

StudioComm for **Surround**

Model 65 Bass Manager

User Guide

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This User Guide is applicable for serial numbers:

M65-00151 and later

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Foreword

I am pleased to present the Model 65 Bass Manager. As President of Studio Technologies, I take a very personal approach when designing products. Growing older has increased my appreciation of the more subtle things in life—be they a part of nature or the nuances contained in a well-designed piece of electronic equipment. Do the technical and operational aspects of a product work together to “feel” right? A Studio Technologies’ design is ready to go only when I am completely satisfied.

Many fine people worked toward making the Model 65 “happen.” Mitch Budniak (ace consulting engineer) designed many of the circuits. Jim Cunningham contributed to the analog design. Carrie Loving provided engineering support. Al Lux designed the printed circuit board. Fred Roeck performed the mechanical design. Joe Urbanczyk coordinated the product testing procedures.

Please contact me with your questions, comments, and suggestions. I can be reached by voice at (847) 676-9177, fax at (847) 982-0747, or via e-mail by way of support@studio-tech.com.

Sincerely,

Gordon K. Kapes
President

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Introduction

What This User Guide Covers

This User Guide is designed to assist you when installing, configuring, and using the Model 65 Bass Manager.

System Overview

Model 65 Bass Manager

The Model 65 Bass Manager is designed to enhance the monitoring of multichannel audio sources during the recording, mixing, mastering, and distribution process. The Model 65 is applicable for any multichannel monitoring environment where some or all channels are not supported with loudspeakers having extended low-frequency response. Resources are included in the Model 65 to make it appropriate for cinema, music, and broadcast applications. The Model 65's design is oriented toward directly supporting 5.1-type applications. The five main input channels are full bandwidth, and use the industry-standard designation of left, center, right, left surround, and right surround. The ".1" input channel is designated as LFE, which is also referred to as low-frequency effects, "boom," or subwoofer. The LFE term originated in cinema formats but is now part of music and broadcast formats as well.

The overall goal of the Model 65 is very simple: Ensure that the entire audio bandwidth of all channels can be accurately monitored. Many loudspeaker systems have inherent low-frequency limitations, preventing a true picture of the source material from being presented. To overcome this, the low-frequency energy from the five main channels can be separated and routed to one or

two subwoofer loudspeakers. The Model 65 includes filters to accomplish this, providing a smooth and sonically pleasing crossover of the signals being routed to the main and subwoofer loudspeakers.

The Model 65 also supports several format-specific parameters required for accurate LFE channel monitoring. To minimize digital bandwidth, some multichannel formats restrict the frequency response of the LFE channel. To emulate this process, a low-pass filter can be inserted into the LFE signal path. For compatibility with some cinema formats, gain can also be added to the LFE signal.

While the Model 65 is intended primarily for use in 5.1 applications, additional specialized features and capabilities are also included. These allow the unit to be configured to meet the needs of a broad range of monitoring applications.

Main Inputs

The Model 65 contains five full-bandwidth input channels, which are intended for connection to left, center, right, left surround, and right surround sources. The electronically balanced inputs are compatible with balanced or unbalanced sources. Associated with each of the five main inputs is a crossover circuit, created by means of separate high- and low-pass filters. The filters are factory-configured to provide a nominal crossover frequency of 80Hz. The output of each high-pass filter is routed to the output circuit of its corresponding channel. The output of each low-pass filter can be individually assigned to subwoofer output 1, subwoofer output 2, or subwoofer outputs 1 and 2. To prevent level build up, the signal is attenuated 6dB when assigned to both subwoofer outputs.

LFE Input

The Model 65 contains an input channel that is specifically intended for connection to an LFE source. To simulate some multichannel formats, a low-pass filter can be inserted, using a front-panel switch or remote control signal, into the LFE signal path. The filter, created by cascading four 2nd-order Sallen-Key low-pass sections, provides a 48dB-per-octave slope with the -6dB point at 120Hz.

To allow accurate monitoring of some cinema formats, a front-panel switch allows 10dB of gain to be added to the LFE signal. This ensures that the proper relative level is maintained between the LFE signal and the low-frequency energy derived from the five main inputs. As with the main inputs, the LFE signal can be assigned to subwoofer output 1, subwoofer output 2, or subwoofer outputs 1 and 2.

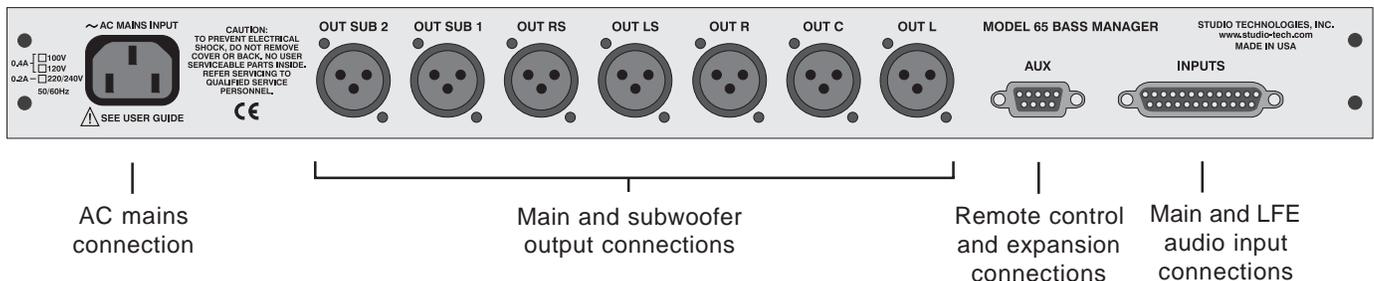
Outputs

The Model 65 provides five main and two subwoofer outputs. Each of the outputs is electronically balanced and can be connected to balanced or unbalanced loads. To minimize the chance of loudspeaker damage, power up/power down mute relays are associated with each output. The nominal level of the five main outputs is +4dBu, maintaining a unity gain input-to-output relationship. The two subwoofer outputs are handled somewhat differently, having a nominal output level of -6dBu. This reduced operating level allows sufficient audio headroom when phase coherent signals from the main inputs are routed, by way of the low-pass filters, to the subwoofer outputs.

Model 65 Front Panel



Model 65 Back Panel



Support for Two Subwoofers

As previously discussed, the outputs of the low-pass filters associated with the five main inputs, along with the LFE signal, can be assigned to either or both of the subwoofer outputs. The two subwoofer outputs allow flexibility when designing a loudspeaker system. A system could be configured to support subwoofers that are position-oriented, such as “sub left front” and “sub right front.” Or, the subwoofers could be configured according to program content, such as having subwoofer output 1 handle only LFE information, while subwoofer output 2 handles the low-passed signals from the main inputs.

Bass Management Bypass

A Model 65 feature allows the bass management function to be disabled by means of a front-panel switch. This function can be useful, especially during the monitor system installation and room-tuning process. When the bypass function is enabled, the five main input signals route directly to the main outputs. In addition, the outputs of the low-pass filters associated with the main inputs no longer route to either of the subwoofer outputs. However, when the bass management bypass function is active the LFE signal continues its normal routing, flowing to either or both of the subwoofer outputs.

