

The Choice of Professionals®

**BMC1
BASS MANAGEMENT
CONTROLLER**

**OPERATION
MANUAL**



PROFESSIONAL

IMPORTANT SAFETY INSTRUCTIONS

1. Read these instructions thoroughly.
2. Keep these instructions in a safe place for future reference.
3. Heed all warnings.
4. Follow all instructions.
5. Do not use this apparatus near water.
6. Clean only with dry cloth.
7. Do not block any ventilation openings. Install in accordance with the manufacturer's instructions.
8. Do not install near any heat source (radiator, heat register, stove, amplifier, etc.).
9. If your electrical outlet accepts a polarized or grounding-type plug, do not defeat the safety purpose of the plug. A polarized plug has two blades with 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 your outlet, consult an electrician for replacement of the obsolete outlet.
10. Protect the power cord from being walked on or pinched, especially at the plug and socket ends, convenience receptacles and the point where they exit from the apparatus.
11. Only use attachments/accessories specified by the manufacturer.
12. Use only with the cart, stand, tripod, bracket or table specified by the manufacturer.
13. Unplug this apparatus during lightning storms or when unused for long periods of time.
14. Refer all service to authorized service personnel. Service is required when the apparatus has been damaged in any way: damage to power cord or plug, spilt liquid or foreign objects in the apparatus, exposure to rain or moisture, abnormal function, dropping, etc.
15. Do not expose the apparatus to dripping or splashing. Do not place objects containing liquids (vases, cups, bottles, cans, etc.) on or near the apparatus.
16. **WARNING:** To reduce the risk of fire or electric shock, do not expose the apparatus to rain or moisture.
17. There should always be easy access to the mains plug or electrical switch used to turn off the apparatus.
18. **WARNING:** A Class I apparatus must be connected to a mains socket outlet with a protective earth connection.



The lightning flash with arrowhead symbol within an equilateral triangle is intended to alert the user of the presence of uninsulated "dangerous voltage" within the products enclosure that may be of sufficient magnitude to constitute a risk of electric shock to persons.



CAUTION:
TO REDUCE THE RISK OF ELECTRIC SHOCK,
DO NOT REMOVE COVER (OR BACK).
NO USER SERVICEABLE PARTS INSIDE.
REFER SERVICING TO
QUALIFIED SERVICE PERSONNEL.



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

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Country:
Invoice Number:

2. PRODUCT OVERVIEW

The MK Sound BMC is a balanced, line-level studio bass management controller intended for use with MK Sound's line of professional studio monitors and with high-end home theater installations. Although the BMC was primarily designed for monitoring 5.1 audio, its flexible architecture allows it to be used for monitoring mono, stereo, Dolby Surround, Dolby Digital, DTS and other formats.

The BMC combines several necessary functions in one 19" rack mount 1RU package. Along with bass management and LFE channel control, it also provides individual channel adjustment capability to properly calibrate your entire monitor system.

The controller consists of a series of five high-pass filters (one each for the L, C, R, LS, RS channels) that route high frequency information (above 80Hz) to their appropriate channel's amplifier and speaker. Each channel is also routed through a matching 80Hz lowpass filter. This low frequency information is then routed to a summing amplifier, which in turn sends this low frequency information, along with the LFE channel, to two subwoofer outputs.

This is done for two reasons. First, small loudspeakers may not be able to properly reproduce information below 80Hz. This information is therefore summed together and redirected from the individual channels to a loudspeaker that can reproduce this low frequency information with clarity and power – a subwoofer. With the introduction of digital audio, it has become necessary for loudspeaker systems to be able to accurately reproduce audio that has a bandwidth of 20Hz to 20kHz with wide dynamics. A satellite/subwoofer system is the best way to accomplish this.

Secondly, today's home theater receivers utilize bass management per Dolby requirements. In order for work done in the studio to translate properly, the mixer must hear his mix exactly the way it will ultimately be played back. The BMC together with a properly set-up and calibrated MK Sound monitor system allows the mixer to hear his work with the greatest possible accuracy.

The LFE channel is a discrete channel created by the mixer to supplement the low frequency content of the mix.

The subwoofer channel is the summed low frequency content from the five main channels. It is created by the processor in the encoder/decoder of your chosen format, or in this case, the MK Sound Bass Management Controller.

The BMC correctly balances all six channels in a 5.1 mix so the mixer can accurately hear how the format processor will affect his mix.

The goal is to be able to accurately monitor multi-channel audio with a bandwidth of 20Hz to 20kHz containing extreme dynamics and have that audio translate accurately when played back on other systems.

A properly set-up and calibrated MK Sound monitoring system with an MK Sound BMC will allow the mixer to make quick and accurate decisions in a listening environment that he will find satisfying and enjoyable.

