UREI
ELECTRONIC
PRODUCTS

JBL Concert Series Systems

Features

Optimum matching of amplifier power and signal processing to loudspeaker systems.

Electronic equipment mounted and wired for immediate use.

Standardized equipment interconnect cables.

Certified hanging and rigging hardware.

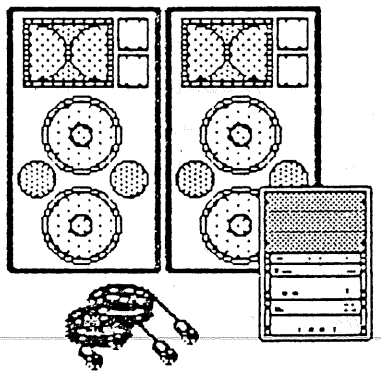
Systems fully tested before shipment.

Stereo (two channel) capability.

Description

JBL Concert Series systems are complete and ready to operate with the addition of source and mixing equipment. Each system includes loudspeaker systems, power amplifiers, electronic crossover and loudspeaker signal processing equipment, equipment racks and loudspeaker connecting cables. Each system is pre-wired, tested and ready for immediate use. Road cases and loudspeaker dollies are available for touring applications.

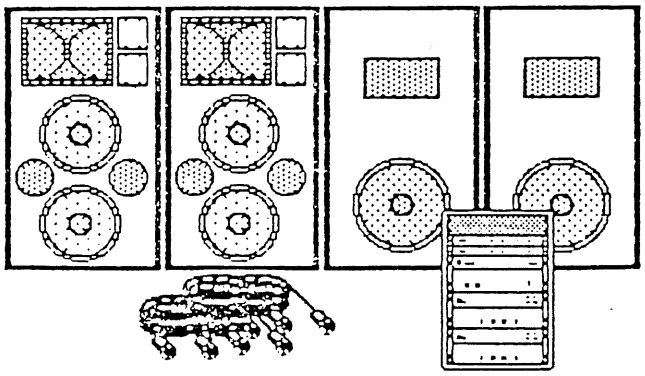
4922 System



4922 Components

[2] 4870 loudspeaker systems
[2] 50 foot EP-8 loudspeaker cables
[1] 9922 equipment rack, including:
[1] 6260 amplifier (HF)
[1] 6290 amplifier (LF)
[1] 5234A dual-channel electronic crossover with high-pass filtering, plug-in cards for 800Hz crossover points and power response correction.

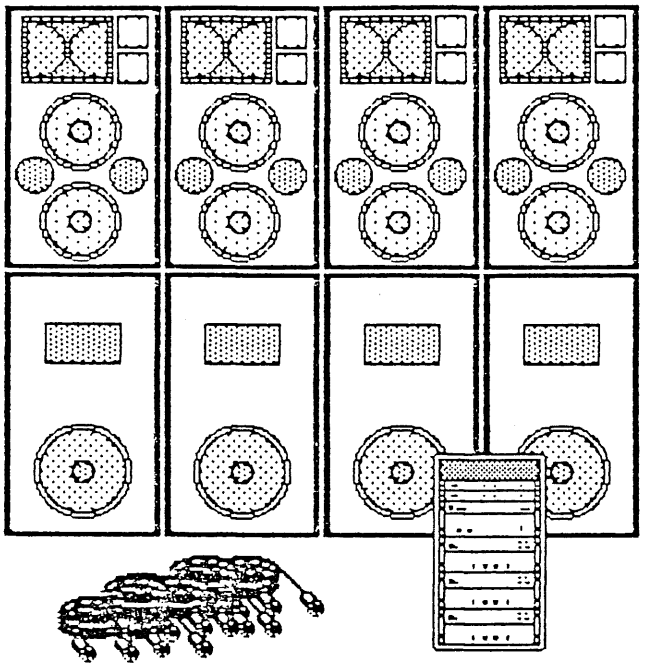
4923 System



4923 Components

[2] 4870 loudspeaker systems
[2] 4845 loudspeaker systems
[2] 50 foot EP-8 loudspeaker cables
[2] 5 foot EP-8 loudspeaker cables
[1] 9923 equipment rack, including:
[1] 6260 amplifier (HF)
[2] 6290 amplifiers (LF, YLF)
[2] 5234A dual-channel electronic crossovers with high-pass filtering, plug-in cards for 80Hz and 800Hz crossover points and power response correction.

