



M&K Firsts: A History

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|------|---|------|--|------|---|
| 1973 | Ken Kreisel designs dual-driver subwoofer for Steely Dan's <i>Pretzel Logic</i> album mixing sessions | 1979 | First M&K digital recordings, in Germany with Philharmonia Hungarica | 1993 | M&K speakers used by Dolby Labs for R&D design work and first demos of Dolby AC-3 (S-90 & MX-5000) |
| 1974 | M&K Sound founded in Beverly Hills, California. First products: high-end subwoofers and RealTime direct-to-disc LPs | 1979 | World premiere of digitally recorded dbx-encoded LPs by M&K RealTime | 1994 | M&K celebrates its 20th Anniversary! |
| 1976 | First M&K Satellite-Subwoofer System (David & Goliath) | 1982 | M&K RealTime CDs available in Japan | 1995 | First Phase-Focused Crossover (S-85, S-125, S-85C, S-125C) |
| 1976 | First M&K direct-to-disc recordings (<i>Blu</i> and <i>Blu Jam</i>) | 1983 | M&K RealTime is first U.S. label to release CDs (RT-2001, RT-2002) | 1995 | M&K introduces lowest-priced single THX subwoofer (MX-150) |
| 1977 | First M&K Satellite speaker with controlled vertical dispersion (Satellite-1) | 1988 | First M&K CES Design & Engineering award (MX-1000) | 1996 | Feature interview with Ken Kreisel in February <i>Audio</i> magazine |
| 1977 | M&K introduces adjustable spectral balance (now known as timbre-matching), in S-1 Satellite | 1989 | First home theater speaker with three-tweeter array (S-100) | 1997 | Feature interview with Ken Kreisel in Spring issue of <i>Stereophile Guide To Home Theater</i> |
| 1977 | Industry's first Internally Powered Subwoofer (M&K Servo Volkwoofer) | 1989 | First Push-Pull Dual-Driver Powered Subwoofer (MX-2000) | 1997 | Feature interview with Ken Kreisel in <i>Widescreen Review</i> magazine |
| 1977 | M&K builds world's first direct-to-disc studio in Beverly Hills for RealTime direct-to-disc recordings | 1990 | First of many M&K Hi-Fi Grand Prix Product Of The Year awards | 1997 | M&K launches 5.1 Pro Solutions professional product line |
| 1978 | M&K releases audiophile classic direct-to-disc <i>For Duke</i> | 1991 | Industry's first compact high-performance subwoofer (MX-70) | 1997 | First M&K inwall speaker (SW-85) |
| 1978 | M&K continues pioneering work in home theater: installing Satellite-1/Volkwoofer systems in Hollywood screening rooms | 1992 | Industry's first Transmission Line Tweeter (S-5000) | 1998 | S-125 system winner of Golden Plug award as Best Surround Speakers from on-line publication <i>E-Town</i> |
| | | 1992 | First M&K Home THX system (S-5000/MX-5000/SS-500) | 1999 | M&K to celebrate 25th anniversary! |
| | | 1992 | Industry's first powered THX subwoofer (MX-5000) | | |
| | | 1993 | First M&K Push-Pull Dual-Driver Satellite speaker (S-1C) | | |



A Partial Listing of M&K Professional Users

20th Century Fox	Fotomag NY	Pacific Ocean Post Audio (Part of the 4MC Group)
4Media Company (4MC)	HD VISION HDTV production studio	Post Audio
Chuck Ainley	JAK Productions (George Lucas)	Trevor Rabin
Columbia Pictures	Kalimba Studios (Maurice White of Earth, Wind & Fire)	River Studios NY
Bakery Studio	Steve Kempster	David Rodriguez
Brian Wilson	Laser Pacific	Saylor Sound
Broadway Video NY	Pat Leonard	Seventeen Grand Recording
Buena Vista Sound/ Walt Disney Pictures	LucasArts Entertainment	Skywalker Sound
California Video Center	Magnolia Studios	Sonic Jungle
Chace Productions	Masterphonics/Tracking Room	Sony Pictures High-Definition TV Laboratory
Chicago Audio Works	Media 100	Sony Music NY
Cinram/Pacific Ocean Post DVD Center	Media Ventures	Sony Music Santa Monica
Dolby Laboratories Los Angeles	Monterey Post	The Tape House NY
Dolby Laboratories New York	Motorola DSP Digital Audio Labs Southern California	Terra Nova Recording Co.
Dolby Laboratories San Francisco	Motorola DSP Digital Audio Labs Hong Kong	THX Division, Lucasfilm, Ltd.
DTS (Digital Theater Systems)	NARAS (Grammy awards people)	University of Southern California Film Department
Enterprise Recording Studio	Ocean Entertainment	Paul Vitello Productions
FCC Advanced Television Standards Committee (HDTV)	Keith Olsen's Goodnight LA and Goodnight Dallas Recording Studios	Village Recorders
Fireside Productions		Visual Music & Sound
FotoKem	Pioneer Video Manufacturing	Warner Bros. Studios

M&K In The Professional Sound World

Here's a trivia question. Who were M&K's first customers? None other than Walter Becker and Donald Fagen of *Steely Dan*, who asked Ken Kreisel in 1973 to design a monitoring system for the *Pretzel Logic* mixdown sessions.

Shortly thereafter, M&K's first Satellite-Subwoofer system was designed (and used by a number of prominent recording engineers) as a portable reference recording monitor system. For nearly 25 years, sound professionals have been

using M&K in both their studio and home systems.

In the early '90s, pro use of M&K speakers really heated up, led by Dolby Labs. During the development of the Dolby Digital (AC-3) discrete 5.1 channel system, several of Dolby's key technical people heard M&K's 5000THX system at Lucasfilm's Skywalker Ranch, during the HDTV Grand Alliance listening tests.

This led to Dolby acquiring a 5000 system, which they used as their reference speaker for the development of AC-3. Dolby's San Francisco labs



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and listening rooms have used M&K since then, and the 150 system has become a fixture in Dolby's Los Angeles and New York reference rooms, currently being used to present 5.1 channel music recordings to the music industry!

M&K speakers were also used for all of the industry demonstrations of AC-3 prior to the introduction of actual processors by individual manufacturers. The FCC's Advanced Television Standards Committee (High Definition TV) uses M&K in their laboratory and in a system that they use in overseas presentations to demonstrate the superiority of the American HD standard to countries that have not yet selected an HDTV standard.

And Dolby is not the only multichannel advocate using M&K. M&K subwoofers are the standard for many of the artists producing DTS music recordings, and DTS has multiple M&K systems. In fact, if there's one thing that Dolby, DTS, and THX can agree upon, it is that they all use M&K speakers!

