided plug does not fit into your outlet, consult an electrician for replacement of the obsolete outlet.10. Protect the power cord from being walked on or pinched particularly at plugs, convenience receptacles, and the point where they exit from the apparatus.11. Use only attachments/accessories specified by the manufacturer
    10. Use only with the cart, stand, tripod, bracket, or table specified by the manufacturer, or sold with the apparatus. When a cart is used, use caution when moving the cart/apparatus combination to avoid injury from tip-over.
    11. Unplug this apparatus during lightning storms or when unused for long periods of time.
    12. Refer all servicing to qualified service personnel. Servicing is required when the apparatus has been damaged in any way, such as a power supply cord or plug is damaged, liquid has been spilled or objects have fallen into the apparatus, the apparatus has been exposed to rain or moisture, does not operate normally, or has been dropped.
    13. The apparatus shall be connected to a MAINS socket outlet with a protective earthing connection.16. Where the MAINS plug or an appliance coupler is used as the disconnect device, the disconnect device shall remain readily operable.

Introduction

If you want to operate a loudspeaker system, that consists of several loudspeakers covering different frequency bands, then you naturally have to work with suitably differentiated input signals for each loudspeaker. To do this you need a frequency crossover that can split the input signal into several frequency bands. A difference should be noted between passive crossovers which are wired between amplifier and speaker, and active systems which are placed before the amplifiers in the signal chain. Multi-way speaker systems can be found almost everywhere today—and not only in stereo systems but in cinemas, discotheques, and concert halls. As customers have become more demanding they can even be found now in such “simple” products as TV sets. Why?

With the same sound pressure, low-frequency sound waves have a much greater amplitude (oscillation range) than high-frequency waves. When a single loudspeaker tries to produce bass and treble frequencies at the same time, a so-called intermodulation distortion will occur. This means that, when the speaker diaphragm is displaced by low frequencies, the treble frequencies seem to be raised in loudness, or lowered when the diaphragm reverses its direction. We cannot therefore expect a single loudspeaker to reproduce signals, spanning the whole audible frequency spectrum at the same level of quality. If, using a frequency crossover, a loudspeaker only has to reproduce a limited part of the frequency spectrum and it will do so at a greatly increased level of quality— thus producing a more regular frequency response and dispersion pattern.◊ This manual first describes the terminology used, so that you can fully understand the SUPER-X PRO and its functions. Please read the manual carefully and keep it for future reference.

Before you begin

The BEHRINGER SUPER-X PRO CX2310 was carefully packed in the factory, in order to ensure safe transport. Nevertheless, should the box show signs of damage please check the equipment itself immediately for any signs of external damage.◊ If the unit is damaged, please do not return it to us, but notify your dealer and the shipping company immediately, otherwise claims for damage or replacement may not be granted. Shipping claims must be made by the consignee. Be sure that there is enough space around the unit for cooling and please do not place the SUPER-X PRO on high-temperature devices such as power amplifiers, etc. to avoid overheating.◊ Before connecting the SUPER-X PRO to the mains, please carefully check that your equipment is set to the correct supply voltage! The fuse holder on the female mains connector has 3 triangular markings. Two of these triangles are opposite each other. The CX2310 is set to the operating voltage shown next to these markings. It can be set to another voltage by turning the fuse holder through 180°.

CAUTION: this does not apply to export models, which were designed e.g. only for a mains voltage of 115 V! Connection to the mains is made by means of a mains cable with an IEC receptacle which complies with the appropriate safety regulations.◊ Please note that all units must be grounded properly. For your own safety, you should never remove any ground connectors from electrical devices or power cords or render them inoperative.

Online registration
Please register your new BEHRINGER equipment right after your purchase by visiting **http://behringer.com** and read the terms and conditions of our warranty carefully. Should your BEHRINGER product malfunction, it is our intention to have it repaired as quickly as possible. To arrange for warranty service, please contact the BEHRINGER retailer from whom the equipment was purchased. Should your BEHRINGER dealer not be located in your vicinity, you may directly contact one of our subsidiaries. Corresponding contact information is included in the original equipment packaging (Global Contact Information/European Contact Information). Should your country not be listed, please contact the distributor nearest you. A list of distributors can be found in the support area of our website (**http://behringer.com**). Registering your purchase and equipment with us helps us process your repair claims more quickly and efficiently.
Thank you for your cooperation!