Input and Output Connector Wiring

Pin 2: Plus

Pin 1: Ground

Pin 3: Minus

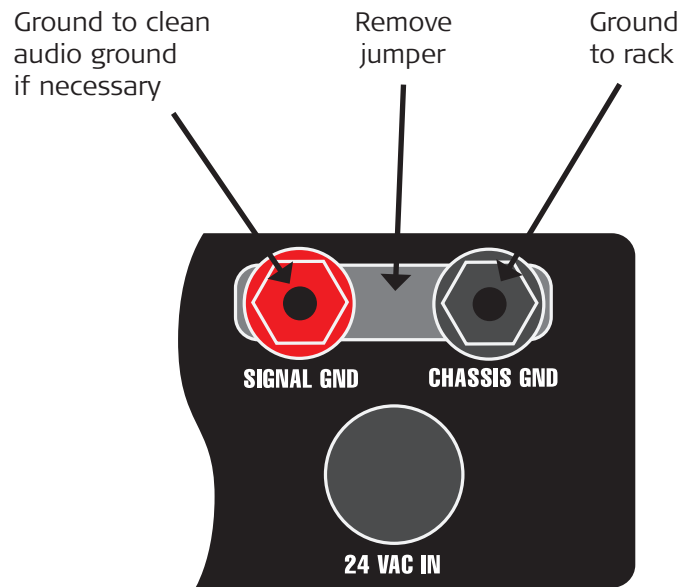
General Connection Guidelines

Certain types of audio cables have high capacitance in the range of 0.75pf/ft. Long runs of high capacitance cable can cause a decrease in high frequency performance of the controller. Approximately 300 feet of 0.75pf/ft cable will cause a drop of 3dB at 24kHz. In order to keep this effect to a minimum, use high-quality, low capacitance cable or keep your cable runs from the controller to your amplifier to under 150 feet.

3. GROUNDING

The bass management controller was designed so as not to add noise to an already clean system. To eliminate the possibility of the extra safety ground introducing ground loop hum, the controller uses an external double-insulated UL-approved power transformer that does not require a safety ground. The controller is grounded to the audio signal ground of the mixer and power amplifiers through the XLR cables. In order to minimize grounding problems between the controller and equipment racks, the internal audio signal ground can be separated from the chassis ground. On the rear of the unit are two binding posts. The black binding post is connected to the chassis. The red binding post is connected to the audio signal ground. Normally, these binding posts are shorted together with a gold-plated jumper. However, in a situation where the chassis may be connected to a "dirty" ground, this jumper can be removed, separating the audio and chassis ground. In addition, the binding post can be used to attach an additional heavy gauge grounding wire.

FIGURE 2: GROUNDING



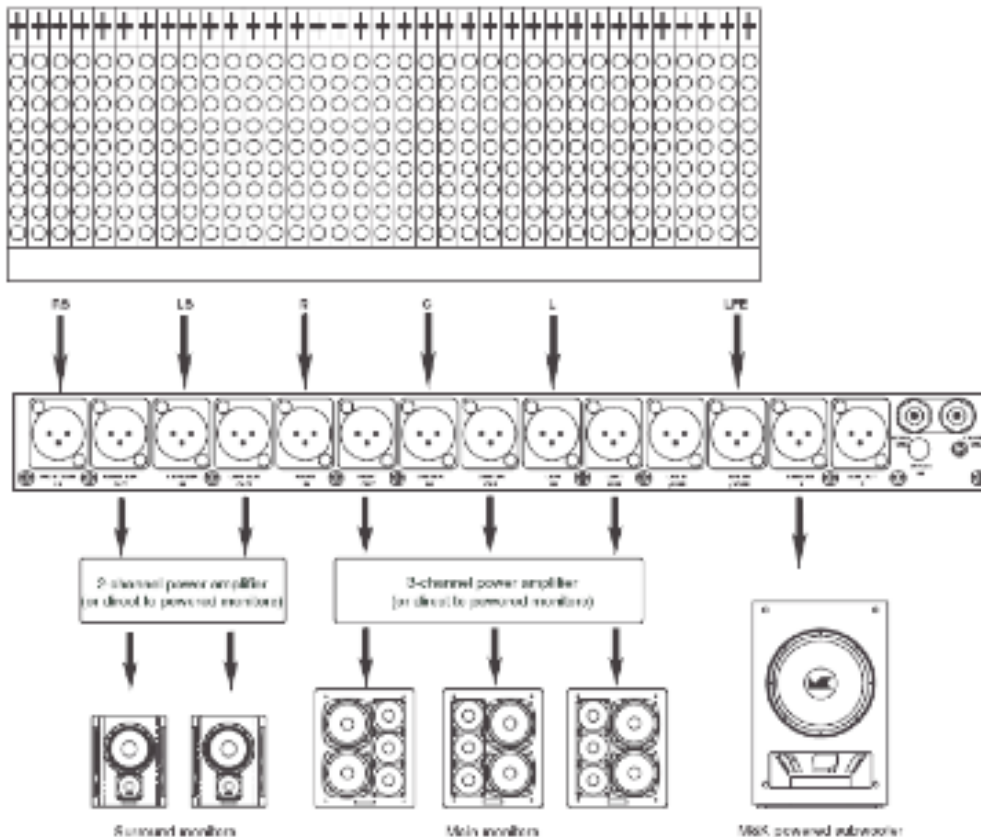
TECHNICAL TIP:

It is sometimes a common practice to only ground XLR cables at one end to prevent ground loops through the cable. In order to work correctly, the BMC must be grounded to either the mixing console or the power amps or both. This is normally done through the XLR cables. If you are using XLR cables with the shield disconnected at one end for both inputs and outputs, you must use the RED binding post to connect the BMC to the audio system ground.