Remote Control

Three remote control functions are available: LFE low-pass filter enable, LFE mute, and subwoofer mono. The remote control functions are specifically provided for use during the recording or mixing process. An effective installation could utilize foot switches or console-mounted buttons to allow easy operator access to the remote control functions.

Remote control of the LFE low-pass filter allows real-time confirmation of LFE content. Some release formats require that LFE program content be band restricted. Under this condition, a valid audio mix would have no change in its sonic character when the LFE low-pass filter is enabled.

When LFE mute is enabled, normal bass management operation continues, but the LFE signal is not routed to either of the subwoofer outputs. This function allows a direct check of the impact an LFE signal is having on an overall mix.

The subwoofer mono function is provided to allow confirmation of the phase-coherency of the two subwoofer outputs. When the function is enabled, the subwoofer signals are combined (summed), attenuated by 6dB, and fed to both subwoofers.

Expansion Capability

Provision has been made to allow multiple Model 65 units to be easily interconnected. For example, by using two units, ten main and two LFE inputs are supported, as well as providing ten main and two subwoofer output channels. For other special applications a virtually unlimited number of units can be interconnected.

Flexibility

The Model 65 is designed to be used directly “out of the box,” providing effective bass management for most 5.1 applications. However, installation-specific requirements, along with the evolving world of multichannel audio, make flexibility imperative. With the Model 65 you can use it “our way,” or easily perform a minor or major reconfiguration. A competent technician can field-adjust a number of key bass management parameters.

The high- and low-pass filters sections associated with the main inputs are implemented by cascading two 2nd-order Sallen-Key filter circuits. Jumpers on the Model 65's printed circuit board allow individual selection of 12dB-per-octave or 24dB-per-octave response. The factory-default configuration for the high-pass filters is 12dB-per-octave, complementing the internal filters contained in many amplified loudspeaker systems. Other speaker systems may benefit from the use of the 24dB-per-octave setting. A third jumper position allows the input signal to be directly routed to the output. This "flat" selection supports loudspeaker systems that already contain filters to provide the desired high-pass response. As for the low-pass filters, the factory configuration is 24dB-per-octave, supporting the needs of many subwoofer loudspeakers. Alternately, the 12dB-per-octave settings can be used to match the Model 65 with other monitor systems.

The high- and low-pass filter frequencies associated with the main inputs can be individually adjusted. This allows the crossover frequencies to be configured on a channel-by-channel basis. While the factory default crossover frequency is set for nominally 80Hz, selecting an alternate crossover frequency, symmetrical or asymmetrical, is simple. To adjust any of these filters requires only changing resistors. Sockets are present in the Model 65's circuit board, eliminating the need to solder.

The LFE low-pass filter frequency can also be adjusted. The factory-default value is 120Hz, but can easily be revised.

Installation

In this section you will be installing the Model 65 Bass Manager in an equipment rack. Audio input and output connections will be made. If required, external equipment will be interfaced to the remote control inputs. In special applications, multiple Model 65s will be interconnected. AC mains power will be connected to the Model 65.

Prior to beginning the installation process, a thorough review of the configuration section is recommended. While it's possible to use the Model 65 directly "out of the box," some configuration changes may add significantly to the performance of a completed installation.

System Components

The shipping carton contains one each of the following: Model 65 Bass Manager, user guide, and warranty card. Units destined for North America also include an AC mains cord. Your dealer or distributor will provide an AC mains cord for non-North American destinations.

Mounting the Model 65

The Model 65 requires one space in a standard 19-inch (48.3cm) equipment rack. It is desirable to locate the Model 65 to allow access to both the front and the back panels. The back panel contains the input and output connectors. The front panel is used to access several operator controls. The Model 65 is secured to the equipment rack using two mounting screws per side.

Audio Inputs

The Model 65 provides six audio inputs: five main and one LFE. These six channels are designated L, C, R, LS, RS, and LFE.

Audio input signal connections are made by way of a 25-pin D-sub connector located on the Model 65's back panel. One cable harness, with a 25-pin D-sub plug (male) on one end and the desired connector or connectors on the other end, is required. This cable harness is not supplied by Studio Technologies. (Note that our friends in some locations may use the term "loom" instead of harness.)

The wiring scheme used by the input D-sub complies with that made familiar by TASCAM® with their DA-88® product. A wiring harness prepared for connection to the six audio input channels is identical to that of a harness prepared to connect to the first six channels of a DA-88 input harness. Please refer to Figure 1 for the connection details. Note that the Model 65's D-sub connector uses 4-40 threads.

Unless there's a special need, it may be cost and time effective to utilize a commercially made cable harness. Let the large market for DA-88-style cabling help you painlessly install your system!

The Model 65's input connector is directly compatible with the monitor output connections of the Studio Technologies' Studio-Comm for Surround Model 68 and Model 68A Central Controllers. The channel layout arrangements of the two systems are identical, making interconnection simple.

Each input circuit is electronically balanced and is intended for connection to balanced or unbalanced sources with a nominal signal level of +4dBu. Balanced sources should be

Channel	+	-	Shield
L	24	12	25
C	10	23	11
R	21	9	22
LS	7	20	8
RS	18	6	19
LFE	4	17	5

Notes: 1) Connector type on Model 65 is 25-pin D-sub-miniature female. Installer must provide plug (male). Connector uses 4-40 threaded inserts for locking with mating plug.

2) Wiring scheme follows Tascam DA-88 convention. Standard DA-88-type wiring harnesses are directly compatible, with the exception of 4-40 screw threads being required.

Figure 1. Main Audio Input Connections

wired so that signal high is connected to + on the D-sub, signal low to – on the D-sub, and shield to the D-sub's shield connection. With an unbalanced source connect signal high to the + connection on the D-sub, and shield to both the – and the shield connection on the D-sub. If connecting to an unbalanced source in this manner results in hum or noise try connecting signal high to + on the D-sub, and shield to – on the D-sub; leave the shield connection on the D-sub unterminated.

Audio Outputs

The Model 65 provides seven audio outputs, designated L, C, R, LS, RS, Sub 1, and Sub 2. These outputs are intended for connection to audio amplifiers associated with monitor loudspeakers, or to the inputs of loudspeakers with integrated amplifiers. The outputs are electronically balanced and capable of driving balanced or unbalanced loads of 600 ohm or greater.

The nominal output level of the main channels, L, C, R, LS, and RS, is +4dBu. The nominal output level of Sub 1 and Sub 2 is -6dBu.

Seven 3-pin male XLR-type connectors are used to interface with the Model 65's outputs. Prepare the mating connectors (females) so that pin 2 is signal + (high or hot), pin 3 is - (low or cold), and pin 1 is shield. To connect to an unbalanced load connect pin 2 as signal + (high or hot) and pins 1 and 3 as signal low/shield. For optimal unbalanced operation, it is important to connect pins 1 and 3 together directly on the connector that mates with the Model 65 and not on the other end of the cable.

Note that while the Model 65's electronically balanced output circuits are capable of driving loads of 600 ohms or greater the output level will drop slightly as the load impedance approaches 600 ohms. For example, a 0.5dB difference in output level can be expected as the load impedance changes from 10k ohms to 600 ohms.