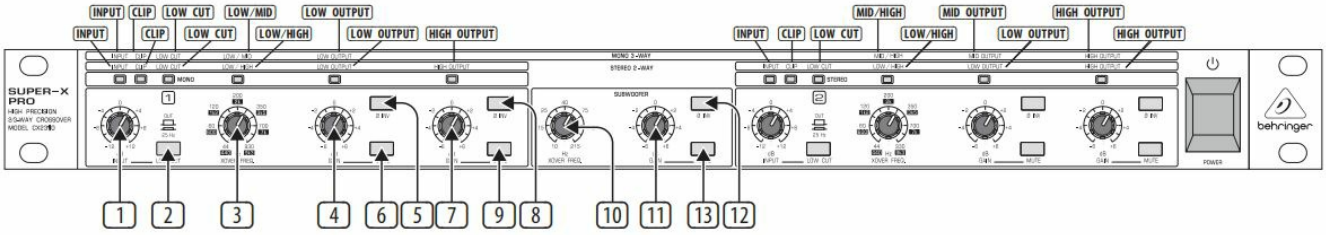
Control Elements

Since the SUPER-X PRO offers a variety of features, we have provided the active controls with suitable light-emitting diodes. These displays help you to keep track of what is happening even in dark stage environments. Additionally, all the switches on the front panel are illuminated and can thus show which functions are presently active. There are two labels in the form of strips, located above the controls. The text of the upper label indicates mono 3-way, and the lower label indicates stereo 2-way mode. The LEDs set below these labels show which

controls are active in the respective mode of operation.◊ On the rear panel, labels above/below the connectors refer to the various crossover modes available. Please make sure that the MODE switch and corresponding connectors are configured properly; otherwise, you could damage your speakers.

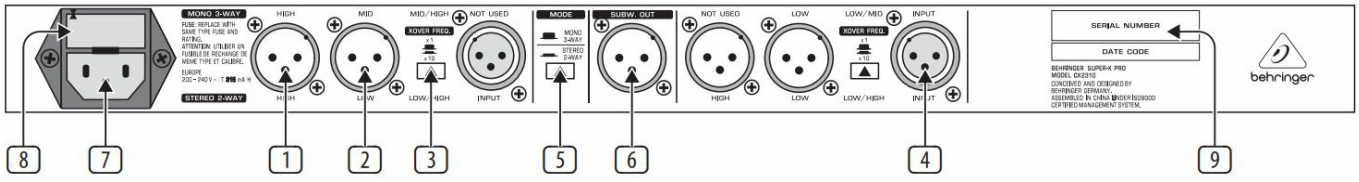
Stereo 2-way operation with separate subwoofer signal

First, activate the 2-way mode using the MODE switch on the rear panel (switch depressed). The STEREO LED on the front panel above the LOW CUT switch in the second channel lights up. The LED's above the active control on the front panel then light up. They show you which controls are active for the mode of operation, which you have selected. The functions of these controls can be seen from the second strip label. In stereo operation, the functions of both channels are identical so that the numbers on the overview are shown for only one channel.