- (NOTE: If you are working in mono or stereo, do not connect any cables to the low frequency effects (LFE) inputs as these formats do not use a discrete low frequency effects track.)

FIGURE 4: DOLBY DIGITAL 5.1 CONNECTIONS

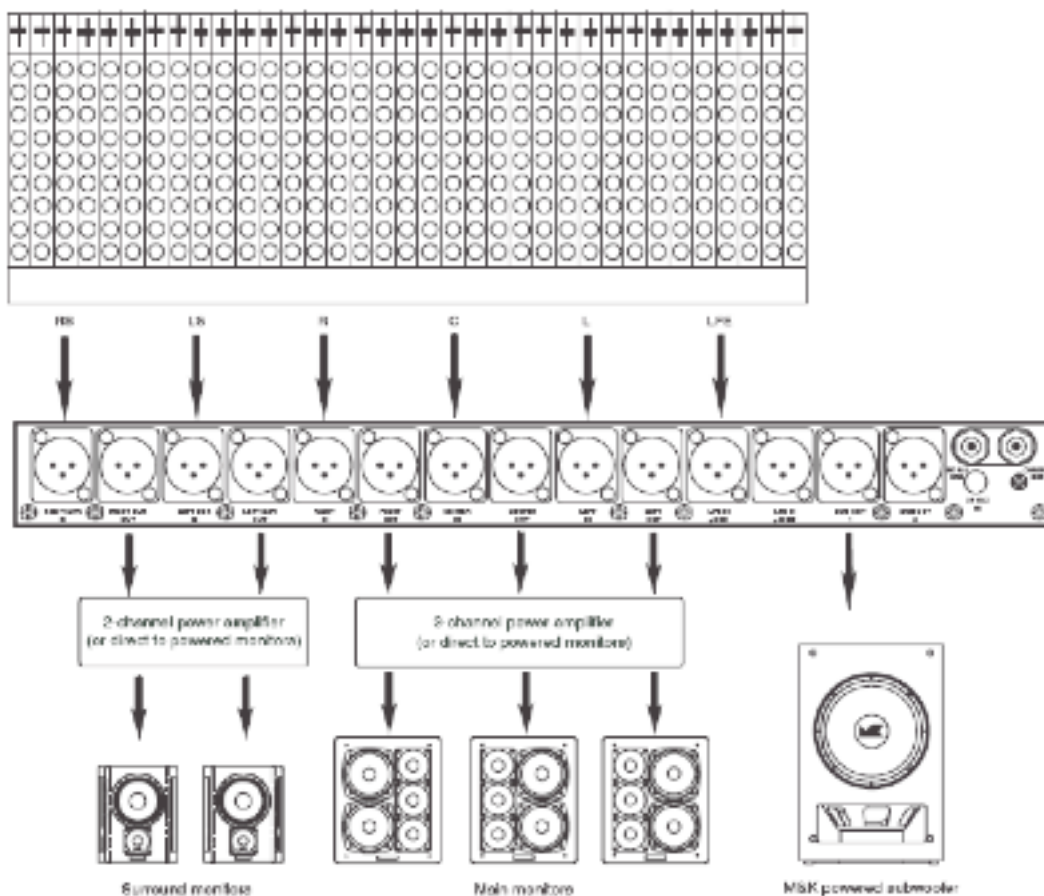


5. CONNECTING FOR DOLBY DIGITAL (Figure 4)

- A.** Connect the left, center, right, left surround and right surround outputs of your mixer to the left, center, right, left surround and right surround input channels of the controller.
- B.** Connect the outputs of the controller to the inputs of your power amplifiers or directly to your powered loudspeakers.
- C.** Connect the mixer output assigned to the low frequency effects channel (LFE) to the +10dB input of the controller.
- D.** Connect one of the subwoofer outputs of the controller to the XLR input of your subwoofer. Set your MK Sound Professional subwoofer as follows: set the filter switch to THX, set the phase switch to plus and set the gain switch to the THX position.
- E.** If you are using passive speakers with external amplifiers, connect your speaker system to the power amplifiers.
- F.** Locate the external power supply for the controller and plug it into the 4-pin power connector on the back of the controller. Secure it in place by turning the outer ring clockwise. Plug the external power supply into a power outlet. The front panel LED will glow red when power is applied.