Remote Control Functions

Support is provided for three remote control functions: LFE low-pass filter enable, LFE mute enable, and subwoofer mono enable. The three inputs use logic gates, "pulled up" to +5V by way of resistors, which are active when brought to the logic low state. Inputs of this type are commonly referred to as GPI inputs. While the input circuitry is protected from over-current and static (ESD) discharge care should be taken to prevent nasty signals from reaching them. The inputs are active only when held in the low state; they can't be configured to change state ("latch") in response to a logic pulse.

The 9-pin D-sub connector (labeled AUX on the back panel) is used to interface the three remote control inputs. Refer to Figure 2 for connection details. Note that pin 1 (shield/remote common) and pin 9 (audio common) are electrically identical. In addition to connecting to system common they connect to the Model 65's chassis and mains earth connections. Even so, the shield of the interconnecting cable, along with the remote control source's common signal, should be connected to pin 1 (shield/remote common). Pin 9 (audio common) should be reserved for use when interconnecting the audio signals of multiple Model 65 units.

Pin	Signal
1	Shield/Remote Common
2	LFE Low-Pass Filter Enable
3	LFE Mute Enable
4	Subwoofer Mono Enable
7	Audio Link Sub 1
8	Audio Link Sub 2
9	Audio Common

Notes: 1) Connector type on Model 65 is 9-pin D-subminiature female. Connector uses 4-40 threaded inserts for locking with mating plug.

Figure 2. Aux Connector Pin Out for Remote Control and Expansion Functions

Interconnecting Multiple Units

Expansion capability is an integral part of the Model 65's design. A virtually unlimited number of units can be connected together to provide bass management for a variety of applications. For example: bass management may be needed for an experimental 10.2 playback system. This can be easily created by using two Models 65, along with a simple interface cable.

It's important to understand how multiple units operate together before attempting an implementation. The Model 65 functions that are interconnected are the remote control inputs and the subwoofer outputs. The remote control functions are pretty obvious as to why they need to be interconnected. A user will want a single command to enable the identical remote control functions on all Model 65 units. The remote control input circuitry was specifically designed to allow multiple units to be directly connected (bridged) together.

Using multiple Model 65 units is a little more involved when it comes to the subwoofer outputs. Each Model 65 has five main inputs with directly associated outputs: L, C, R, LS, and RS. Each of them can also assign bass management audio information to Sub 1, Sub 2, or both. In addition to the five inputs, a sixth input, LFE, can also be routed to Sub 1, Sub 2, or both. But when multiple Model 65s are used, the bass management and LFE input information from all units must end up on a common set of Sub 1 and Sub 2 outputs. This is accomplished by designating one Model 65 as "master" and using its Sub 1 and Sub 2 outputs as the connections to the subwoofer loudspeakers. The other Model 65 units are configured as "slaves" and send bass management and LFE audio information to the master unit. In practice, the hardware linking is accomplished using three pins on the Model 65's Aux connector. The three pins link the units together in a simple one-to-one connection arrangement. In addition, two internal jumpers must be configured on each unit.

The installation of multiple Model 65 units begins by configuring one unit to serve as "master" and the other unit(s) as "slave."

Internal jumper, located on the Model 65's circuit board, allow each unit to be configured for either mode, or to the factory-configured disabled mode.

Warning: A competent technician is required to perform any configuration review or changes. The cover of the Model 65 must be removed to access the configuration jumpers. This exposes the technician to a potential shock hazard. Only after mains power has been disconnected and the mains cord removed from the back of the Model 65, should the cover be removed.

Once mains power has been disconnected, the cover of each Model 65 can be removed. Option jumpers are associated with the expansion functions. These are located on the printed circuit board. Refer to Figure 3 for detailed view. From the factory the jumpers for audio link Sub 1 and audio link Sub 2 are set to the disabled position. On the Model 65 designated as "master," the jumpers must be moved to the positions labeled IN. This configures the unit to receive sub audio from the slave(s). On the Model 65 unit(s) designated as "slave," the jumpers must be moved to the positions labeled OUT. This configures the unit(s) to send bass management and LFE information to the master. Confirm that the desired configuration has been achieved. The covers from the Model 65 units can then be replaced and secured.

Implementing the physical connections between multiple units is simple. First of all, the Model 65 units should be mounted in adjacent rack spaces. This will encourage

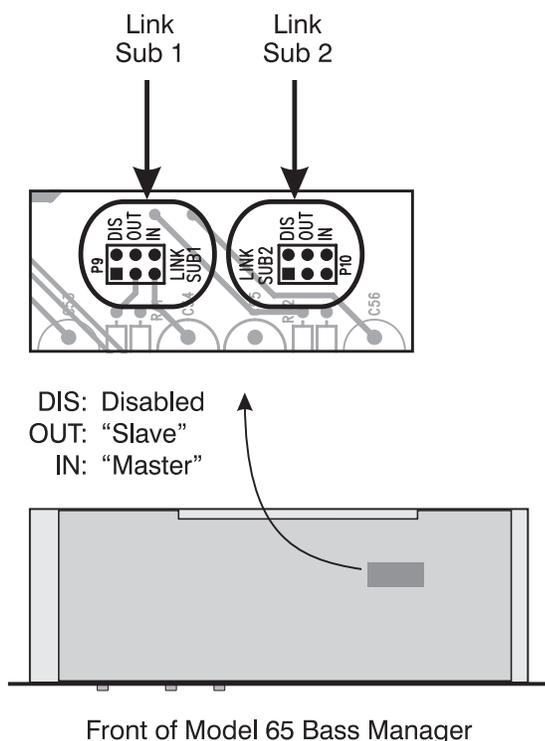


Figure 3. Link Signal Configuration

creating the shortest possible interconnecting cables. Should the remote control inputs be utilized, they must be interconnected by way of pins in the Aux connector. Refer to Figure 2 for a detailed description of the connections on the 9-pin D-sub Aux connector. Pin 1 (Shield/Remote Common), pin 2 (LFE Low-Pass Filter Enable), pin 3 (LFE Mute Enable), and pin 4 (Subwoofer Mono Enable) on all Model 65 units must be connected together in a one-to-one arrangement. While not required, using shielded cable is optimal with pin 1 connecting to shield.

The bass management and LFE audio signals on multiple units are connected together using pins 7 (audio link Sub 1), 8 (audio link Sub 2) and 9 (audio common).

They, too, should be connected in a one-to-one arrangement. As the audio signals are unbalanced shielded cable is optimal with pin 9 being connected to the shield. Be certain to keep the interconnecting cable length to a minimum.

AC Mains Power

The Model 65 is internally configured to operate from either 100, 120, or 220/240V, 50/60Hz. In most cases, units shipped to North America are factory selected for 120V operation. Units bound for Japan may have been selected for 100 or 120V, while our friends "down under" and in Europe receive units set for 220/240V. Before connecting the Model 65 to AC mains power check that it is configured to match the local mains voltage. Look on the back panel, adjacent to the power entry connector for the configured voltage. Note that an incorrect configuration could seriously damage the unit. Should it be necessary to change the unit's operating voltage it must be performed only at the factory or by a competent service technician.