The Hollywood postproduction community has embraced the M&K system as the 5.1 channel standard. As more professionals have an opportunity to hear it, the number of studios installing it increases. See the above list for a few of the users of M&K's MPS professional speaker system. Well over 100 professional recording and mastering studio rooms in the music, film, and video fields are using M&K systems as their reference.

Pro audio's EQ magazine reviewed the MPS system, and the reviewer loved it, concluding "For a professional surround sound system, I think the M&K MPS-150THX is the one to beat."

Dan Shimiael, Technical Manager of The Enterprise studio (which has several M&K systems), said "The MPS-5000 SUB is clearly the best subwoofer made...Dolby is using the same system as we are using, and they pretty much accepted it as the reference system for their surround system."

And composer Trevor Rabin, using M&K for the score of the blockbuster *Armageddon*, says "the bottom line is M&K's MPS line of 5.1 monitors and powered subwoofers are the best speakers I've ever heard."

M&K History

Founded in 1974, M&K Sound is the only manufacturer with nearly a quarter-century of experience in designing and manufacturing subwoofers and other high-end loudspeakers, *as well as* twenty-five years of audiophile-label recording experience.

The vision of company founders Ken Kreisel, Dr. Lester Field, and D. Jonas Miller is realized in today's extensive line of innovative speaker products. As chief speaker designer and recording engineer, President Ken Kreisel works at the leading edge of technology, bringing **25+ years of interest and experience in advancing the state-of-the-art in both the recording and reproduction of music and film sound.**

Anticipating home theatre by more than a decade, M&K is recognized as the pioneer in the design concept of Powered Subwoofers and Satellite speakers, which is utilized by virtually every speaker manufacturer in their own Home Theatre systems.

Ongoing research continues to provide significant improvements to the M&K line, with innovations such as the Phase-Focused crossover, Headroom Maximizer circuit, and Push-Pull Dual Driver subwoofers.

In 1974, the brand-new company combined Kreisel's live recording and loudspeaker design experience with the research and acoustics background of Dr. Field, who retired as Chief Scientist and vice president of research at Hughes Aircraft Company, after being a full professor at both Caltech and Stanford Universities and prior work at Bell Telephone Research Laboratories after obtaining his Ph.D. at Stanford.

By combining Kreisel's creativity, remarkable hearing acuity and experience in live sound recording with Dr. Field's scientific methodology and experience, M&K's foundation was set. They began their extensive research into reproduced sound and its perception (psychoacoustics), which Ken continues to this day.

Today's research utilizes the most sophisticated computerized sound measurement and evaluation equipment, including MLSSA systems and B&K's \$35,000 Model 2012 analyzer.



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Kreisel's earliest passion was for recording pipe organs and other live musical performances. These perfectionist recordings were of true audiophile quality, and many were cut as LPs, first for demonstrations at Jonas Miller's salon and later for sale because of their popularity and acclaim.

Kreisel was among the very first to explore the limits of the phonograph record through direct-to-disc recording, using M&K's own \$150,000 modified cutting lathe and custom microphones and mixers. Even today, *For Duke* is recognized as one of the few LP records defining the state-of-the-art.

But in the early '70s, there were virtually no audiophile speakers capable of reproducing the deep bass Kreisel's recordings had captured. The answer? Kreisel started designing subwoofers!

In 1973, Walter Becker of Steely Dan asked Kreisel for a studio reference subwoofer and monitoring system for the *Pretzel Logic* mixdown sessions. M&K's speaker business was born with the balanced dual-driver subwoofer Kreisel designed for the sessions. RealTime's acclaimed direct-to-disc recordings soon followed.

By the end of the '70s, M&K was a leader again, among the first to make commercial recordings digitally, using an M&K-modified Sony 16-bit digital recorder. In fact, **M&K was the first U.S. company to release Compact Discs!** 25 CD titles are available on the RealTime and Perpetua labels.

With M&K's experience in Home Theatre dating back to Hollywood screening room design and installation in the '70s, M&K has long been at the leading edge of music and film sound technology.

This is why M&K was among the very first companies to join Lucasfilm in the Home THX program, and why M&K speakers are considered to be the best at reproducing both music and film soundtracks. Numerous awards and number one rankings in product reviews and shootouts have followed and continue to this day.

And in 1997, M&K finally made its formal entry into the world of professional audio, even though M&K has been at home in recording studios from day one). See "M&K In The Professional Sound World" above for the details on this most recent and exciting part of M&K's history.

Stay tuned. The best is yet to come!

M&K's Design Philosophy

As an audiophile recording engineer and a high-end loudspeaker designer, my strong belief has always been that a good loudspeaker should accurately and realistically reproduce whatever the microphone captured, whether the source is a human voice, a musical instrument, an explosion, car crash, etc.; *including* the acoustical ambience of the environment in which the source was recorded.

Our philosophy is that exciting and lifelike sound and music reproduction takes place when your ears, in effect, become the recording microphones. Our speakers are designed to allow you to hear exactly what the microphones heard, placing you as close or as far away from the music or sound source as the recording engineer placed the microphones.

Too many so-called "music" loudspeakers are designed with a philosophy that *all* recordings should sound as if the music comes from a stage 10 or 20 rows distant, even if a recording is closely miked with performers as close as a few inches from the microphones (as is often done on film soundtracks, especially for dialog).

This "homogenizing" effect may be pleasant for some music recordings, but it inaccurately reproduces both close-miked recordings and recordings that accurately capture the acoustic space of a recording site. This is why many "music" speakers do so poorly when trying to reproduce both the intensity and intimacy of closely miked sound effects and dialog on today's best soundtracks.

Ken Kreisel, President



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M&K's has the most (24+ years) experience with Satellite-Subwoofer systems

M&K is the only speaker manufacturer that has produced only Satellite and Subwoofer systems since 1974. M&K makes Satellite-Subwoofer systems because we believe this is the optimum configuration for reproducing music and film sound. Here is why:

Bass frequencies are best produced by large enclosures

Physics dictates that speakers reproducing true Deep Bass (down to 20 Hz and below) must be large. Therefore, M&K Powered Subwoofers, like all subwoofers, come in fairly large enclosures (with the exception of the MX-700, MX-70B and VX-7 Mk II).

and...

Midrange and high frequencies are best produced by small enclosures

But large enclosures, with their large front baffles, are not good for reproducing the rest of the audible spectrum. Midrange and high frequencies produced from cabinets with large front baffles have a distinctive coloration known as baffle diffraction distortion. The small baffles of M&K Satellites minimize this coloration, resulting in an open, natural three-dimensional sound.