(Note: In order to gain an extra 10dB of headroom on the low frequency effects (LFE) channel, Dolby specifies that this channel be recorded 10dB lower than the 5 main channels. This 10dB lower level is made up in the playback chain to restore the correct 5 channel to .1 channel balance. For additional information, please see the "Dolby Digital Professional Encoder Manual" which is available from the Dolby website. (www.dolby.com)

FIGURE 5: DTS 5.1 CONNECTIONS



6. CONNECTING FOR DTS (Figure 5)

A. Connect the left, center, right, left surround and right surround outputs of your mixer to the left, center, right, left surround and right surround input channels of the controller.

B. Connect the outputs of the controller to the inputs of your power amplifiers or directly to your powered loudspeakers.

C. Connect the mixer output assigned to the low frequency effects channel (LFE) to the +0 dB input of the controller.

D. Connect one of the subwoofer outputs of the controller to the XLR input of your subwoofer. Set your MK Sound Professional subwoofer as follows: set the filter switch to THX, set the phase switch to plus and set the gain switch to the THX position.

E. If you are using passive speakers with external amplifiers, connect your speaker system to the power amplifiers.

F. Locate the external power supply for the controller and plug it into the 4-pin power connector on the back of the controller. Secure it in place by turning the outer ring clockwise. Plug the external power supply into a power outlet. The front panel LED will glow red when power is applied.

7. THE LOGIC BEHIND BASS MANAGEMENT

Engineers mixing multi-channel audio (Stereo, Dolby Surround, 5.1 Dolby Digital, DTS, and other surround formats) are faced with numerous challenges when trying to accurately monitor complex and dynamic material, and determine how this material will sound in its intended playback space. These issues include reproducing 5, 7, or more channels of full range audio, plus an optional Low Frequency Effects channel (LFE), all of which have bandwidth to 10Hz or below, with very high dynamic range, and achieving consistent bass response from all the channels throughout the control room monitoring area.

Any studio designer will tell you that for a stereo mix environment it is crucial that the left and right monitor speakers, when in their selected studio location, have near identical bass response when measured at the mixer's position. No less is true in multi-channel mixing. Proper low frequency equalization and mixing decisions are difficult, if not impossible, unless all 5.1 or more channels have the same bass frequency response at the mixer's listening position. Due to unavoidable room modes, five or more correctly placed full range speakers, (in even the most perfectly designed studio) will produce dramatically different low frequency characteristics at the mix position. This is especially true for the very crucial center channel speaker. Variations of 10 to 20dB may be measured at frequencies below 80Hz.

When the bass from all the channels is redirected into a single, PROPERLY placed subwoofer, then each and all of the channels will exhibit identical bass response at the listening position, and give surprisingly even coverage in virtually every control room. Simply stated, bass management is putting an electronic bass frequency crossover (typically 80Hz) on all the channels, and redirecting the bass frequencies below 80Hz from each of the channels to a common subwoofer. By combining a carefully designed low frequency acoustic rolloff of all the main speakers, including the surrounds, and a matching 2nd order electronic filter in the MK Sound Bass Management Controller, MK Sound achieves all the theoretical benefits of a 4th order Linkwitz-Riley filter.

Another good reason for using bass management in the control room is that even the least expensive Dolby Digital consumer decoder, as found in millions of homes, has bass management built in, allowing the bass from all channels to be fed to a single subwoofer. Also, all Home THX systems utilize an 80Hz bass management system. Monitoring with proper bass management in the professional control room insures proper playback translation into the "home theater" environment and into larger spaces such as motion picture theaters.

It is important to understand that Bass Management is done as a function of the monitoring system and in no way affects the actual mix. Full frequency musical content, is assigned or panned around the room via normal console or software operations to the various desired subjective locations such as Left, Center, Right, Left Surround, and so on. This full frequency musical data corresponding to each speaker location channel is stored normally on tape, hard drive, etc.

Bass Management psychoacoustically works because the ear-brain mechanism cannot detect direction at low frequencies, but takes its directional cues from the harmonics of the low frequency sound. In the monitoring process, frequencies below 80Hz are redirected to the subwoofer. Frequencies above 80Hz are sent to the desired speaker. During the hearing process, our hearing mechanism integrates the sound into the correct spatial auditory image.

Bass management is equally suited to all formats from two-channel stereo to 5.1 and beyond. Indeed, existing control rooms that are doing stereo two-channel mixes, especially with smaller nearfield monitors placed on the console, can benefit immensely from the correct integration of Bass Management and a subwoofer; because the engineer is now able to hear low frequency anomalies caused by room rumble, microphone stand thumping, breath pops, and other artifacts that cause undesirable actions later in the broadcast, film chain, or DVD Mastering process.

When mixes are intended for theatrical presentation, it is sometimes necessary to use an additional channel for extra low frequency effects or enhancement. This channel is called the LFE or Low Frequency Effects/Enhancements channel. In the control room monitoring environment, the LFE channel, if or when it is used in the mix, is monitored by the same subwoofer used for the regular [L,C,R,LS,RS] channels. The MK Sound BMC has both a 0dB (with unity gain) and +10dB (with 10dB gain) inputs to accommodate any mixing / monitoring situation, as per Dolby specifications.