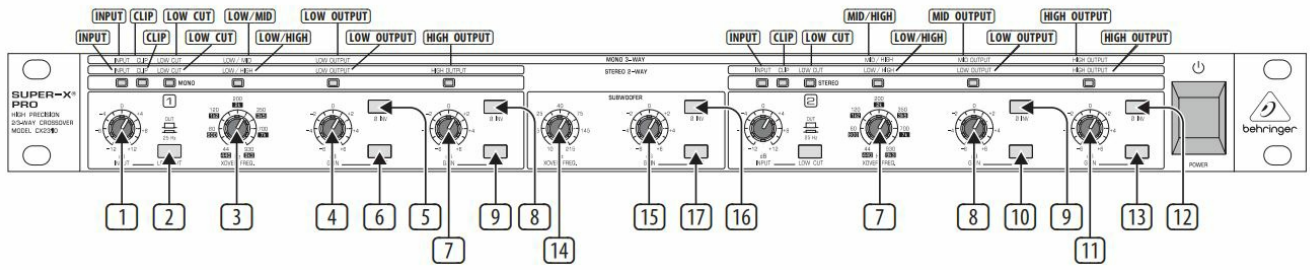
1. INPUT control. This control adjusts the input gain over the range from -12 to +12 dB.
2. LOW CUT switch. This switch activates the 25 Hz high-pass filter. It has a side gradient of 12 dB/octave and is used to protect your bass loudspeaker.
3. LOW/HIGH XOVER FREQ. control. This control governs the crossover frequency between the low and high bands.
4. LOW OUTPUT control. Controls the output level of the low band over the range from -6 to +6 dB.
5. LOW PHASE INVERT switch. This switch reverses the polarity of the low output.
6. LOW MUTE switch. This is used to mute the low band.
7. HIGH OUTPUT control. This controls the output level of the high band over the range from -6 to +6 dB.
8. HIGH PHASE INVERT switch. This switch reverses the polarity of the high output.
9. HIGH MUTE switch. This is used to mute the high band.
10. XOVER FREQ. control. This control governs the crossover frequency between the low signal and the subwoofer signal (10 to 235 Hz).
11. GAIN control. This is used to set the subwoofer output volume at the SUBW. OUT output.
12. PHASE INVERT switch. This switch reverses the polarity of the subwoofer output signal.
13. MUTE switch. This mutes the subwoofer output signal.

Fig. 2.2: Active control elements and connections on the rear panel of the SUPER-X PRO in stereo 2-way operation with separate subwoofer signal



1. HIGH OUTPUT connectors. These are the balanced XLR connectors for the high-band output signal.
2. LOW OUTPUT connectors. These are the balanced XLR connectors for the low-band output signal.
3. XOVER FREQ. switch. These switches are used to switch between the control ranges on the front panel LOW/HIGH XOVER FREQ. control. The range is either 44 to 930 Hz or 440 Hz to 9.3 kHz.

4. INPUT connectors. These are the balanced XLR connectors for the input signal.
5. MODE switch. In stereo 2-way operation the switch must be depressed. Please refer to the text on the rear panel of the equipment. Never activate the MODE and XOVER FREQ. switches without having first switched off the equipment. Switching between these while the equipment is in use produces heavy interference noise which could damage the loudspeakers or the system.
6. SUBW. OUT connector. This is the balanced XLR output for the mono subwoofer signal. This signal is constant in mono and stereo mode and provides an additional means of providing 2- and 3-way operation (see chapter 3.5).
7. IEC-RECEPTACLE. This is the main connection of the SUPER-X PRO. A suitable mains cable is included with the equipment.
8. FUSE HOLDER /VOLTAGE SELECTOR. Before connecting the equipment to the mains supply, please check that the voltage display conforms with your mains voltage supply. When replacing the fuse, make sure you use another one of the same type. With many units, the fuse holder can be set in one of two positions, in order to switch between 230 V and 115 V.
   Please note: if you wish to operate a unit outside Europe, then a stronger fuse must be used.
9. SERIAL NUMBER. Please take the time to complete and return the warranty card within 14 days of the date of purchase, otherwise, you will lose the right to the extended warranty. Or just use our online registration (**behringer.com**).



Mono 3-way operation with separate subwoofer signal
First, activate mono 3-way mode using the MODE switch on the rear panel (switch released). The MONO LED on the front panel above the LOW CUT switch lights up. Then the LEDs above the active control on the front panel light up. They show which controls are active for the mode of operation, which you have selected. The text on the first label shows the functions of these controls.

1. INPUT control. This control adjusts the input gain from -12 to +12 dB.
2. LOW CUT switch. This switch activates the 25 Hz high pass filter.
3. LOW/MID XOVER FREQ. control. This control governs the crossover frequency between the low and middle bands.
4. LOW OUTPUT control. This controls the output level of the low band over the range of -6 to +6 dB.
5. LOW PHASE INVERT switch. This switch is used to reverse the polarity of the low output.
6. LOW MUTE switch. This is used to mute the low band.
7. MID/HIGH XOVER FREQ. control. This control governs the crossover frequency between the mid and high bands.
8. MID OUTPUT control. This is used to control the output level of the mid-band over the range of -6 to +6 dB.
9. MID PHASE INVERT switch. This reverses the polarity of the mid-output.
10. MID MUTE switch. This is used to mute the midband.
11. HIGH OUTPUT control. This controls the output level of the high band over the range from -6 to +6 dB.