M&K powered subwoofer designs are optimized to outperform passive designs by a wide margin

M&K subwoofers are designed as complete systems. Each model's performance is even better than you would expect from the high quality of its driver, cabinet, and amplifier—because these elements are optimized to work with each other in that specific product.

M&K's design allows the user to set the bass level anywhere from flat to grossly exaggerated. Built-in adjustable low-pass filters allow users to fine-tune the splice between the Satellite and Subwoofer speakers without a separate crossover, and some models have a fixed filter for optimum sound with M&K high-pass filters. For Dolby Digital and THX units, most models have a low-pass filter bypass to eliminate any phase problems associated with dual filters.

Locating speakers for the best imaging will not produce the best bass, and vice versa

When speakers are set up in a room, they are usually located to produce the best imaging at the main listening position. In virtually all rooms, though, that location does not give the deepest and smoothest bass response. It usually means that the speaker's bass response will be disappointing, because the speaker will not meet its bass specs in that room! This compromise is inherent for all speakers without a separate subwoofer.

With an M&K system, you simply locate the Satellites for imaging and the Subwoofer(s) for the best bass. Listening rooms have an enormous effect on sound quality, and only Satellite-Subwoofer systems provide this superior flexibility for achieving the best possible sound in any room.

M&K Satellite speakers are the ideal size for Home Theater systems

M&K Satellites' compact size has been appreciated by customers for years because that means great placement flexibility and unobtrusiveness. With the advent of 5.1 channel home theater and music systems, this advantage is appreciated even more!



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M&K uses only sealed-box cabinet designs for superior transient response and Deep Bass

All M&K Subwoofers (and Satellites) are sealed-box designs, tightly packed with highly efficient sound absorbing material. This configuration delivers the best transient response, and is the only design capable of producing true Deep Bass.

Good transient response means that the speaker responds quickly to input signals, with a quick start and (especially) a quick stop. Speakers with poor transient response have a blurred, muddy sound with little pitch definition. Deep Bass refers to the ability of the speaker to produce significant output to very low frequencies below 20 Hz, which is needed to produce the "startle factor."

M&K cabinets are very heavily braced (2 x 4s are used in both the S-5000 and MX-5000!) to provide the most stable platform for the drivers and to avoid the resonances, buzzes and rattles that are surprisingly common in competitive subwoofers. Flimsy, unbraced cabinets produce an easily recognized sound. They sound cheap!

Weaknesses of vented (ported and passive radiator) designs

Many competitive subwoofers are vented designs, using ports or passive radiators. These designs have inherently poor transient response, producing a boomy, uncontrolled sound you are familiar with. They may play fairly loud, but their sound is boomy and muddy, and that sound becomes fatiguing to listeners very quickly. Most produce a very audible air turbulence noise from their ports when producing certain frequencies. This noise can draw your attention to the subwoofer and make its sound directional. Most of these subwoofers respond poorly or not at all to very rapid impulses, such as flamenco dancers' foot stomps on a wooden floor.

Like a bottle filled with water that produces one particular frequency when you whistle across its opening, the sole purpose of a port or passive radiator is to make a cabinet resonate at or near the tuned frequency of the port. This generates added output (3 to 6 dB) at that frequency, but there is a price to pay for that poorly damped extra output, because with this design internal damping material cannot be used.

Remember that a speaker driver is radiating as much sound inside the cabinet as it is filling the room. This is why all M&K subs are tightly stuffed with highly efficient absorbing material to absorb much or all of the sound inside the cabinet. When a cabinet does not have this absorbing material, the sound in the room becomes muddy. *In a ported speaker, stuffing cannot be used.*

The other fatal weakness of vented designs is their extremely rapid rolloff below their tuned resonance frequency (usually well above 30 Hz). Below that frequency, the woofer's response drops off so quickly it essentially disappears, making it unable to reproduce subsonic transients. **Vented boxes roll off at twice the rate of sealed box speakers (24 dB per octave)**, and their active driver and vent are actually out of phase with each other, so they cannot produce Deep Bass.



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M&K proprietary high-performance subwoofer drivers

All M&K subwoofer drivers are designed by and manufactured exclusively for M&K. Our designers take full advantage of the fact that these drivers are used to reproduce only the lowest bass frequencies, thereby allowing the drivers to be optimized for the best low frequency transient response and lowest distortion.

For reduced distortion and improved definition, all of these drivers have an undercut core, an asymmetrical voice coil mounting, and an extremely linear magnetic motor design. Voice coil and magnet sizes are matched to the sensitivity and power handling requirements for each model's amplifier and cabinet.

Our best drivers (MX-5000 and M2C) add an aluminum shorting ring, which substantially lowers distortion and increases linear cone travel by further linearizing the driver's magnetic field forces.

Amplifiers are designed as integrated system with driver and cabinet

The amplifier found in each M&K Powered Subwoofer is specifically designed for that model's cabinet and driver. It is designed to drive the specific load of the driver(s) used and to provide the desired response for that driver in its cabinet. By designing the subwoofer and its amplifier and driver components as a complete integrated system, we get extremely flat frequency response; optimized transient response; very deep bass response for the cabinet's size; maximum amplifier efficiency by optimizing the amplifier to its driver's impedance; and control of the system "Q" to deliver tight, musical bass.

Present no load to the main amplifier

M&K Deep Bass amplifiers electronically combine both inputs. Their low-level "FROM PREAMP" inputs have a 15 K ohm impedance, and their speaker-level "FROM AMPLIFIER" inputs have a 200 ohm impedance. This means that the subwoofer will present virtually no load to the amplifier driving the customer's main speakers. Paralleled with a Satellite speaker's 4 or 8 ohm impedance, 200 ohms is invisible to that amplifier.

Extremely flat frequency response

When we design a subwoofer, we start with a driver design optimized for excellent transient characteristics, with low distortion and high output capability. Once it is mounted in its cabinet, we can then tailor the response of its amplifier to make the system's response perfectly flat to any frequency we desire, typically well below 20 Hz, even in small cabinet enclosures. With a standard external amplifier, this would not be possible.

Very deep bass response from small cabinets

Maximum amplifier efficiency by optimizing for the driver's impedance

M&K power amplifiers are optimized for the load presented by the specific driver(s) used for that model. The amplifier is simply designed for maximum performance when driving the load it sees from those driver(s).



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Control of system "Q" to deliver tight, musical bass

"Q" is a measure of quality that involves the speaker's transient performance, with a low "Q" being better. Subwoofers with passive radiators, vented boxes (bass reflex) or bandpass designs use air in a chamber or port as a high Q resonator, much as a bottle filled with water whistles at one frequency when you blow across its opening. The vent "tunes" the speaker to a given frequency, which then becomes essentially its low frequency limit.