8. SPEAKER PLACEMENT

TWO-CHANNEL SPEAKER PLACEMENT

The sound quality produced by your speakers can be significantly enhanced by careful attention to their placement. There are several things that you can do to achieve an excellent monitoring environment in your room.

These four factors are essential to achieving excellent performance from your speakers:

- A. Height or angle
- B. Location away from walls or reflecting surfaces
- C. Separation between Left and Right speakers
- D. Vertical orientation of the speaker cabinets

A. Height or angle

Your MK Sound speakers are designed for very fast and accurate transient response. They will provide you with the best sound quality and flattest frequency response when properly oriented relative to your ear. Ideally, the tweeters should be on the same axis as your ears when you are sitting in your main listening position. If your speakers are mounted above or below this position, angle the speakers so that the tweeters are aimed at your ears when you are in the main listening position.

An LED has been installed inside the front baffle of your speaker. This LED can be used as an alignment tool for you speakers and indicates perfect on-axis alignment when the LED is at its brightest.

B. Location away from reflecting surfaces

Whenever possible, avoid placing your speakers directly on the mixing console. Contact with the console can create a buildup of certain frequencies, particularly in the low to low-mid frequencies, that will cause uneven bandwidth reproduction.

Additionally, speakers placed on the console disperse sound onto the console as well as the listener. The reflected sound off the console arrives at the ear slightly later than the direct sound. This results in comb-filtering, phasing and a general blurring of the sonic image.

To avoid these problems, consider using stands or wall mounting brackets to optimize your speaker's performance.

Remember to allow for adequate ventilation for your speakers. Your speaker's power amplifiers are mounted on the back of the cabinet and these generate heat through the heatsink. Leave at least three inches of clearance around the back of the speaker and do not place them close to heaters or heating ducts.

C. Separation between left and right speakers (Figure 6)

Your MK Sound speakers are designed as near to mid-field monitors. This generally means placing the speakers at a distance of 3 to 6 feet (roughly 1 to 2 meters) from the listener.

Many engineers feel that creating an equilateral triangle between the two speakers (Y & Z) and your listening position (X) provides the best placement solution. This means that the distance between you and each speaker and the distance between the two speakers should be equal. Or, if the distance between you and one of the speakers is 6 feet, make the distance between the two speakers 6 feet and the distance between you and the other speaker 6 feet as well. See Figure 6.

When using MK Sound powered speakers, angle the speakers towards you until you can see the LED at its brightest. This will insure that the woofer and tweeter are pointed directly at your ears. If you set up your system and you feel that you don't have phantom center clarity, your speakers may be too far apart – try moving the speakers closer together until the center channel image is restored.

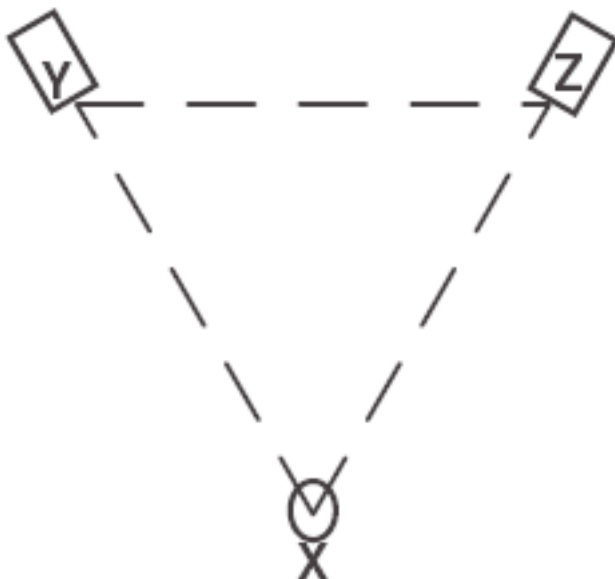


FIGURE 6: TWO-CHANNEL SPEAKER SEPARATION
 $XY = YZ = ZX$

D. Vertical orientation

Your MK Sound professional speakers are designed to be oriented vertically. This orientation provides the best image and phase coherency. For this reason, the bracket mounting holes are located on the bottom of the cabinet.

If your installation requires horizontal orientation, the MPS-1611P and MPS-2401P may be placed in this manner, but do not place the MPS-2510P or the S-150 horizontally.

MULTI-CHANNEL SPEAKER PLACEMENT

There is considerable debate within the professional audio community as to the best speaker placement for multi-channel mixing. Some mixers use placement solutions that are understood and well accepted, while others remain unconvinced about a speaker placement standard and prefer to try other options.

One of the biggest obstacles to accurate monitoring in the control room is the recording console. With its large, flat surface and its placement in the middle of the room, it provides the largest reflective surface between you and your speakers. Reflected sound coming off the console arrives later than direct sound. The combination of direct and reflected sound creates distortion in the form of comb-filtering. For this reason, we recommend that you do not place your speakers on the console itself, but rather on stands around the console or wall-mounted on brackets above the console.