4943 System



4943 Components

[4] 4870 loudspeaker systems
[4] 4845 loudspeaker systems
[4] 50 foot EP-8 loudspeaker cables
[4] 5 foot EP-8 loudspeaker cables
[1] 9943 equipment rack, including:
[1] 6260 amplifier (HF)
[3] 6290 amplifiers (2-LF, 1-YLF)
[2] 5234A dual-channel electronic crossovers with high-pass filtering, plug-in cards for 80Hz and 800Hz crossover points and power response correction.

Typical System Characteristics

System	Frequency Range [-10 dB]	Frequency Response [+/- 3dB]	Maximum SPL [1]	Amplifier Power [2]
4922	35 Hz to 20 kHz	45 Hz to 16 kHz	135 dB	1350 W
4923	25 Hz to 20 kHz	30 Hz to 16 kHz	135 dB	1950 W
4932	40 Hz to 20 kHz	60 Hz to 16 kHz	141 dB	1950 W
4934	35 Hz to 20 kHz	55 Hz to 16 kHz	146 dB	3900 W
4942	30 Hz to 20 kHz	40 Hz to 16 Khz	140 dB	2700 W
4943	20 Hz to 20 kHz	25 Hz to 16 kHz	140 dB	5100 W

[1] SPL at 1 meter, continuous program.
[2] Total power available into nominal system load impedances.

UREI
ELECTRONIC
PRODUCTS

Features

Concert-proven componentry and design configuration.

35 Hz to 20 kHz usable frequency range.

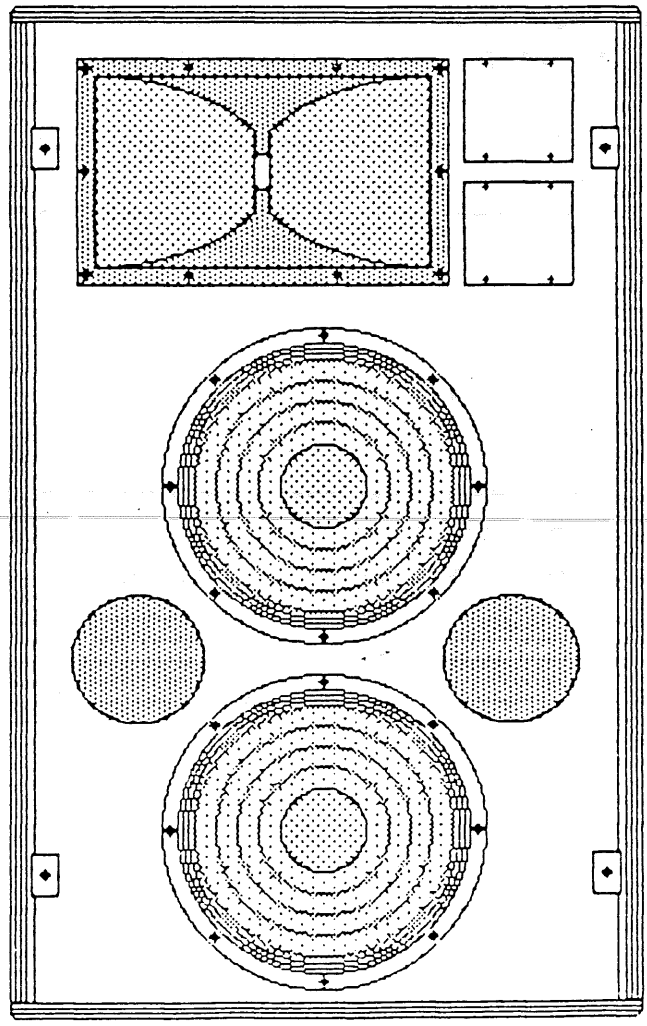
Ruggedized construction for touring sound reinforcement applications.