12. HIGH PHASE INVERT switch. This reverses the polarity of the high output.
13. HIGH MUTE switch. This is used to mute the high band.
14. XOVER FREQ. control. This control governs the crossover frequency between the low signal and the subwoofer signal.
15. GAIN control. This sets the subwoofer output volume level at the SUBW.OUT output.
16. PHASE INVERT switch. This switch is used to reverse the polarity of the subwoofer output signal.
17. MUTE switch. This is used to mute the subwoofer output signal

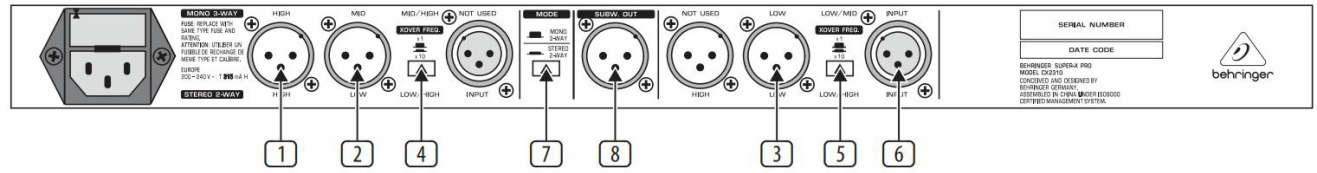


Fig. 2.4: Active control elements and connections on the rear panel of the SUPER-X PRO in mono 3-way operation with separate subwoofer signal

1. HIGH OUTPUT connector. This is the balanced XLR connector for the high-output signal.
2. MID OUTPUT connector. This is the balanced XLR connector for the mid-output signal.
3. LOW OUTPUT connector. This is the balanced XLR connector for the low output signal.
4. XOVER FREQ. switch. This is used to switch between the control ranges of the front panel MID/HIGH XOVER FREQ. control. The range is either 44 to 930 Hz or 440 Hz to 9.3 kHz.
5. XOVER FREQ. switch. This is used to switch between the control ranges of the front panel LOW/MID XOVER FREQ. control. The range is either 44 to 930 Hz or 440 Hz to 9.3 kHz.
6. INPUT connector. This is the balanced XLR connector for the input signal.
7. MODE switch. This must be de-activated when in mono 3-way operation. Never activate the MODE and XOVER FREQ. switches without having first switched off the equipment.
8. Switching between these whilst the equipment is in use produces heavy interference noise which could damage the loudspeakers or the system.
9. SUBW. OUT connector. This is the output for the mono subwoofer signal. This signal remains constant in mono and stereo mode and offers an additional way of providing 2-way and 3-way operation (see chapter 3.5).

Applications

You will need some tools to help set up the SUPER-X PRO to its optimal configuration. To set up the crossover frequency you need to know which frequency range a loudspeaker stack covers, over which range the sound energy is linearly transmitted, and where reductions or increases in the frequency response occur. In addition, every room has different size and quality characteristics. These strongly influence the sound response, since resonances and reflections in the different frequency ranges can also lead to reductions or increases in the sound picture. You will need suitable equipment in order to be able to recognize and compensate for these features.

Tools

You will need a high-grade microphone for making measurements. This should have a frequency response that should be as linear as possible (e.g. the BEHRINGER measurement microphone ECM8000) and at least linear over the range from 90 Hz and 15 kHz. Place the microphone about 5 m. in front of the speaker system and between the diaphragms of the two frequency bands you wish to measure. When using a measuring microphone to set the levels for the individual frequency bands and the crossover frequencies, you should only operate one loudspeaker stack. For optimal settings, you will usually need to reposition the microphone between two successive measurements. When used in combination with a measuring microphone and a generator producing pink noise via input into the P.A. mixing console, an analyzer will show the sound energy distribution over the

individual frequency bands (usually in 1/3 of an octave). The BEHRINGER ULTRA-CURVE PRO DSP8024 equalizer/analyzer is the ideal tool for this application.