For music mixing or composition, all speakers should be of the same model and placed equidistant from the listener. This is to maintain timbre and coincidental arrival of all channels at the listening position. If the center channel must be a smaller speaker, we recommend using the MPS-2401P, or the passive M-7 placed horizontally. Their timbre is matched to that of our other powered monitors.

When your speakers are used as front loudspeakers, they should be located with the tweeter at seated ear height (center tweeter on the MPS-2510P and S-150). If this is not possible, your speakers should be angled in the vertical plane and toed-in to meet at seated ear height at the center of the primary seating/monitoring location, so as to cover the listening area uniformly with high frequency energy. An LED has been mounted on the center axis of the speaker. This LED can be used as an alignment tool for final aiming of the loudspeakers and indicates perfect on-axis alignment when the LED is at its brightest.

If the speakers are not at seated ear height, it is recommended that they not be higher than 15 degrees above that plane.

For film work, all five speakers in a surround system should be of the same model or with Tripole surrounds for the rear speakers. Sometimes, however, the surround speakers must be smaller than the mains. MK Sound offers several smaller models that are timbre matched to our larger speakers.

If the speakers are located behind an acoustically transparent picture screen it is recommended by SMPTE and THX that they be placed at $\frac{5}{8}$ the height of the picture screen. Placing the speakers in this manner will ensure that sound elements relate best to the image.

When placing loudspeakers around a video monitor, it is best to place all three main speakers either all above or all below the screen. Placing the center channel speaker on a different horizontal plane from the left and right speakers will create different arrival times between the front three speakers and will adversely affect imaging.

NOTE: All MK Sound Professional main monitors are shielded. However, be careful not to place MK Sound Tripole surround monitors near video monitors, as the side-firing drivers may gauss the video monitor and distort the visual image.

For the best low-frequency match between speakers, we recommend the speakers be placed a minimum of 3 feet (or 1 meter) in front of any wall. If your speakers are placed inside a cabinet, resonances from the cabinet cavities should be eliminated; a combination of front baffling, internal damping, and perforation of the sides and rear of the cabinetry should reduce the resonance effects.

The base monitoring width (also referred to as monitoring angle) is important for both music and film sound reproduction. Monitoring angles from 45 to 60 degrees are commonly used for proper translation and accurate stereo imaging. While the stereo base width will become greater in larger rooms or with greater monitoring distances, in rooms where picture is used as reference, the size of the picture will dictate the available width. In general, a stereo base width corresponding to angles of 45 degrees relative to the left and right loudspeakers when viewed from the principal seating location, is preferable for mixing sound with picture. Wider monitoring angles up to 60 degrees are more common for music mixing. Placement optimization should also include locating the speakers in such a way as to put all speakers equidistant from the listening position. This timealigns the speakers to the monitoring position and improves imaging. A digital delay may be used to achieve similar results.

ITU-R BS.775-1 Recommendation

Many professionals find the ITU-R BS.775-1 recommendation useful as either a final placement solution or as a starting point from which to work. This recommendation is based on placing the speakers at equal distances around a 2.5 meter circle with the height of each speaker at 1.2 meters. The center speaker is placed directly in front of the listener with the left and right speakers placed 30 degrees on either side of the center speaker.

Placement of the surrounds is somewhat more flexible. The ITU recommends that the surrounds be placed anywhere between 100 and 120 degrees from the location of the center speaker with 110 degrees being the most common solution. Placing the surrounds farther behind the mixer (120 to 135 degrees) may cause the single enveloping sound field to collapse, leaving the listener with two distinct and seemingly unrelated soundfields.

The ITU-R BS.775-1 placement solution works very well in critical listening environments where the listening position is known and is especially effective for those working in applications like music composition and mixing, sound design, broadcast and DVD authoring.

(See speaker placement diagram in APPENDIX A)

9. CALIBRATING YOUR MK SOUND PROFESSIONAL SPEAKER SYSTEM

A. For this set-up procedure, you will need the following:

1. An SPL meter. Radio Shack has an analog SPL meter that is very effective and not expensive.
2. MK Sound Professional test tones (available as a download from www.mksoundsystem.com).
3. A small, flat-blade screwdriver (or "tweaker") to adjust the channel trim pots on the Bass Management Controller.
4. A CD player or DVD player that can play CD-R's (unless you have downloaded your tones).
5. An MK Sound speaker system with the Bass Management Controller.

B. It may be helpful to have one person sit at the listening position and read the meter while another person adjusts the trim pots on the BMC.

C. When the slot of the channel trim pots on the BMC are pointing straight up and down, the gain of each of the channels is approximately 0dB or unity. The trim pots have a plus or minus 12dB gain range. Rotating the pot counter-clockwise will attenuate the channel a maximum of -12dB and rotating the pot clockwise will boost the channel gain a maximum of +12dB.