The Model 65 uses an IEC standard connector to mate with the AC mains cord. The wire colors in the AC mains cord should conform to the internationally recognized CEE color code and must be wired accordingly:

<u>Connection</u>	<u>Wire Color</u>
Neutral (N)	Light Blue
Line (L)	Brown
Protective Earth (E)	Green/Yellow

Safety Warning: The Model 65 does not contain an AC mains disconnect switch. As such, the mains cord plug serves as the disconnection device. Safety consideration requires that the plug and associated outlet be easily accessible to allow rapid disconnection of mains power should it prove necessary.

After mains power has been connected, a power-up delay circuit prevents operation for several seconds. This delay prevents audio “pops” or other noise from being sent out the main audio outputs and on to the loudspeakers. Once the power-up delay has elapsed, the Model 65’s power present LED will light and the output muting relays will change to their normal non-muted state. The unit is now ready for years of trusty service!

Configuration

While it is easy to install and use, the Model 65 does provide a number of configurable parameters that can be used to “tune” an installation for optimum performance. From the factory, default settings have been selected that are appropriate for many installations. But don’t be lulled into complacency by the fact that “out of the box” the Model 65 may seemingly perform well in an application. It’s critical to review how the Model 65 functions within the scope of the entire monitoring system. A system will only meet its potential when all of the components work together to achieve a common goal.

The configurable parameters can be separated into two groups: basic and advanced. The basic parameters are high-pass filter slope selection, low-pass filter slope selection, and subwoofer assignment. The advanced parameters are high- and low-pass filter frequency adjustment, as well as adjustment of the LFE low-pass filter frequency.

Warning: Mains power must be disconnected prior to setting the mode. Only a competent technician must perform this procedure!

Basic Configuration

In this section the configuration of the main input’s high- and low-pass filter slope will be reviewed. Changes will be made if necessary to meet the needs of the monitor system. The bass management and LFE signal routing to the subwoofer outputs will be reviewed. Again, changes will be made if required.

High-Pass Filter Slope Selection

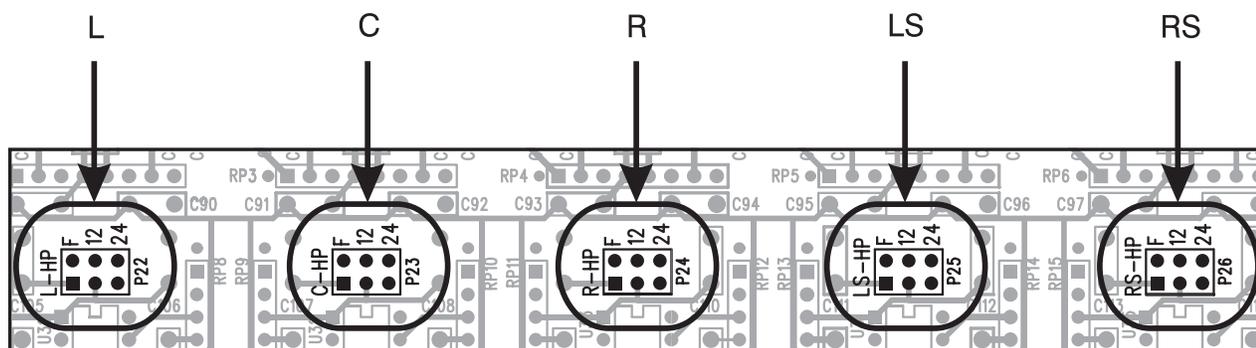
Each of the five main input channels (L, C, R, LS, and RS) includes a high-pass filter section. These filter sections remove the audio-frequency content that is to be routed, by way of the low-pass filters, to the subwoofer output(s). Each filter section is implemented by cascading (connecting in series) two identical high-pass filter circuits. Each filter circuit has a slope of 12dB-per-octave and is factory selected to have its –3dB point at nominally 80Hz. Option jumpers are provided to allow the audio signal to pass through either or both of the filters, providing a slope of 12- or 24dB-per-octave. For added flexibility, an additional jumper position allows the filter to be

removed from the signal path. This is designated as the Flat position. Refer to Figure 4 for a detailed view of the jumper locations.

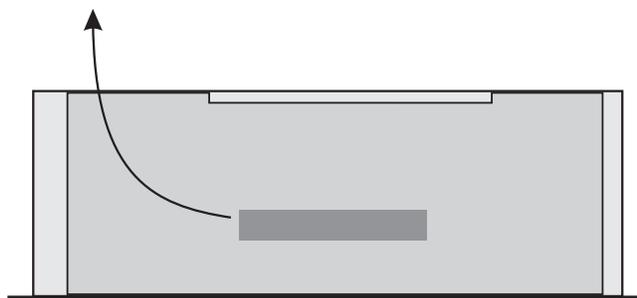
From the factory the jumper locations are configured for 12dB-per-octave. This is appropriate for many applications, such as where the loudspeakers connected to the main-channel outputs include a 12dB-per-octave high-pass filter. (Of course this assumes that an overall 24dB-per-octave response is desired.) Many small amplified loudspeakers include such internal high-pass filters. There are also situations where the 24dB-per-octave setting would be the correct choice. This would be the case where the loudspeakers connected to the main-channel outputs do not contain integral high-pass filters.

The Flat position is provided for special situations. An example would be where the loudspeakers associated with the main channels already implement the desired low-frequency response curve. This could be due to the loudspeakers containing integral high-pass filters, or to the fact that the speaker's inherent low-frequency response naturally provides the desired frequency response. To review: In the Flat position the full bandwidth of the signals entering the main inputs (L, C, R, LS, and RS) route directly to their respective output circuitry. No high-pass filtering is performed.

The key to correctly selecting the slope of the high-pass filters is to first understand the needs of the entire monitoring system. It's important to maintain a smooth transition



- F: Flat (no filter)
- 12: 12dB-per-octave slope
- 24: 24dB-per-octave slope



Front of Model 65 Bass Manager

Figure 4. High-Pass Filter Slope Selection

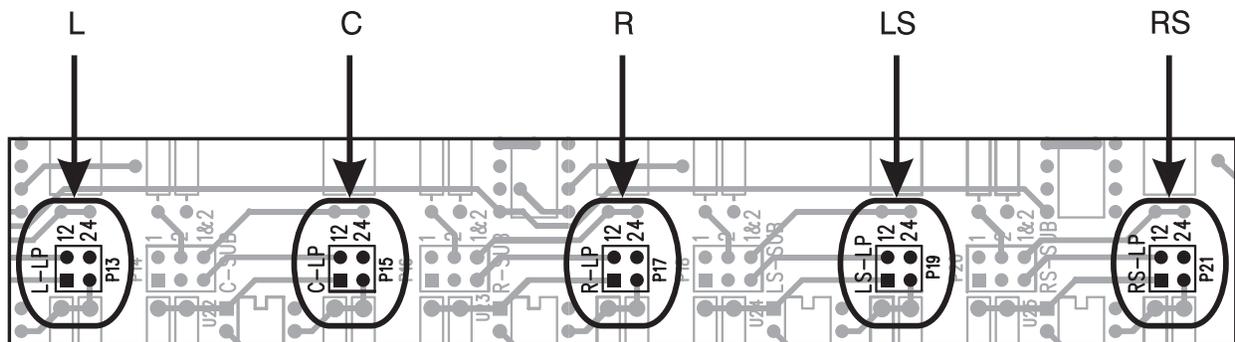
(crossover) between the main channel loudspeakers and the bass management audio signals being reproduced by the subwoofer(s). Only by studying the entire monitoring configuration can a correct selection be made. Personal taste and philosophy play a major role in decisions like these. Some people prefer crossover slopes of 24dB-per-octave, while others prefer the more gentle 12dB-per-octave. Don't minimize the impact that a little planning can have on a system's performance.