When listening to the overall sound of your system, you should walk around the audience area and try to detect resonance frequencies or cancellations. The sound should be optimized for the position where most of the audience will be gathered, without however neglecting other areas. This often means that the system must be operated in mono. Whenever you use technical aids such as analyzers, measuring microphones, etc., you should check the desired results with your own ears.◊ BEHRINGER accepts no responsibility for any damage or destruction of loudspeakers arising from improper or incorrect use of the SUPER-X PRO and in particular from actions that are in contravention of the clearly stated procedures given in this manual.

Setting the input and output levels

Both inputs offer a gain or loss of up to 12 dB. Normally, the output level on the mixing console and the input sensitivity of the amplifiers are identical, i.e. 0 dB at the mixing console corresponds with 0 dB at the amplifiers. This means that there is full control over the amplifiers. In this case, the SUPER-X PRO should have no effect on the system level and all input and output level settings should be set at 0 dB. Where e.g. a home recording or disco console is being used with an operating level of -10 dBV but the amplifiers need +4 dBu for complete control, then an additional gain of 12 dB must be provided between them. In this case, the INPUT control of the SUPER-X PRO should be set to the maximum. The output levels of the single bands can be raised/lowered by as much as 6 dB. To achieve a linear frequency response in the system, all output levels should be adjusted with the help of an analyzer. To check the crossover frequencies and levels, mute all outputs except for one, and playback pink noise over the system at an appropriate volume level. When you now switch on the adjacent band, the level measured around the crossover frequency should go up by 3 dB.
Repeat this process for all crossover frequencies.

Correcting problems

Check the entire frequency response of the system. Rooms have quite an impact on the frequency response of speaker systems, due to resonance and various reflections, so you cannot expect to achieve a linear frequency response right from the start. To achieve this, you need an equalizer such as the ULTRA-CURVE PRO DSP8024 or the ULTRA-GRAPH GEQ3102. Look for drop-outs around the crossover frequencies! If the frequency response is very irregular, then it can make sense to grade adjust it using the frequency crossover, before using an equalizer (EQ). The errors in the crossover frequency must then be as far as possible corrected using the EQ. If the loudspeaker diaphragms in a multi-way system are not exactly aligned along a vertical axis, the varying distances between the sound source and the listener result in phase errors and cancellations (also known as the “comb filter effect”). Particularly in the higher frequencies, it is important, due to the shorter wavelengths, to position the diaphragms above each other and not next to each other.

The various types of construction used in individual systems (horns, bass reflex cabinets, etc.) still give rise to run time differences, even where the front sides of all systems are aligned vertically above each other. In this case, a run time correction must be made by electronic means. This can be done by using a delay function. Run time differences can be compensated by delaying the frequency bands over a range of milliseconds. This helps avoid loss of sound quality, particularly in the high tone ranges.◊ Runtime correction is not the same as phase correction. If a speaker system has the same run times then it also has the same phases (unless the polarity of a cable has been reversed). However, the opposite is not necessarily true.

Setting the crossover frequencies

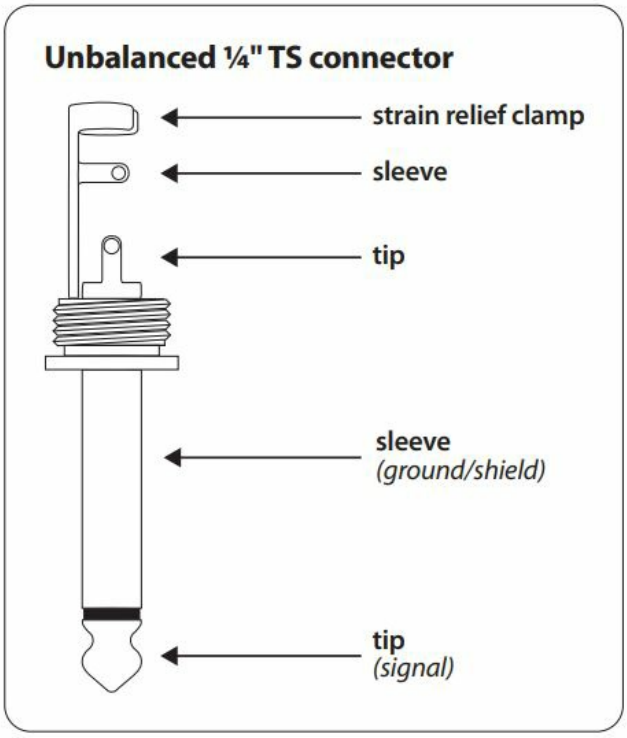
The frequency range from which the crossover frequencies can be selected can be one of two ranges—from 44 to 930 Hz and from 440 Hz to 9.3 kHz. To set the crossover frequencies, please first read the manufacturers’ specifications for the individual loudspeaker components. To use the capacity of your system at its best you should set up the crossover frequencies in accordance with the frequency diagrams on the individual loudspeaker boxes. Further, the crossovers should not lie on peaks or drop-outs. Look for a range with the flattest possible curve. If folded bass horns are being used, then the length of the horn path must also be taken into account, since the run-time displacements arising from differing long paths can also have a negative effect on the frequency