The maximum output of the BMC is + 27dBu. With a nominal signal level of + 4dB with 20dB of headroom, the maximum signal level from the source (console, etc.) can be + 24dB. Therefore, at very high signal levels you can only add around + 3dB of gain with the trim pots before the signal chain of the BMC overloads. If you need more than 3dB of gain at high signal levels, it is better to increase the output of power amplifiers and use the trim pots on the BMC for fine tuning.

MK Sound Professional test tones

A specially designed and produced set of alignment test tones is available at www.mksoundsystem.com. These tones have been designed expressly for use with MK Sound satellite/subwoofer loudspeaker systems. The tones are all bandwidth-limited Pink noise. This is to avoid room anomalies and therefore provide a more accurate calibration.

By using these tones with a Radio Shack SPL meter and following the instructions in this manual, you can achieve a remarkably accurate system calibration.

The goal here is not to find an absolute SPL level, but to balance the SPL level of all channels relative to each other. For this application, the Radio Shack SPL meter will work very well.

If a more accurate calibration is desired, we recommend using a real time analyzer with calibrated microphones and appropriate room analyzing software.

The following alignment tones are available from the MK Sound website:

Track one: Band-limited Pink Noise from 500Hz to 3kHz, recorded at –20dB FSD. Use this tone to calibrate your main and surround (satellite) speakers.

Track two: Band-limited Pink noise from 40Hz to 80Hz, recorded at -20dB FSD. Use this tone to adjust your subwoofer level.

Track three: 1 kHz sine wave, recorded at –20dB FSD. Use this to set the reference level of your source (console, etc.) On an analog console, this will be 0VU. On digital sources, this will be either –20dB FSD or –18dB FSD.

10. SPEAKER CALIBRATION PROCEDURE

1. Your speakers should now be in their final positions.
2. Remove all EQ and signal processing from the monitor path.
3. Turn all volume controls in the signal chain to their “reference level” position. These volume controls include the console main monitor pot, submaster faders and power amplifier volume pots. The “reference level” position is your defined reference playback level, which is typically 85dB SPL for film, video and music. For the purposes of this discussion, we will assume that 85dB SPL is your reference level. If you use a different reference level, then substitute the level that you use whenever you see 85dB SPL.
4. Transfer one channel only (left or right) of the MK Sound Professional test tones onto your audio storage medium (Pro Tools, open reel recorder, etc.). It is important that the tones be played back from your source through the normal routing of your console or Pro Tools system, so that the system calibration is conducted through the same signal path that your audio goes through.
5. Select track three of the test tones and use the 1kHz tone to level-set your console for 0VU on an analog console, or –18 FSD if working digitally. Do not move the faders once you have level-set your monitor path.
6. Select track one of the test tones and route it to the speaker that you want to calibrate (for example: left front).
7. Set your SPL meter for C weighting (flat) and slow (average) response. Set the scale to 80dB. Hold the meter at about a 45 degree angle to vertical and at arm's length to avoid a false reading from sound bouncing off your body and into the microphone. Point the meter at the chosen speaker at about ear height. Play track one of the test tones through the selected speaker and read the SPL. Adjust the level to 85dB using a small screwdriver on the trim pot on the selected channel of the BMC.
8. Do the same for all front (or main) speakers and point the meter at each speaker in turn. The meter's microphone is directional.

9. Do the same for the surround speakers (Note: the film community prefers to use 82dB as the reference level for surround speakers while DVD authors, broadcasters and music mixers prefer to set all their speakers, including the surrounds, to the 85dB standard.)

NOTE: *if your speakers are moved, it is recommended that the whole system be re-calibrated.*

11. SUBWOOFER PLACEMENT

Perhaps the most challenging aspect of tuning a subwoofer/satellite monitor system is finding the best place to put the subwoofer in the listening room. Each room exhibits unique characteristics and challenges because of the wide range of size, shape, building materials and equipment in the room.

Generally speaking, it is not a good idea to place the subwoofer directly in the center between the left and right speakers. There is usually a null in this location which absorbs low frequencies rather than reinforcing them. Instead, try placing the subwoofer near a wall or even in a corner of the control room. When properly set up, the low end will sound tight and phase-coherent with the satellites, even though the subwoofer is placed off-center. This is because the wavelengths of low frequencies are very long and are omni-directional.

Remember that when you place the subwoofer near a wall, the sound will couple with the wall and create an extra 3dB of gain. Place the subwoofer in a corner and you will pick up an additional 3dB of gain.

An effective way to find the best location for the subwoofer is to start out by placing the subwoofer at the listening position. Connect an audio source to the input of the subwoofer and play music with good low-end content through the subwoofer. While the music is playing, move around the room in areas that you think might be good locations for the subwoofer's final placement.

Try to locate an area that responds well to the music being played by the subwoofer. Listen for an even, well-defined, low frequency response. Once you have settled on a possible placement, move the subwoofer to that location. Experiment with aiming the subwoofer directly at the console, or aiming it at a wall or even aiming it along a wall. Once you have found a good placement solution for the subwoofer, play program material that you are familiar with through the satellites and subwoofer and check the sound quality. Two-channel material is good for this as the imagery of the phantom center depends upon equal volume from both channels and phase coherency of the satellites with the subwoofer.