Low-Pass Filter Slope Selection

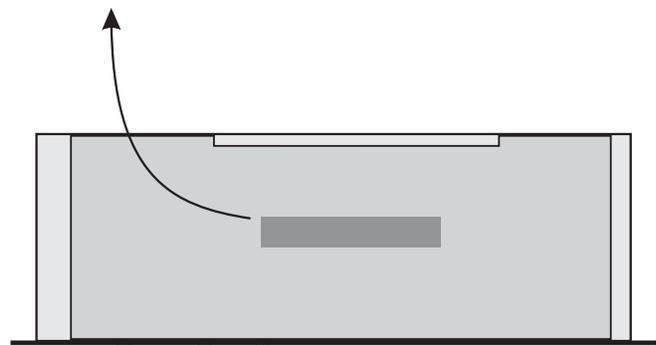
Each of the five main input channels (L, C, R, LS, and RS) includes a low-pass filter section. These filter sections separate the audio-frequency content that will be routed to either or both of the subwoofer outputs.

Each filter section is implemented by cascading (connecting in series) two identical filter circuits. Each filter circuit has a slope of 12dB-per-octave and is factory selected to have its -3dB point at nominally 80Hz. Option jumpers are provided to allow the slope of the signal going to the subwoofers to be 12- or 24dB-per-octave. Refer to Figure 5 for a detailed view of the jumper locations.

From the factory the jumper locations are configured for 24dB-per-octave. This is appropriate for applications where a relatively steep crossover slope is desired. There are situations where selecting the 12dB-per-octave setting may be appropriate. Specific examples are hard to provide as the number of different monitoring



12: 12dB-per-octave slope
24: 24dB-per-octave slope



Front of Model 65 Bass Manager

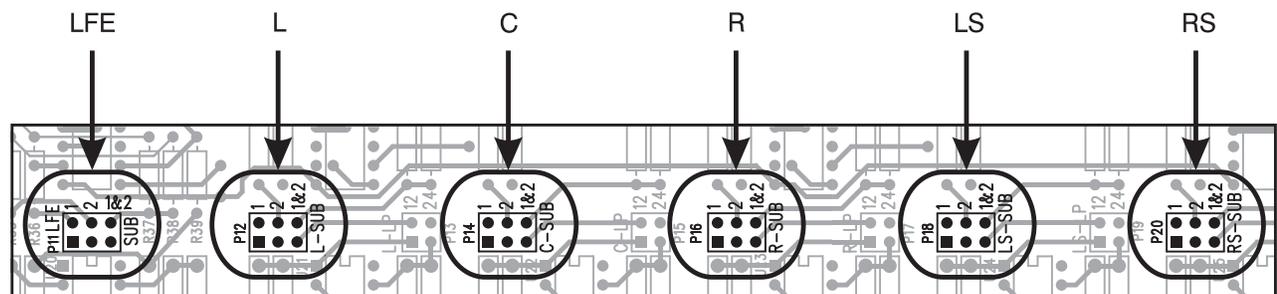
Figure 5. Low-Pass Filter Slope Selection

arrangements is enormous. The key to successful selection is to ensure that the low-pass filter slope meets the exact needs of the monitoring system.

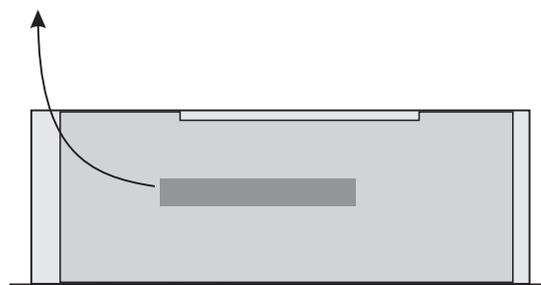
Subwoofer Assignment

Each of the five main input channels (L, C, R, LS, and RS) includes a low-pass filter section. The output of these filters is the “bass management” signal that is routed to either or both of the subwoofer output channels. The LFE input channel is also routed to either or both of the subwoofer outputs. Option jumpers, located on the printed circuit board, allow selection of the desired routing. Refer to Figure 6 for a detailed view of the jumper locations. The choices are Sub 1, Sub 2, or both Sub 1 and 2. An attenuation (level drop) of 6dB is implemented whenever the routing is selected for both Sub 1 and Sub 2. This feature is important, preventing low-frequency level buildup.

From the factory the subwoofer routing for the five main inputs and the LFE input is selected to be Sub 1. This is appropriate for applications where a single subwoofer loudspeaker will be utilized. The jumpers can easily be changed to support an alternate configuration. There are many opinions as to how subwoofers should be used in a listening environment—almost as many as there are opinions as how to correctly make a martini! In some cases, two subwoofers might be used in a “stereo” configuration. One may be designated as sub left, the other as sub right. In this case, main input L and LS signals might be assigned to Sub 1, R and RS would be assigned to Sub 2, while C and LFE would be assigned to both sub outputs. Another application might find one subwoofer used for the main input channels and the second for the LFE channel. In this case L, C, R, LS, and RS would be assigned to Sub 1, while LFE would be assigned to Sub 2.



- 1: Subwoofer 1
- 2: Subwoofer 2
- 1 & 2: Subwoofer 1 and Subwoofer 2



Front of Model 65 Bass Manager

Figure 6. Subwoofer Assignment

There might be a case where it is desirable to have one of the five main inputs not assigned to a subwoofer output. While we can't really think of an application like this, there is no technical problem in having no routing selected for a main input channel. Leaving jumper positions unused should not pose a problem.

Advanced Configuration

In this section the configuration of the main input's high- and low-pass filter frequencies will be reviewed. Changes will be made if necessary to meet the needs of the monitor system. The frequency of the low-pass filter associated with the LFE input will be reviewed. Again, changes will be made if required.

Main Input High-Pass Filters

As previously discussed, each of the five main input channels (L, C, R, LS, and RS) has a high-pass filter section associated with it. Each filter section is created by cascading (connecting in series) two identical 2nd-order Sallen-Key filter circuits. Components were selected at the factory so that the filter section's output has a -6dB point of nominally 80Hz. (To be more precise, the math calculations work out to be 83Hz.) For some applications it may be optimal to adjust this frequency. The Model 65 makes this a simple task, with no soldering or complicated procedure required. Note that each of the five high-pass filter sections can be independently configured. This is provided to meet "real world" monitoring environments. For example, it's quite reasonable that the L, C, and R channels utilize one frequency, while the LS and RS channels use another.