The purpose of these ports or passive radiators is to resonate the cabinet at some frequency, which, if done properly, can increase the speaker's output by 3 to 6 dB at that frequency.

But these high Q systems have an unavoidable tendency to resonate (or "ring"), much as a tuning fork continues to sound long after it is struck. M&K's sealed-box low Q sealed box designs, tightly stuffed with special sound-absorbing material (which cannot be used with a vented speaker), produce a solid output without ringing, down to frequencies below 20 Hz.

Every element of an M&K subwoofer, from the driver to the enclosure and the amplifier is very tightly damped (low Q), so the combination achieves extremely tight and articulate musical bass.

36 dB/octave Low-Pass filters make M&K Powered Subwoofers truly non-directional

The M&K low-pass filter is an important element in the sound quality of M&K Subwoofers. Our 36 dB/octave filters have a sufficiently sharp rolloff to truly eliminate the reproduction of frequencies above 125 Hz, where subwoofer output is unwanted.

Virtually all competitive subwoofers have a shallower filter slope, meaning they reproduce audible information such as voices at 200 Hz and above. This degrades the system's overall sound quality and means that listeners may be able to identify the location of the subwoofer.

When customers say they can locate a subwoofer in a room, it is because of this higher frequency reproduction. You can tell these customers that **M&K subwoofers are truly non-directional.**

There are actually two filters in the circuit. The first is user-adjustable through the FILTER knob on the amplifier back panel. This lets the user set the "knee" of the rolloff curve (3 dB down point) anywhere between 50 and 125 Hz. This first filter rolls off the woofer at a rate of 12 dB/octave. The second filter comes into play at 125 Hz, and adds a second filter to produce a total rolloff of 36 dB/octave.



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Push-pull dual driver configuration

M&K's innovative Push-Pull Dual Driver configuration delivers a major improvement in subwoofer detail and clarity by virtually eliminating even-order harmonic distortion, which produces a boomy and poorly defined bass sound.

In these subwoofers, one driver is mounted conventionally on the cabinet's front baffle. The second driver, however, is mounted *inverted*. The front of its cone faces the inside of the cabinet, with the back side of the cone, magnet, and frame facing the outside.

Although both drivers fire into the room in pressure phase (one with the front side of its cone and the other with the back side), they operate mechanically out of phase relative to each other's magnetic structure. (They are driven electrically out of phase). Therefore, regardless of position, each cone is always in the exact opposite position from the other in its travel, relative to its own magnet.

The even-order (second, fourth, etc.) harmonic distortion products of each driver cancel acoustically because the even-order harmonics of each driver are both virtually equal and exactly opposite in time phase to each other. Even-order harmonic distortion is caused by different non-linearities in the cone's motion when the voice coil is moving deep into its magnet compared with when it is moving away from its magnet.

As important as the distortion cancellation, push-pull also doubles efficiency in comparison to a single 12" driver subwoofer (the same as doubling the amplifier power), as well as allowing twice the amplifier power to be used because of the power dissipation of two drivers. **The total output improvement is four times! (6 dB).**

M&K Push-Pull Dual Driver designs deliver deep bass with very low musical distortion and tremendous articulation to produce a very natural and powerful bass reproduction.

The M&K Deep Bass concept

Since 1974, M&K has invited listeners to "Discover Deep Bass." Deep Bass specifically refers to a subwoofer's ability to produce usable steady-state and transient output below 20 Hz. **M&K's Deep Bass design produces significant deep bass output in some models down to frequencies below 10 Hz.** This output makes a major difference in subwoofer performance, producing what some have described as the "startle factor," or "awesome" bass.

Most conventional subwoofer designs (especially units with passive radiators and vented cabinets) have an extremely sharp rolloff (**24 dB/octave**) below the lower limit of their "flat" response. But M&K subwoofers have a much shallower rolloff below their -3 dB anechoic response frequency. By reproducing bass frequencies well below 20 Hz, M&K subwoofers have a lifelike power and authority that other subwoofers cannot match.



Ease of service

M&K subwoofers have a 3 year warranty, which *includes* the subwoofer amplifier. Compare that to competitive products.

All M&K amplifiers **and crossovers** utilized printed circuit boards for maximum reliability, QC testing, and easy of service. Unlike M&K, many speaker crossovers are simply glued to a mounting panel or the cabinet itself, and they cannot be easily removed or tested.

M&K amplifiers are modular in design, meaning they can be easily removed from the cabinet and returned for service. To remove the subwoofer amplifier, remove the screws around the amplifier's metal backplate. Ease the amplifier assembly out of the cabinet. Gently remove the white plastic Molex plug off of the circuit board. Disconnect the other white plastic in-line Molex AC power connector. The amplifier is now completely disconnected and can be removed.

M&K Satellite crossovers are similarly designed and can be removed and replaced quite easily in the event of major damage.

M&K subwoofer cabinets use heavy-duty T-Nut type fasteners to secure the speaker drivers. These make driver removal and reinstallation a snap, without the worry of stripping the wood.

In virtually all cases, M&K speakers do not have to leave the customer's home to be serviced!



Installing subwoofers

Ultimately, the amount and quality of bass you get in a room are dependent on the room itself and the location of the subwoofer in that room. Low frequency bass sounds are affected most by the size of the room and the method of construction used to build it. All rooms are different when it comes to reproducing bass, and the quantity and quality of that bass is highly dependent on the subwoofer's location.

A simple rule to remember is that you get more bass when you move a subwoofer towards any wall or corner. Moving it away from a wall or corner gives you less bass. Remember that the floor also loads the subwoofer, and that maximum bass is found with the woofer on the floor in a corner.

Our experience in measuring subwoofer performance (in hundreds of rooms) shows that in the majority of cases the best location is either directly in or very close to a corner.

All our measurements were taken using the MLSSA system's Adaptive Window technique, the only room measurement technique that correlates well to the time and frequency domain characteristics of the human ear-brain system. Third-octave techniques do not provide sufficient frequency resolution or time-domain selectivity needed for accurately determining ideal subwoofer placement.

Placing the subwoofer near or in a corner provides good loading to the room, and is the best place to start when experimenting. Placing the subwoofer in a corner maximizes bass output, but in *some* rooms it may negatively affect the quality of the bass. In these cases, placement away from the corner is indicated.

One room position will exhibit the flattest response, with no peaks and dips, and the highest output (room gain). Typically this is the corner closest to the listening position. If the seating is in the rear half of the room, this is a rear corner.

Virtually every room has a set of frequencies that are either over-emphasized (response peaks) or lacking (response dips) because of the room's dimensions. When this happens, the sound is "boomy" and unclear - not just at those frequencies but overall. The goal is to achieve a smooth sound quality, with the entire bass spectrum equally prominent.