30 degree wedge frustum shape for coherent wide angle coverage. Matches JBL 4845.

Fiberglass-reinforced finish for durability.

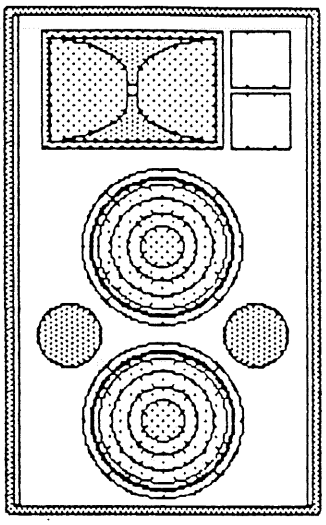
14 aircraft-type hanging points.

JBL Concert Series
4870



Description

The JBL Concert Series 4870 is a modular high-power loudspeaker system designed for a wide variety of sound reinforcement applications. It is a biamplified system consisting of dual fifteen-inch direct radiator loudspeakers and a 2-inch throat (4-inch diaphragm) compression driver mounted to a Bi-Radial™ constant coverage horn in a vented enclosure. Cabinetry is crafted from void-free birch plywood, coated with virtually indestructible fiberglass reinforced plastic, and fitted with handles and reinforced aircraft style pan fitting hanging hardware. The enclosure is tapered from front to back, forming a 30 degree wedge frustum to enable tight cluster grouping for coherent wide-angle coverage.



Low Frequencies

A ported enclosure, tuned to 40 Hz mounts two JBL 2225H loudspeakers. Large ducts allow complete freedom from vent compression over the entire dynamic operating range of the 4870. The large linear displacement, high efficiency and power capacity of the 2225 bass drivers assure low distortion and smooth, uniform power response.

High Frequencies

Frequencies above 800 Hz are reproduced by the JBL 2445J compression driver mounted on a JBL 2380 Bi-Radial™ horn. The 2445J provides usable response to the highest audible frequencies and robust power handling, due to a diaphragm of pure-grade titanium, distributed-stress compliance assembly and four-inch voice coil.

JBL's exclusive Bi-Radial™ horn assures uniform response within the nominal coverage angles to beyond 16kHz. Using one Bi-Radial™ horn/driver eliminates lobing and comb filter effects associated with multi-way HF horn systems, and minimizes the need for coverage overlapping in large installations.

Physical

The 4870 sides taper from front to back at an angle of fifteen degrees from rectangular convention. This allows several systems to be configured in tight clusters for wide angle coverage, and improves coupling at low frequencies. Fourteen system hanging points are included to facilitate cluster rigging and flying. The 4870 is identical in shape, size and rigging points to the JBL 4845 VLF loudspeaker system.

The 4870 includes mounting provision and wiring for the installation of two JBL 2404 ultra-high frequency transducers for those applications that require additional power above 10 kHz. Cover plates are standard.

The 4870 is energized through one EP-8 input connector. Two connectors are installed on each cabinet to enable loop-thru wiring for use with 4845 systems.

An accessory dolly, model 4870DL, is available to facilitate handling and cartage. The 4870DL also fits the 4845 system.

Model 4870

System Type	Modular, direct radiating LF, two-way, externally biamplified concert reinforcement loudspeaker system
Frequency Range (-10dB)	35 Hz to 20kHz
Frequency Response (±3dB)	45 Hz to 16kHz
Axial Pressure Sensitivity	LF: 100 dB/1w/1m HF: 112 dB/1w/1m
Power Capacity[1]	LF: 800 watts continuous program HF: 150 watts continuous program
Recommended Crossover	800 Hz, 12 dB per octave minimum
Coverage Angles [-6dB points, nominal]	90 degrees Horizontal 40 degrees Vertical
Nominal Efficiency	LF: 7.0% HF: 30%
Maximum SPL	132 dB [1m, continuous program]
Nominal Impedance	LF: 4 ohms HF: 16 ohms
Connectors	ITT Cannon EP-8 type, one each male and female
Dimensions	49-1/2" (126 cm) H 29-1/2" (75 cm.) W 19-3/4" (50 cm.) D
Weight	214 lbs (97 kg.)
Finish	Dark gray impregnated fiberglass-reinforced plastic, black nylon protective grill

[1] Continuous program power is defined as 3 dB greater than continuous sine wave power and is a conservative expression of the transducer's ability to handle typical speech and music program material.