development (see Chapter 3.3). Never operate loudspeakers or horn drivers below the limiting frequency specified by the manufacturer!

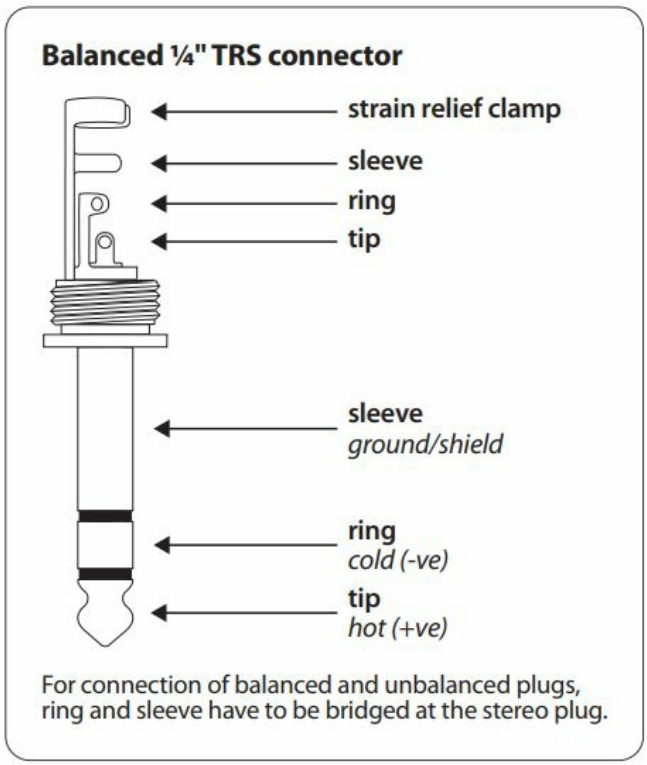
SUBWOOFER output

To achieve a very loud and deep bass playback the SUPER-X PRO has an additional mono subwoofer output for 2-way and 3-way operation. In this sense, the CX2310 is a stereo 2-way + mono 1-way or mono 4-way frequency crossover. The subwoofer signal is mono since people cannot sense the location of lower frequencies. Another reason is that combining all bass signals into a single signal produces an excellent effect. This is because two bass speaker boxes combined together produce 3 dB more sound pressure than if they were separated from each other by a small distance. The increased pressure is due to the speakers producing a single wavefront. With four loudspeaker boxes, the increase is 6 dB. The reason here is the spherical shape of the expanding low-frequency sound waves. Bass boxes that are separate from each other can mutually disrupt each other where their sound waves meet (what happens here can be easily imagined if you throw two stones into the water—first separately and then stuck together).