Special techniques for finding the best location for a subwoofer

Here are two useful techniques for placing a subwoofer in a room. The first is unique in that it does not involve moving the subwoofer around the room:

Place the subwoofer where your main **listening** position will be, connected to your system. Play some music through the system, and then walk around the room, stopping to listening to the sound quality of the bass in potential room locations for the subwoofer.

The location where you hear the best combination of smooth response, exciting deep bass, with impact and sock, and the least "boominess" is likely to be the best place to locate the subwoofer.

Move the subwoofer to that location, and continue your listening tests from the main listening position. If the sound quality is good, leave the subwoofer where it is. If it is not, continue experimenting as above.

The other technique is to use a sound level meter and a series of low-frequency test tones (100 Hz and below), such as those found on a test disc. Move the subwoofer to each possible location in the room, taking measurements at the listening position for each location. Measure the sound level for each frequency and plot it on a sheet of graph paper. The location that has the smoothest overall response is the best location for the subwoofer.



Advantages of multiple subwoofers

Whenever possible, we recommend using two (or more) subwoofers in any system. A second subwoofer significantly improves a system's total bass output, dynamic range, and headroom. The second unit doubles the amount of driver radiating area, which, depending on room placement, increases efficiency as much as 3 dB (the same as doubling the amplifier's power). The second subwoofer then doubles available amplifier power for another 3 dB of output **for a total increase of 6 dB!**

The addition of a second woofer means that both woofers have to work up to 6 dB less hard (25% of the work) for a given output level, making for lower distortion (due to less cone motion) at all but the highest playback levels (which are much higher with the second woofer).

You'll remember that the bass quality and peaks and dips in the frequency response of a subwoofer in a given room are dependent on the location of the subwoofer. If you can find and use the optimum location for a subwoofer in a room, two subwoofers at that single location is best!

If the optimum location cannot be used, two subwoofers in different locations can complement each other. From two locations, different room modes are "driven", which can produce a smoother response in the room. Listening and measurement tests can help determine the best dual subwoofer placement. The use of stereo subwoofers is controlled by the same conditions.

Multiple subwoofers in 5.1 channel systems

Recently, some questions have arisen regarding the use of multiple subwoofers in 5.1 channel Dolby Digital and DTS systems. Often overlooked in these discussions is the fact that 5.1 channel controllers and receivers include what is called Bass Management. This allows the user to route the bass content of each channel either to the main speaker reproducing that channel or to the subwoofer(s).

This means that a single subwoofer can reproduce the output of all 5.1 channels (just as a single subwoofer in a stereo system reproduces the bass content of the left and right channels). Whether a system has two channels or five channels, the Satellite-Subwoofer concept means that one subwoofer can always handle the output of all channels. Of course, multiple subwoofers are always better (see above).

We strongly recommend that the bass content of all channels be fed to all subwoofers in a system. Never send just the LFE channel to a subwoofer.



Servo and other types of feedback

Many customers ask about negative feedback in powered subwoofers. M&K does not currently manufacture subwoofers using servo feedback, although the original Volkwoofer *did* have a servo circuit. Here is some discussion on the subject.

Feedback uses a sensor mounted on the speaker that detects the movement of the cone. The signal generated by this movement is sent from the speaker voice coil area back to the electrical input of the power amplifier and compared to the subwoofer's input signal. Any difference between the two represents distortion. The feedback circuit takes that difference (distortion) signal, inverts its phase, and applies it back to the amplifier's input, theoretically canceling the distortion.

When an input signal is steady-state, like a sinewave, feedback can measure extremely well. Unfortunately, music *always* changes. And if a musical signal has changed by the time the "correction" signal has been applied, the sound is not improved—it is made worse!

This is why designers of high-end amplifiers strive for *minimum* feedback. Even though greater feedback produces lower *measured* distortion, excessive feedback produces poorer sound due to a phenomenon known as Transient Intermodulation Distortion.

In loudspeakers, the same principle applies, but to a much greater degree, because the delay in applying the correction signal is due to the motion of the speaker instead of the speed of electrons moving through an amplifier (at nearly the speed of light).

In speakers, feedback also affects transient performance and dynamic range. **Feedback systems can become unstable with sharp transients and high output levels, so designers must put limiting circuitry on the amplifier.** This changes the sound quality by dulling transients and compressing dynamics.

M&K's philosophy is to strive for excellent reproduction of transients, not sine waves. Compare the sound of an M&K Powered Subwoofer to any subwoofer using servo feedback. The dynamic and transient performance of the M&K will result in an *audibly* cleaner and more detailed musical sound.



<http://www.mksound.com>

Advantages of Satellite Speakers

Because M&K Satellites do not have to reproduce deep bass (thanks to the M&K powered subwoofer), those Satellites are optimized to reproduce midrange and highs without size compromises. Each cabinet's front baffle is about the minimum size that will accommodate its drivers, with many cabinet optimized in shape (trapezoidal or with multiple non-parallel walls) which eliminate midbass and midrange problems found in virtually all other speakers.

Optimum location of Satellites for imaging without compromise

Very few loudspeakers are capable of reproducing fundamental frequencies below 50 Hz. This is made worse when the speakers are placed in a room because they are usually set up for the best imaging.

The location with the best imaging is virtually always different from the one that gives the deepest and smoothest bass response. That means that a speaker in that location will not meet its bass specifications, either for low frequency extension or for flatness of response.

With M&K Satellite speakers, no compromise is necessary, as the Satellites can be located for optimum imaging, with the Subwoofer located for optimum bass.

M&K's attributes

Our strengths are in our quality of construction and appearance, our long-term reliability, and our sound quality. M&K speakers are engineered for excellent transient performance, which we have always considered essential for the accurate reproduction of music. Our superiority in this area becomes even more apparent in home theater, where the overly polite and compressed sound of many speakers will turn an exciting soundtrack dull.

M&K Satellite speakers produce a very natural, lifelike three-dimensional sound, thanks to their compact cabinet sizes and the transient accuracy of their crossovers. In addition to producing a sometimes startlingly real sound with good recordings, this means excellent soundstaging and *accurate* (unexaggerated) depth.



Small cabinet and front baffle sizes mean sharper imaging and less coloration than large speakers

Midrange and high frequencies sound best when the speakers producing them are mounted on the smallest possible baffle (as long as the backward sound radiated from the driver is contained and absorbed, as in an acoustically stuffed sealed box). For this reason, M&K Satellites have just about the minimum baffle necessary to mount their drivers. This helps to provide the sharp detail and clarity M&K Satellites are famous for.