The frequency of each filter section is configured by means of six resistors, each identical in value. Two 6-position sockets, located on the printed circuit board, are used to hold the resistors. As received from the factory, two 27k (27,000) ohm 6-pin single-inline-package (SIP) resistors are used to configure the filters for nominally 80Hz. To revise the frequency these can be replaced with two 6-pin SIP resistors, or six individual ¼-watt, 1%-tolerance resistors. The SIP resistors must be isolated-terminal-type, providing three independent resistors in one assembly. As the SIP resistors have a tolerance of 2%, using ¼-watt 1%-tolerance, rather than 5%-tolerance, resistors is appropriate.

A simple formula is used determine the resistance required for a specific filter frequency: $R = 2,251,000 \div F$, where R is resistance in ohms and F is frequency in hertz. Figure 7 lists several frequencies that are provided by standard SIP resistors. Using ¼-watt, 1%-tolerance resistors will allow many other frequencies to be implemented.

Once the new SIP or 1%-tolerance resistors have been procured, they should be double-checked. Use an ohmmeter to confirm that the resistance value is correct. If SIP resistors are being used, check to ensure that they are isolated-terminal-type. These simple checks should take only a short time and will insure that a change to the filters will achieve the desired audio performance.

150Hz: 15k	68Hz: 33k
125Hz: 18k	58Hz: 39k
113Hz: 20k	48Hz: 47k
102Hz: 22k	40Hz: 56k
83Hz: 27k	33Hz: 68k

Figure 7. High-Pass Filters, Frequency versus SIP Resistor Value

The process required to actually change the components is simple, although a competent technician must perform the steps. Following the previously discussed safety procedures, mains power must be disconnected and the Model 65's cover removed. Refer to Figure 8 for a detailed description of the location of the resistors on the printed circuit board. The factory-installed 27k SIP resistors must be carefully removed by using a pair of needle-nosed pliers. The SIP resistors should be lifted straight up out of their sockets. If SIP resistors are to be used to achieve the revised frequency, they can be directly inserted into the sockets. Pin 1 of the SIP resistors should correspond with pin 1 of the sockets. Pin 1 is clearly marked by means of a white dot on the printed circuit board.

If six individual 1%-tolerance resistors are to be used they must first be prepared for insertion. To begin, one lead of each of the resistors must be folded over (carefully bent 180 degrees) so that it becomes parallel with the other. Then both leads must be trimmed (cut) so that they extend out from the body of the resistor by about 1/8 to 1/4 inch. Once this has been completed the resistors can be inserted into the sockets, with three going into each. The first resistor is inserted into socket pins 1 and 2, the second into pins 3 and 4, and the third into pins 5 and 6. After the resistors are inserted, ensure that they are positioned so that they stand straight up, safely away from other components.

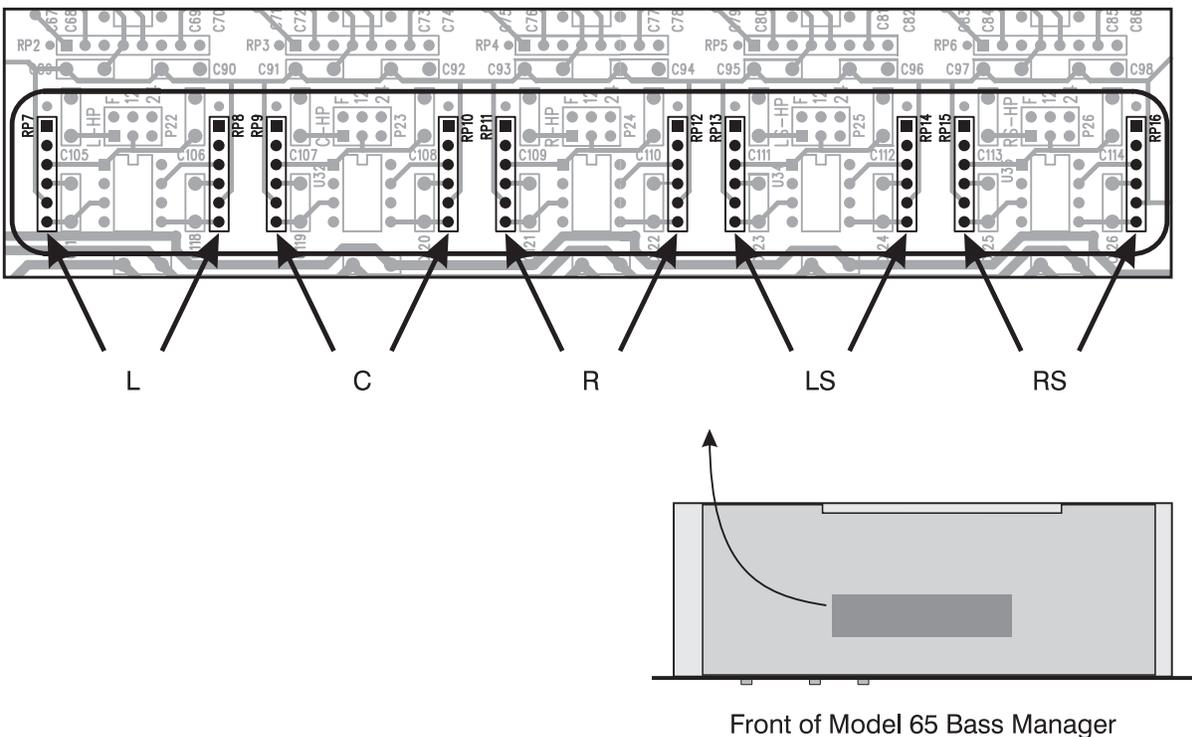


Figure 8. Main Input High-Pass Filter Frequency Configuration

Main Input Low-Pass Filters

Each of the five main input channels (L, C, R, LS, and RS) also has a low-pass filter section associated with it. Each filter section is made up of two identical filter circuits that are cascaded, i.e., connected in series. Components were selected at the factory so that the filter section's output has a -6dB point of nominally 80Hz. (To be more precise, the math calculations work out to be 82Hz.) As with the high-pass filter sections, each of the five low-pass filter sections can be configured independently. It's quite reasonable that the L, C, and R channels utilize one frequency while the LS and RS channels use another. It's also reasonable that each input channel's low-pass frequency be configured differently from its associated high-pass filter frequency. Using asymmetrical filter settings can be very effective in achieving the desired monitor system performance.

The frequency of each low-pass filter section is configured by means of four ¼-watt, 1%-tolerance resistors, each identical in value. One 8-pin socket, located on the printed circuit board, is used to hold the resistors. From the factory, four 13.7k (13,700) ohm resistors are used to configure the filters for nominally 80Hz. To revise the frequency, these can be replaced with four other resistors, or one 8-pin SIP resistor package. It's important to note that the SIP resistor must be isolated-terminal-type, providing four independent resistors in one assembly.

A simple formula is used determine the resistance required for a specific filter frequency: $R = 1,125,400 \div F$, where R is resistance in ohms and F is frequency in hertz. Figure 9 lists several frequencies

that are created using 1%-tolerance and SIP resistors. As may be evident, the frequencies were selected to roughly match the high-pass filter frequencies shown in Figure 7.