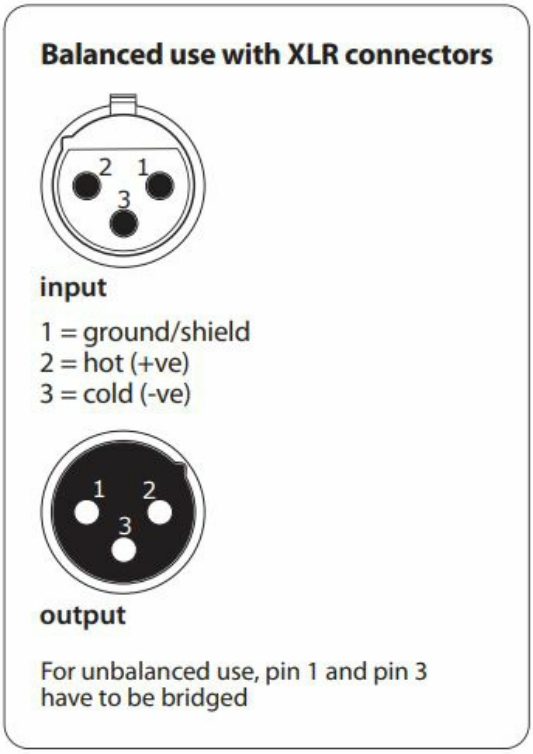
Audio Connections



As a standard, the BEHRINGER SUPER-X PRO CX2310 is equipped with electronically servo-balanced inputs and outputs. The circuit design features automatic hum suppression for balanced signals and so ensures trouble-free operation, even at the highest operating levels. Externally induced mains hum, etc. can therefore be effectively suppressed.



The automatic servo function recognizes the presence of unbalanced connectors and adjusts the nominal level internally to avoid level differences between the input and output signals (6-dB correction). Please ensure that only qualified persons install and operate the SUPER-X PRO. During installation and operation, the user must have sufficient electrical contact with the earth. Electrostatic charges might affect the operation of the unit.



Specifications

Inputs

- Connectors XLR
- Type Electronically servo-balanced, HF filtered
- Impedance balanced >50 kOhm, unbalanced >25 kOhm

- Max. Input level +22 dBu typical, balanced or unbalanced
- CMRR >40 dB, typical >55 dB at 1 kHz

Outputs

- Connectors XLR
- Type Electronically servo-balanced, HF filtered
- Impedance balanced 60 Ohm, unbalanced 30 Ohm
- Max. Output level +20 dBm balanced/unbalanced

Performance

- Bandwidth 20 Hz to 20 kHz, +0/-0.5 dB
- Frequency response <5 Hz to >60 kHz, +0/-3 dB
- Signal to noise Ref.: +4 dBu, 20 Hz to 20 kHz, unweighted
- Stereo-Mode: Mono-Mode:
- Low output >93 dB >93 dB
- Mid output >95 dB
- High output >91 dB >91 dB
- Interchannel crosstalk High to Low: <93 dB
- High to Mid: <94 dB
- Mid to Low: <95 dB

Crossover

- Filter-Type Linkwitz-Riley, 24 dB/octave, state-variable
- Mono Mode Frequencies x1 x10
- Low/High 44 to 930 Hz 440 Hz to 9.3 kHz
- Low/Mid 44 to 930 Hz 440 Hz to 9.3 kHz
- Mid/High 440 Hz to 9.3 kHz
- Stereo Mode Frequencies x1 x10
- Low/High 44 to 930 Hz 440 Hz to 9.3 kHz

Power Supply

- Mains voltage
- USA/Canada 120 V~, 60 Hz
- U.K./Australia 240 V~, 50 Hz
- Europe 230 V~, 50 Hz
- General Export Model 100 – 120 V~, 200 – 240 V~, 50 – 60 Hz
- Power consumption <17 W
- Fuse UL 100 – 120 V~: T 630 mA H
- Europe 200 – 240 V~: T 315 mA H
- JP 90 – 110 V~: T 630 mA H

- Mains connection Standard IEC receptacle
- Physical/Weight
- Dimensions approx. 44.5 x 482.6 x 215 mm (1.75 x 19 x 8.5″)
- Net Weight 2.3 kg (5 lbs)
- Shipping Weight 3.4 kg (7.5 lbs)

BEHRINGER is constantly striving to maintain the highest professional standards. As a result of these efforts, modifications may be made from time to time to existing products without prior notice. Specifications and appearance may differ from those listed or illustrated.

Documents / Resources

	behringer CX2310 High-Precision Stereo 2-Way-Mono 3-Way Crossover [pdf] User Manual CX2310 High-Precision Stereo 2-Way-Mono 3-Way Crossover, CX2310, High-Precision Stereo 2-Way-Mono 3-Way Crossover, Stereo 2-Way-Mono 3-Way Crossover, 2-Way-Mono 3-Way Cr ossover, 3-Way Crossover, Crossover