On a large baffle, signals from the tweeter and woofer drivers travel on its surface until they reach a cabinet edge. There they radiate into the room—but time delayed in comparison to the direct signal coming from the drivers. When these time-delayed signals reach your ear, the sound becomes jumbled, with a loss of clarity and imaging, leading to the “canned” unnatural sound of conventional speakers.

With diffraction distortion reduced or eliminated, M&K Satellites have much sharper imaging (which some have described as "holographic") and detail.

Trapezoidal cabinets and cabinets with non-parallel walls for optimum sound quality

Virtually all M&K Satellite cabinets are either trapezoidal in shapes or have non-parallel walls. This is done to optimize sound in the critical midbass and midrange regions.

A trapezoid shape is used for the S-5000THX and SS-150THX. These cabinets do not have the typical midbass irregularity of conventional boxes that is caused by comb filtering. Precise angles were optimized through time-domain measurements.

The trapezoidal cabinet shape also improves sound quality by minimizing coloration caused by the energy produced by the back side of the speaker cones by affecting the internal modes. Overall, the trapezoidal cabinet reduces coloration and produces much flatter response through the critical midbass region.

Other models (S-150THX, S-125, and S-85) are designed in mirror-imaged pairs (with a separate center-channel design), using front baffles angled to provide an automatic toe-in. For front channel use this improves stereo imaging. When these speakers are used in the surround channels, this angle can help to increase the diffuse nature of the surround channel by reflecting sound off the side or rear walls.

Further significant sonic improvement comes from the fact that the small left and right cabinet side walls are also non-parallel, meaning that the only parallel surfaces of the cabinet are its top and bottom.



Phase-Focused Satellite crossovers

M&K's Phase-Focused crossovers deliver razor-sharp stereo imaging by combining three important elements of crossover design: Time Domain Analysis, Frequency Domain Analysis, and what we call Point-In-Space Analysis (a three dimensional analysis of the speaker's response *in the room*).

Other crossover designs consider just frequency response on one axis by designing the crossover for a "sweet spot" listening position. **The Phase-Focused crossover is designed by measuring and optimizing both its phase and amplitude response at dozens of points (angles) each in both the vertical and horizontal planes.**

This means that we consider its response at various angles in both the vertical and horizontal planes, optimizing its three-dimensional response. Our uniquely sophisticated crossovers are critically tuned through both psychoacoustic listening analysis and complex computer analysis—giving you much more than just good on-axis response. You hear a very smooth response over a wide listening window (very important for home theater), *and* you also hear a more focused and coherent sound on axis!

Take an M&K crossover out of a cabinet and compare it to other crossovers. Only high quality components are used, including **large-trace circuit boards**, distortionless air-core inductors, and high quality resistors and capacitors. Combine this with our designed-in performance and extraordinary user flexibility, and it means that M&K crossovers deliver better sound quality.

Compare the sharp transient response, razor-sharp imaging, and accurate soundstaging of M&K Satellites to an ordinary speaker's "smeared" sound. The crossover is a major reason the M&K produces a much more lifelike and detailed three-dimensional sound.

Satellite crossover timbre controls

Through multiple inputs or back-panel switches, M&K Satellites can be fine tuned for a listener's room, equipment, personal taste, etc. to achieve a flat response *at the listener's ear*. They also provide the unique ability to most closely realize a timbre match with non-M&K speakers in multichannel systems.

These switches can be used to optimize response for room conditions or personal preference, but in normal room locations, known as 4 pi space (NORMAL position); when the speaker is on the floor or directly against a wall, known as 2 pi space, (SPECIAL position); or when tuning a system with third-octave equalization.

Additional positions provide a psychoacoustic LOW or MID EFFICIENCY for use in live and bright-sounding rooms; any time the Satellite is used without a subwoofer, or when the listener prefers it.

A separate Treble Contour switch (or Hi/Lo Tweeter inputs) provide flat and increased/decreased high frequencies in specially designed contours. These are not simple tweeter level controls and are useful for tuning the speaker to the room or the system.



Advanced low-distortion woofer and tweeter designs

The drivers used in M&K's Satellite speakers have extremely low distortion thanks in great part to their development using a speaker driver measurement technique known as the "two-tone distortion test."

This severe test measures the distortion produced when a driver is fed with a swept signal consisting of two closely-spaced tones. This test has very close correlation to the perception of experienced audiophiles listening to music. It is a breakthrough tool in improving the sound quality of high-performance loudspeakers.

This technique made it possible for M&K to develop drivers that go beyond conventional distortion measurements to accomplish truly superior audible reproduction of musical signals.

Transmission line tweeter

The M&K-developed Transmission Line Dome Tweeter utilizes an acoustic absorbing transmission line to establish a new standard of tweeter performance, delivering cleaner, more detailed and natural high frequencies.

The transmission line, which is a damped, absorbent-filled cylinder, absorbs the sound energy travelling rearward (from the back side of the tweeter diaphragm). Ordinarily, this rearward sound energy reflects off the tweeter's solid internal structure and radiates through the tweeter diaphragm, resulting in audible coloration and time domain smearing.

This extraordinary new tweeter reproduces music with tremendous sonic transparency and delicacy, while maintaining the capability of reproducing extraordinarily high output levels, so that it is fully capable of the tremendous dynamic range and continuous output levels required for home theatre reproduction.

Transmission line tweeters are standard on the S-5000THX and the S-1C.



Connecting a subwoofer to a surround sound receiver or processor

The preferred connection from a surround sound amp or controller is from the subwoofer output jack. This may be called SUBWOOFER OUT, MONO, LOW PASS, CENTER WOOFER, etc. This connection usually insures that a full bass signal is fed to the subwoofer. Never use the CENTER CHANNEL OUTPUT jack.

If your component has no subwoofer output jack, connect the Subwoofer to the front Left and Right channel speaker outputs with speaker wires. **VERY IMPORTANT:** When the Subwoofer is connected with speaker wires and the controller is in Pro-Logic mode, the Center channel WIDE/NORMAL switch **MUST** be set to the NORMAL mode. If the switch is set to the WIDE mode, the bass content of the Center channel will not be fed to the Subwoofer, and you will lose a significant amount of bass.

With 5.1 channel systems, make certain that the bass from ALL channels is fed to the subwoofer(s). Set all speakers to the SMALL or Normal setting. Be sure that you do not send only the LFE (Low Frequency Effects channel) to the subwoofer. This channel contains only special bass effects, not the normal bass content.

Timbre-matching

A critically important factor in achieving excellent multichannel sound is timbre-matching. On film soundtracks, specific sounds are often moved from left to right or from front to back. When speakers reproducing these sounds have dissimilar characteristics, there is an audible discontinuity when the sound shifts from one speaker to another.