150Hz: 7.50k	68Hz: 16.5k
124Hz: 9.09k	57Hz: 19.6k
113Hz: 10.0k	48Hz: 23.7k
102Hz: 11.0k	40Hz: 28.0k
82Hz: 13.7k	33Hz: 34.0k

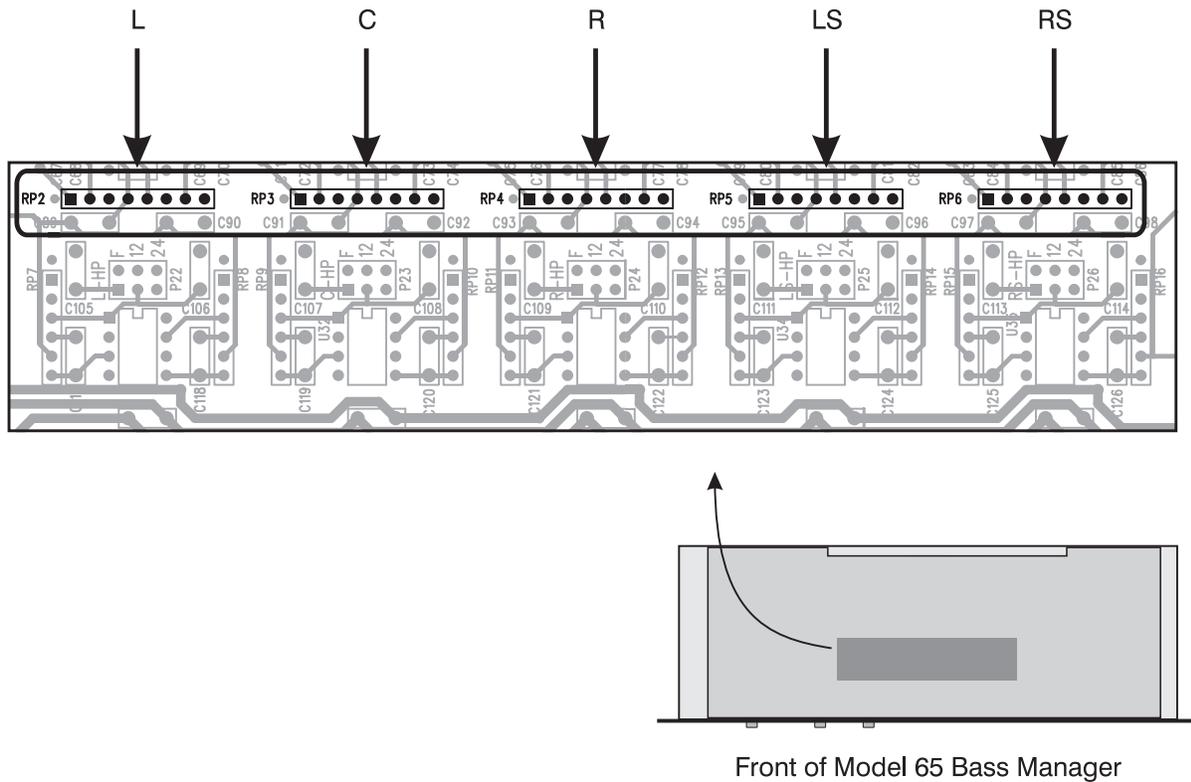
Figure 9. Low-Pass Filters, Frequency versus 1%-Tolerance Resistor Value

As with the procedure for the high-pass filters, once new 1%-tolerance or SIP resistors have been procured, they should be double-checked. Use an ohmmeter to confirm that the resistance value is correct. If a SIP resistor is being used, check that it is an isolated-terminal-type.

The process required to actually change the resistors is basically the same as with the high-pass filter sections. Refer to Figure 10 for a detailed description of the location of the resistors on the printed circuit board. The four factory-installed 13.7k resistors should be carefully removed by using a pair of needle-nosed pliers. If four individual resistors are to be used, they must be prepared for insertion. The first resistor is inserted into socket pins 1 and 2, the second into pins 3 and 4, etc. After the resistors are inserted, ensure that they are positioned so that they stand straight up, safely away from other components.

LFE Input Low-Pass Filter

A low-pass filter section is associated with the LFE input channel. This 48dB-per-octave filter can be inserted into the LFE



Front of Model 65 Bass Manager

Figure 10. Main Input Low-Pass Filter Frequency Configuration

signal path to simulate the bandwidth restrictions found with some digital audio distribution formats. The low-pass filter section is made up of four 2nd-order Sallen-Key filter circuits that are cascaded, i.e., connected in series. Components were selected at the factory so that the filter section's output has its -6dB point at nominally 120Hz. For some applications it may be desirable to revise the frequency of the low-pass filter. For example, in the future it's possible that the -6dB point may need to be configured for 80Hz, matching the LFE encoding parameters as proposed by the creators of several formats.

As received from the factory two 8-pin SIP resistor packages are used to implement the 120Hz frequency. Two 8-pin sockets

located on the printed circuit board are used to hold the resistors. To achieve the 120Hz frequency requires two SIP different resistance values. An 8-pin 6.8k SIP is "shared" by the first two filters, while an 8.2k SIP is used by the third and fourth. For simplicity, eight ¼-watt, 1%-tolerance resistors of identical value should be used to implement a revised frequency.

The formula to determine the resistance required for a specific filter frequency is: $R = 900,000 \div F$, where R is resistance in ohms and F is frequency in hertz. As an example, to revise the low-pass filter for 80Hz eight 11.3k (11,300) ohm resistors should be used.

As with the previous filter revision procedures, the new 1%-tolerance resistors must be double-checked for accuracy. The process required to actually change the resistors is basically the same as with the main channel's high- and low-pass sections. Refer to Figure 11 for a detailed description of the location of the resistors on the printed circuit board. The two factory-installed SIP package resistors should be carefully removed by using a pair of needle-nosed pliers. The eight individual 1%-tolerance resistors must be prepared for insertion. The first resistor is inserted into socket pins 1 and 2, the second into pins 3 and 4, etc. After all the resistors are inserted, ensure that they are positioned so that they stand straight up, safely away from other components.

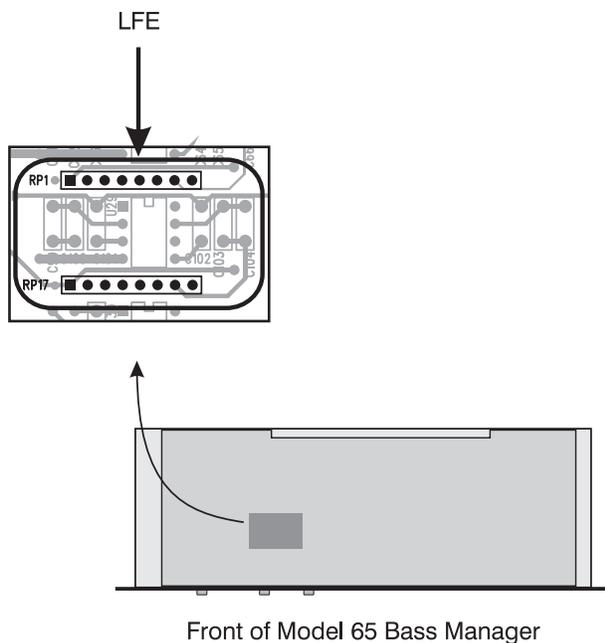


Figure 11. LFE Input Low-Pass Filter Frequency Configuration

Operation

Now that the Model 65 has been installed, the unit should be ready to go. Operation is very simple with, in many cases, little or no operator intervention required. The LED labeled $\pm 17V$ will light whenever mains power is connected, both DC power supply voltages are operating correctly, and a short turn-on time delay has elapsed.