Using the guidelines in this manual and with a little experimentation, it will be possible to find a solution for almost any room.

12. SUBWOOFER CALIBRATION

A. Set your SPL meter for C weighting and slow response. Set the scale to 80dB. Point the meter at the center speaker at ear height with the meter at a slightly up-turned angle. Play track two of the TEST TONES through the selected speaker and read the SPL (Remember that the BMC will re-route all frequencies below 80 Hz to the subwoofer.) Adjust the subwoofer level using a small screwdriver to 85dB on the subwoofer trim pot on the BMC.

B. Next, route track two of the TEST TONES to each of the 5 channels. Make sure that the subwoofer level is exactly 85dB SPL for all channels. If they are not, you may have a frequency response problem in the signal path that will have to be corrected before proper calibration can be achieved.

13. BMC1 SPECIFICATIONS

Front Panel Trim Controls. +/- 12dB trim control for balancing the system.

LCR and Surround channels:

Input Impedance: 20 kOhm, balanced
 Output Impedance: 200 Ohm, balanced
 Highpass Filter: 80Hz, 12 dB/octave
 Nominal Input Level: +4 dBu
 Maximum Recommended Input Level: +24 dBu
 Output Clipping Level: +27 dBu
 Gain Adjustment: +/- 12dB
 THD (1kHz @+4 dBu): 0.002%

LFE Inputs:

Input Impedance: 20 kOhm, balanced
 Nominal Input Level: +4 dBu
 Maximum Input Level: +24 dBu
 Gain Adjustment: +/-12dB
 Gain +10dB Input: +1 0dB
 Lowpass Filter: 125Hz, 24dB/octave
 THD (1kHz @+4 dBu): 0.002%

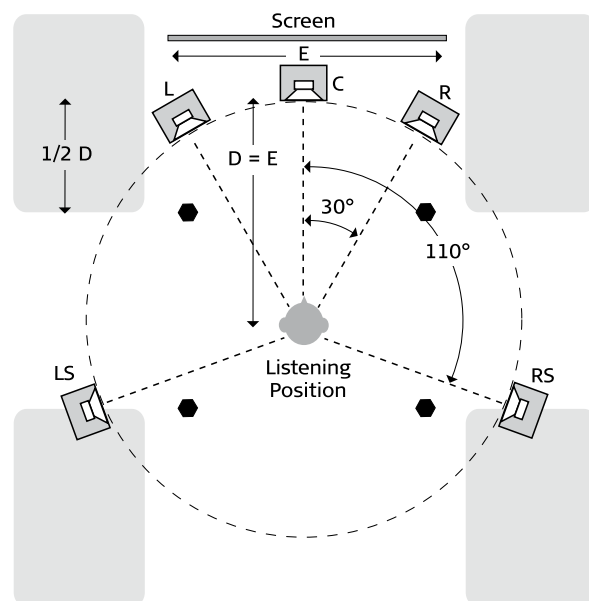
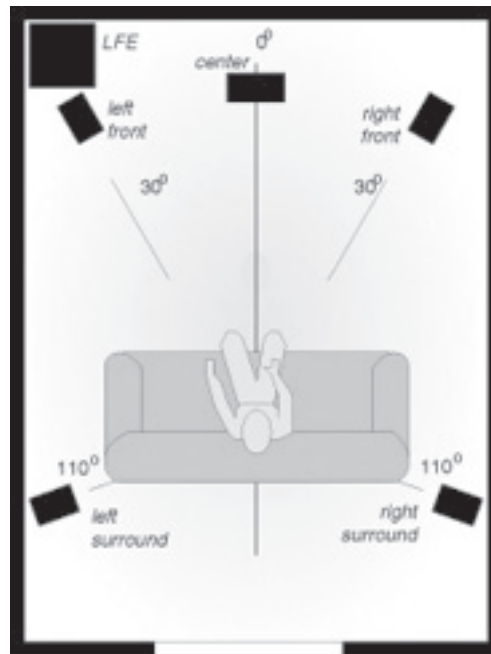
Subwoofer Output:

Output Impedance: 200 Ohm, balanced
 Nominal Output Level: +4 dBu for +4 dBu input
 Filters for LCR and Surround: 80Hz, 24dB/octave
 Filter for LFE: 125Hz, 24dB/octave
 THD (20Hz @+4 dBu): 0.002%

APPENDIX A

SPEAKER PLACEMENT DIAGRAMS

Dolby Laboratories 5.1 Speaker Placement for Home Theater



ITU-R BS.775-1 Recommended Listening Room

E = Loudspeaker Base Width

D = Listening Distance

L = Left

C = Center

R = Right

LS = Left Surround

RS = Right Surround

Light Gray Areas = Suggested Subwoofer Placement

● Worst Case Listening Position



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