Timbre-matched speakers have very similar tonal characteristics and sound, which come from three critical elements: similar or identical drivers; similar or identical crossovers; and similar or identical frequency response. In full M&K systems, these elements have been addressed. You can be assured that the system can achieve the full potential of Home Theatre sound.

Channel balancing

The other factor crucial to achieving excellent Home Theatre performance is level-matching the three front and two surround channels. This is even more important than timbre-matching.

We strongly recommend that you purchase a Radio Shack Sound Level Meter (buy the analog meter, not the digital one, available for less than about \$40), and use it to measure the output of the speakers by pointing the unit's microphone at each speaker, at the same distance, when playing the test tones generated by your processor or receiver. **DON'T CALIBRATE LEVELS BY EAR!**

When using identical front speakers and amplifiers with speakers at about equal distance, when you get a different reading from different channels, don't automatically set the channels to different levels. These different readings are probably the result of limitations of that type of meter measurement technique. Identical speakers with identical amplifiers should be set to the same level, at least within 1 or 2 dB.



Speaker placement

When M&K Satellites are being used in a Home Theatre system, placement becomes extremely important, as you will be balancing five or more speakers (not counting the subwoofer) rather than two. The following guidelines are for a five-channel Pro-Logic or 5.1 channel Dolby Digital/DTS system. If you are not using a Center channel, the instructions for the other four channels will still apply.

Center Channel

The Center channel speaker in a Pro-Logic or AC-3 system is the most important speaker in the system. This speaker often produces more output than the left and right speakers *combined*. This speaker should be of the highest possible quality, and as similar as possible in response and radiation pattern to the left and right speakers. Three identical speakers are best, unless the Center channel is designed to work with a set of left and right speakers.

It is also important to have as much amplifier power as possible for the Center channel. As a minimum, the three front channels should be identical in power output, but it is better if the Center channel has more. If you have less power in the Center channel, this will be the limiting factor in the total output capability of the system when watching and listening to video sources.

M&K Satellites, with their compact size and adjustable tonal balances, are ideal for Center channel use. Because of their adjustable tonal balances, they will blend with a wide range of speakers and can be acoustically balanced to provide a smooth front channel sound-field. M&K Satellites are also offered with optional magnetic shielding to allow them to be used close to a television set.

The Center channel speaker should be located as close as physically possible to the television or projection screen. It should be just above or just below the screen. If that is not possible, then just to the left or the right of the screen may still be acceptable.

If the television is not in the center of the room (or not centered between the Left and Right speakers), the Center channel speaker should still be as close as possible to the screen—even if it is outside the left and right speakers (such as a TV located in a corner of the room outside the stereo spread of the left and right speakers). Good results can be achieved in unusual configurations when the Center speaker is as close as possible to the screen.

Front channels

The Left and Right front channel speakers in a Home Theatre system should be placed the same as the left and right speakers in a stereo setup. Some listeners, however, may prefer to reduce the distance between the left and right speakers to bring the size of the acoustic image closer to the size of the screen image.



Front channels (cont.)

For example, with a 25" direct-view television, you would want the speakers closer together than you would with a 100" projector. One recommendation is to separate the speakers by 1.5 times the diagonal screen size; another is to place the left and right speakers to create a 45 degree angle with the main listening position.

There is a great deal of latitude in this area, as it is one of personal preference (especially if you will listen to music without video).

It is also preferred that the speakers be equidistant from the listening position. Equidistant usually means that when the center speaker is on top of the television, the left and right speakers will sit in front of the set (they will be farther from the wall behind the TV than the center speaker). Ideally, the speakers should be at the same height as the screen, but it is much more important that all three speakers be as close to each other's height as possible. If the center is much higher or lower than the other speakers, the effect can be distracting. Angling, or toeing-in the speakers, to aim at the listening position often improves imaging.

When using a Center channel speaker, you have extra flexibility in placing the left and right speakers, as the Center channel speaker will tie most dialog and effects directly to the screen.

Surround channels

The Surround channel speakers can be placed in a wide variety of locations in the room to give good performance. In general, the surround speakers should be either adjacent to or behind the main listening position, and located higher than the listener's heads. They can be mounted on either the side walls or on the back wall, flush to the wall, on shelves, on brackets, etc.

The goal is to achieve an enveloping sound. The surround channels should seem to come from all around you, rather than seeming to come from behind you only or directly from a speaker.

This section discusses non-THX surround speakers. THX system requirements call for dipolar surround speakers mounted to the sides of the listening position above the listeners' heads. See M&K's THX surround speaker instruction manual and the THX Installation Guide for detailed instructions.

M&K's ST series of stands can be used to mount surround speakers at virtually any height, including well above listeners' heads, simply by using a custom length of pipe to set the height.

For non-THX surrounds, try starting with speakers on the side walls of the room, two to three feet above the listeners' heads, directly adjacent to the listening position or behind it. You can aim the speakers to fire towards each other (across the listening area), or you can aim them to fire towards the back wall at an angle. When possible, the surround speakers should not be in front of the main listening position.



Surround channels (cont.)

If you mount the surrounds on the side wall behind the listening position, they can be aimed towards each other or angled towards the back wall or the side wall surface directly behind them. By reflecting sound behind the listening position, you may increase the sense of envelopment in the sound.

If you want or need to mount speakers on the back wall of the room, there are several options. You can aim them so that they fire towards each other (so they fire along the back wall); you can aim them towards the front wall of the room; or you can angle them so they fire toward the side walls. Symmetrical arrangements work best.

The speakers should be a minimum of a few feet away from the nearest listener. If the speaker is located too close to a listener, its sound will become too directional and may distract that listener. Ideally, the surround speakers should not call attention to themselves and should not be audible as separate sources of sound.

If the surrounds must be located close to the listeners, aiming them at the room walls or even the ceiling can help to reduce any directional effect. As described above, this can produce a desirable result even in rooms where the surround speakers are an adequate distance from the listeners' heads.

If the surrounds cannot be placed on a wall, try placement on tables or the floor to the sides of the main listening position, firing up towards the ceiling. This can work very well in environments that do not allow permanent attachment of speakers to the walls.

Some listeners prefer to use multiple pairs of surround speakers. While this is not necessary, it can provide a broader and deeper surround effect, with better coverage in very large rooms. When using multiple pairs of surround speakers, a symmetrical installation pattern works best. For example, if you are using two pairs of S-85s or SS-150 Tripole Satellites for the surround channel, one pair could be mounted on the back wall of the room, mounted equidistant from the back corners, with the other pair mounted on the side walls of the room, equidistant from the same back corners.

The surround channels can be installed in a wide variety of locations, but because they are usually mounted on the walls of the room, they can be a challenge to successfully install. If you have further questions, please call us at the M&K factory, and we will be happy to discuss them with you in detail.