Front-Panel Controls

Three push-button switches and associated LED indicators are located on the Model 65's front panel. They are designated Bass Management Bypass, LFE Input +10dB Gain, and LFE Input Low-Pass Filter. The Bass Management Bypass function is intended for use mainly during installation and testing. When the button is placed to the bypass (on or in) position, the associated LED will light and the bass management function is disabled. In this mode the L, C, R, LS, and RS inputs are routed, by way of the input circuitry and analog switches, directly to their associated output circuits. Low-passed audio signals from these inputs are muted, rather than being connected to Sub 1, Sub 2, or both. Note that the LFE input and its subwoofer routing is not affected by the Bass Management Bypass function.

A slight audio "tick" or "pop" may be heard when the Bass Management B-pass function is enabled or disabled. This is normal and should not be a cause for concern. While the audio switching is performed by high-quality solid-state components, it is not intended to be "click free." As the bypass function is not intended for use during audio mixing or playback monitoring, a "silent" switching function was not deemed necessary.

The other two push-button switches are associated with the LFE Input. The function of the +10dB gain switch is very simple; it adds 10dB of LFE input sensitivity when the switch is in the +10 (on or in) position. As expected, its associated LED will light whenever the function is enabled. This function is provided so that an LFE input signal that has been level adjusted for cinema playback can be correctly monitored. Such formats reduce the nominal level of the LFE signal by 10dB, allowing greater headroom in the playback system. This is technically clever, but can pose a problem for non-theater playback environments. Using the +10dB gain switch allows the gain to be made up and the monitoring to be accurate.

The LFE input low-pass filter function is provided to emulate the processing done by some formats to the LFE channel. Unlike the five main input channels, the LFE input channel is often bandwidth restricted to save digital “bits.” It’s important that an audio “mix” maintain its integrity when such LFE bandwidth restrictions are in place. The LFE input low-pass filter function is enabled by placing its switch to the LPF (on or in) position. When enabled the LFE signal is routed through a series of analog filters which provide a 48dB-per-octave slope with a –6dB frequency of 120Hz.

Philosophy dictates how the filter function should be used. The function can be used as a final “double check” to ensure that material will maintain overall integrity when digitally processed. Enabling the filter during a final listening session should find the spectral content remaining constant. If the mix is impacted, content has been incorrectly routed to the LFE channel!

It’s also acceptable to leave the filter enabled at all times. This will ensure that an audio mix will “hold up” when processed. However, this may mask content remaining in the LFE channel which, although it won’t be present after processing, may be confusing to mastering engineers or other personnel who monitor the original source material.

Remote Control Functions

The Model 65 provides three functions that can be controlled by external sources: LFE low-pass filter, LFE mute, and subwoofer mono. The first two functions are just a means of remotely enabling functions that are also controlled by front-panel push-button switches. They effectively perform a logical “OR” function with the front panel buttons. The LED indicators on the front panel will light whenever their respective function is enabled, whether by means of the front panel switches or the remote control inputs.

The subwoofer mono function allows the phase coherency of signals on the two subwoofer outputs to be checked. When the function is enabled signals destined for the subwoofers are added (summed), reduced in level by 6dB, and routed to both subwoofer outputs. Note that there is no LED indicator associated with the subwoofer mono function.

Specifications

Audio Inputs: 6

Type: electronically balanced, compatible with balanced or unbalanced signals

Impedance: 24k ohms

Nominal Level: +4dBu

Main Input Channel High-Pass Filters: 5

Type: two cascaded 2nd-order Sallen-Key; factory configured for 12dB-per-octave; field configurable for flat, 12, or 24dB-per-octave response

Response: -3dB @ 80Hz, nominal, 12dB-per-octave; -6dB @ 80Hz, nominal, 24dB-per-octave; field configurable

Main Input Channel Low-Pass Filters: 5

Type: two cascaded 2nd-order Sallen-Key; factory configured for 24dB-per-octave; field configurable for 12 or 24dB-per-octave response

Response: -3dB @ 80Hz, nominal, 12dB-per-octave; -6dB @ 80Hz, nominal, 24dB-per-octave; field configurable

Main Input Channels to Subwoofer Outputs:

Overall Gain: -10dB, nominal

Routing: subwoofer output 1, 2, or both; as signing to both subwoofer outputs implements 6dB additional attenuation; factory default routing to subwoofer output 1

LFE Input Channel to Subwoofer Outputs:

Overall Gain: -10 or 0dB, nominal, switch or remote control selectable

Routing: subwoofer output 1, 2, or both; as signing to both subwoofer outputs implements 6dB additional attenuation; factory default routing to subwoofer output 1

LFE Input Channel Low-Pass Filter:

Type: four cascaded 2nd-order Sallen-Key sections; 48dB-per-octave (8th order)

Response: -6dB @ 120Hz, nominal, field configurable

Operation: switch or remote control selectable, on/off

Audio Outputs: 7

Type: electronically balanced, direct coupled, intended to drive balanced or unbalanced loads of 600 ohms or greater

Output Impedance: 50 ohms, nominal

Nominal Level, Main Channels: +4dBu

Nominal Level, Subwoofer Channels: -6dBu

Maximum Output Level: +27dBu into 10k ohms, +26dBu into 600 ohms

Frequency Response: 20Hz-20kHz \pm 0.1dB, measured with bass management bypassed

Distortion (THD+N): 0.005%, measured at 1kHz, +4dBu

S/N Ratio: 85dB, ref +4dBu out

Crosstalk: 78dB, ref +4dBu in

Remote Control Inputs: 3

Functions: LFE low-pass filter enable, LFE mute, subwoofer mono

Type: +5V logic, activates on closure to system common

Expansion Capability: allows multiple Model 65s to be directly interconnected; user-created interface cable required

Connectors:

Audio Inputs: 1, 25-pin D-subminiature female

Audio Outputs: 7, 3-pin XLR-type male

Remote Control/Expansion (Aux): 1, 9-pin D-subminiature female

AC Mains: 1, 3-blade IEC-type

AC Mains Requirement:

100, 120, or 220/240V, \pm 10%, factory configured, 50/60Hz, 12W

Dimensions (Overall):

19.00 inches wide (48.3cm)

1.72 inches high (4.4cm)

6.65 inches deep (16.9cm)

Mounting:

One standard rack space

Weight: 7.0 pounds (3.2kg)

Specifications and information contained in this User Guide subject to change without notice.

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