Architect's and Engineer's Specifications

Model 4870

The loudspeaker system shall be of the two-way type, incorporating two 15-inch low frequency loudspeakers in a vented direct radiator enclosure, and a compression driver mounted to a 90 degree by 40 degree constant coverage high frequency horn. The system shall meet the following performance criteria: Frequency range: 35 Hz to 20kHz. Pressure sensitivity: 100 dB/1w/1m [LF], 112 dB/1w/1m [HF]. Power capacity: 400 watts continuous sine wave above 40 Hz [LF], 75 watts continuous sine wave above 800 Hz [HF]. Horizontal coverage: 90 degrees between -6 dB points. Vertical coverage 40 degrees between -6 dB points. The LF drivers shall be capable of 5mm peak linear displacement, and the cabinet shall incorporate a tuning frequency of 40 Hz, with a total duct surface area of not less than 56 square inches.

The cabinet shall be constructed of void-free birch plywood, stiffened internally and coated with fiberglass reinforced plastic. All exposed corners shall be rounded for damage resistance. Aircraft-type hanging fixture attachment points shall be installed through the cabinet to internal steel reinforcement plates. Fourteen hanging points shall be provided. Each hanging point shall have a load rating of 2000 lbs. at 90 degrees to the fitting. Cabinet width shall taper front-to-back, forming a 30 degree wedge frustum.

The modular loudspeaker system shall be the JBL Concert Series model 4870.

UREI
ELECTRONIC
PRODUCTS

Features

Concert-proven componentry and design configuration.

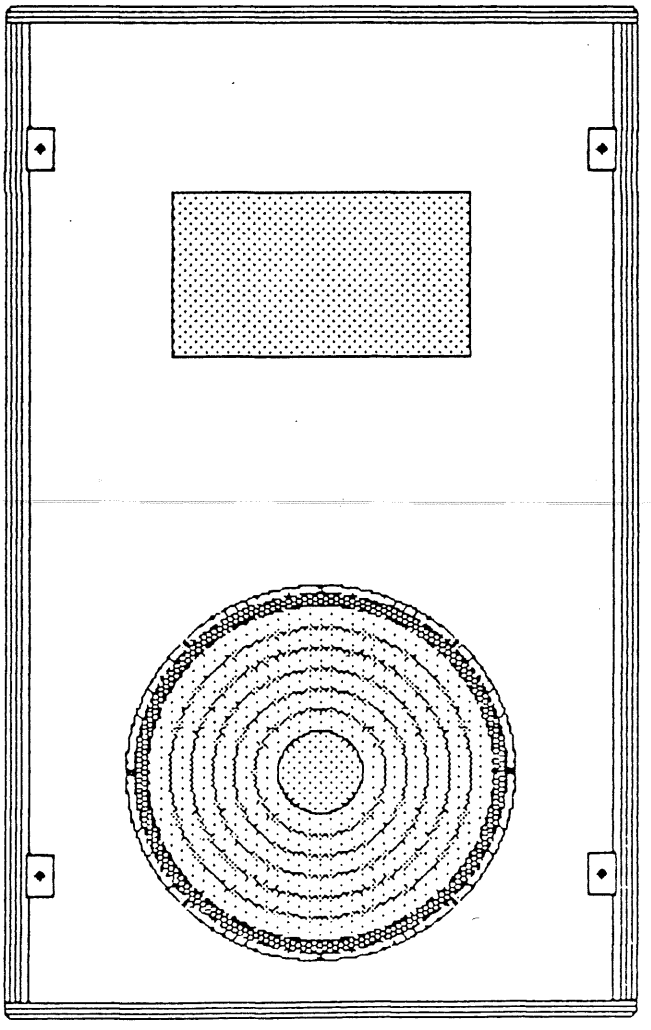
20 Hz to 800 Hz usable frequency range.