5.1 & Pro-Logic System Setup Outline

The 5 Most Important Items In System Setup:

**Find the best location for the subwoofer
for maximum output and flattest response
(usually the corner closest to the listening position)**

**Aim the front speakers (and the surrounds, if possible)
vertically for the flattest response and best imaging**

**Set all speakers to the Small setting
for proper High-Pass and Low-Pass Filter operation
to get the lowest distortion and maximum dynamic range**

**Calibrate all speakers and the subwoofer to the identical level
for proper imaging and balance**

**Make sure all speakers are in phase
for proper imaging and impact**

These instructions will help you make sure that you cover all steps in setting up a 5.1 multi-channel or Pro-Logic surround sound system. In addition to following this list, make certain that you study and understand the owner's manual for each and every component used in the system, especially the processor/receiver's manual. Have fun and good luck!

A useful tool for system setup is the Laserdisc or DVD called *Video Essentials*. If you don't have one, you can order it by calling 1-800-USA-DISC (872-3472).

Here are the instructions for speaker setup.

1. Locate the front speakers. The left, right, and center speakers should be equidistant from the main listening position. Try to set up the speakers so that they are reasonably symmetrical to room surfaces. A tape measure may be very helpful.
2. Locate the subwoofer.
 - A. The ideal place for the subwoofer is the corner with the best structural strength. If the corners are roughly equal in construction, use the corner nearest the listening position. If the listening position is in the front half of the room, place the subwoofer in a front corner. If the listening position is in the back of the room, place the subwoofer in a back corner.

If possible, avoid corners near doorways or openings.



- B. If you are willing to experiment, another option is to place the subwoofer at the listening position and walk around the room. Stand in and near each corner. The location where you hear the tightest bass with the most impact is probably the best location in the room for the subwoofer.
- C. If multiple subwoofers are used, place them in the same location. Stacking is best, but you can also put them side by side.

Another option for multiple subwoofers is to place them in different locations. This is appropriate when you have limited choices in locating the subwoofer and none of the available locations work well. Try to place multiple subwoofers at equal distances from the listening position to avoid phase cancellation.

- 2. Locate the surrounds. Determine the best position in the room. It will probably be the position used for THX speaker, directly to the right and left of the main listening position on the side walls (so that a listener in the center seat is directly between the speakers). If that doesn't work or is not practical because of the room, try these locations: on the ceiling; on the back wall, or in the back corners (using an M&K ST Corner bracket).
- 3. Install all wiring and interconnects.
- 4. Connect the subwoofer. Always use the processor/receiver's subwoofer output.
- 5. Aim the front speakers (this is a must for THX front speakers). Use a laser level to align each speaker. Place the level on the flat surface between the midranges and tweeters that is roughly in the center of the front baffle. The red dot of the laser should be aligned to the center of the listener's forehead at ear height. Make sure that the volunteer who sits in the main listening position keeps their eyes closed!

Make sure that you aim the left and right speakers in both the horizontal and vertical planes. Horizontal toe-in is important for the best possible imaging.

- 6. If you have a Dolby Digital AC-3 5.1 channel processor/receiver, follow these instructions. If you have a Pro-Logic processor/receiver, go to item 7 below.

SPECIAL NOTE: Always check the processor/receiver's owner's manual. Different manufacturers use different descriptions for the same function, and sometimes the same description for different functions!. Your component may use terminology different from that used below.

- A. High-Pass Filters: All Dolby Digital processor/receivers have built-in high-pass filters for the Left, Center, Right, Left Surround, and Right Surround channels. Always turn these filters ON by using the SMALL setting. If you have a THX component, use the THX setting. See the owner's manual of the processor/receiver for instructions.



- B. Bass Management: If the processor/receiver has a setting to turn the Subwoofer off or on, make sure that it is set to SUBWOOFER YES or ON.
- C. Dialog Normalization: If your component has this function, turn it off to avoid any possible effect on sound quality.
- D. THX Dolby Digital units have an adjustable limiter for the subwoofer feed, called "Bass Peak Level Management". Turn it off, or set it for the highest possible level. M&K subwoofers do not need this limiter.

7. If you have a Pro-Logic only processor/receiver, follow these instructions.

SPECIAL NOTE: Always check the processor/receiver/receiver's owner's manual. Different manufacturers use different descriptions for the same function, and sometimes the same description for different functions!. Your component may use terminology different from that used below.

- A. If the component has high-pass filters for the Left, Center, and Right channels (usually only THX components have these filters), they should be turned on or set to THX (if you have a choice, use the frequency closest to 80 Hz. The *surround* channels in a Pro-Logic only system do not have switchable filters.
- B. Set the center channel to Normal, unless you have a THX controller. With a THX controller, set the center channel to Large/THX.
- C. Turn off all limiters and compressors, auto azimuth controls, auto balance controls, etc.
- D. If the processor/receiver/receiver has an input level control, calibrate it per the manufacturer's instructions.
- E. If the component has a digital input, and you are using a source component with a digital output, always use the digital input, not the analog input.

8. Set levels for each channel. You can take a measurement at the listening position to establish the reference level, but it is usually more accurate to take levels at about one meter from each speaker. Set all channels to exactly the same level.

Use a Sound Level Meter. Point it directly at the speaker being measured. Set all channels to the same level, using the processor/receiver/receiver's internal test signal. Set the meter to "C" weighting and "Slow" response. Set the levels to 75 dB if you have a THX processor/receiver/receiver or are using the Video Essentials disc as a source for setting levels.



NOTE: If you using identical speakers anywhere in your system (e.g., S-150THX speakers for the left, center, and right channels), all of those channels should be set to the same level. If your meter measures a different level, it is probably a limitation of this type of meter measurement method and not an actual audible level difference. Set the channels using identical speakers to the same level, unless you actually hear a difference later when you are doing listening to verify the system setup.

9. Check phase. Make sure that all five main channel speakers are wired in phase. The Video Essentials disc has tests for main speaker phase.
10. Make sure that the subwoofer and main speakers are in phase at the 80 Hz crossover point. Listen to something with a consistent bass line around 80 Hz while a partner switches the "Phase" control on the subwoofer from "+" to "-". The switch position that results in the greatest bass at the listening position is the correct setting.
11. Play something that is familiar to you through the system to verify the system's overall performance. If something does no sound right, recheck your connections and settings. Re-measure, re-check, re-align.
12. Switch the processor/receiver to each input that you will use. Check your settings for each input and each mode. Some processor/receivers require that you enter settings separately for each mode and/or input.
13. Before playing the system, check levels and speaker alignment one last time. Make sure that you write down all processor settings for future reference.