Ruggedized construction for touring sound reinforcement applications.

30 degree wedge frustum shape for mutual coupling. Matches JBL 4870.

Fiberglass-reinforced finish for durability.

JBL Concert Series 4845



Description

The JBL Concert Series 4845 is a vented direct radiator very low frequency (VLF) loudspeaker system suitable for a wide variety of sound reinforcement and playback system applications. Unlike many products intended for VLF service, the 4845 provides uniform power response to 30 Hz. Cabinets are identical in size and shape to JBL 4870 systems for stacking. Cabinetry is of void-free birch plywood, coated with virtually indestructible fiberglass reinforced plastic, and fitted with handles and reinforced aircraft style pan fitting hanging hardware. The enclosure is tapered from front to back, forming a 30 degree wedge frustum. This enables several 4845s to be grouped in a tight cluster to take full advantage of mutual coupling effects.

Performance

A ported enclosure, tuned to 27 Hz mounts a JBL 2245H loudspeaker. The alignment has been carefully executed to assure that the driver operate within its displacement limit for the entire power bandpass. Large ducting assures freedom from vent compression and turbulence at all operating power levels. Unlike many so-called subwoofers, the 4845 delivers its full rated acoustic power output and maximum SPL to 30 Hz.

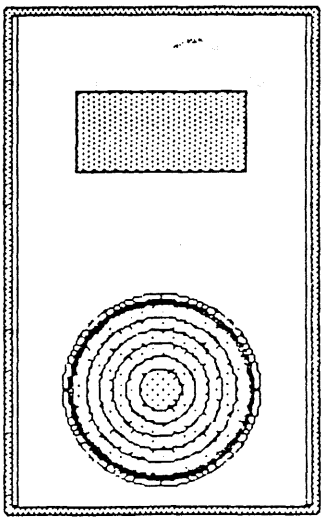
The 2245H loudspeaker features unusually large linear displacement capability, exceptional power handling, a rigid cone assembly of great strength and JBL's unique Symmetrical Field Geometry (SFG) magnetic structure. The result is an extension of low frequency power response and extremely low distortion.

Physical

The 4845 sides taper from front to back at an angle of fifteen degrees from rectangular convention, forming a 30 degree wedge frustum shape. This allows grouping of 4845s in tight clusters for improved coupling at low frequencies. Fourteen system hanging points are included to facilitate cluster rigging and flying. The 4845 is identical in shape, size and rigging points to the JBL 4870 two-way Concert Series loudspeaker system.

The 4845 is energized through one EP-8 input connector. Two connectors are installed on each cabinet to enable loop-thru wiring for connecting additional 4845s or 4870s.

An accessory dolly, model 4870DL, is available to facilitate handling and cartage. The 4870DL also fits the 4870 system.



Model 4845

System Type	Modular direct radiating low frequency loudspeaker system
Frequency Range (-10dB)	20Hz to 800Hz
Frequency Response (±3dB)	25 Hz to 250 Hz
Nominal Impedance	8 ohms
Connectors	ITT Cannon EP-8 type, one each male and female
Dimensions	49-1/2" (126 cm) H 29-1/2" (75 cm.) W 19-3/4" (50 cm.) D
Weight	176 lbs. (80 kg.)
Finish	Dark gray impregnated fiberglass-reinforced plastic, black nylon protective grill

Quantity of Units	One	Two	Four
Pressure Sensitivity [1w/1m half-space]	95dB	98dB	101dB
Nominal Efficiency [half-space reference]	2.1%	4.2%	8.4%
Power Capacity (continuous pgm)[1]	600w	1200w	2400w
Acoustic Power Output [2]	6 watts	25 watts	101 watts
Power Response [+/- 3 dB]	30Hz-250Hz	28Hz-125Hz	25Hz-80Hz
Maximum SPL at 1m (half-space ref.)[2]	120 dB	126 dB	132 dB

[1] Continuous program power is defined as 3 dB greater than continuous sine wave power and is a conservative expression of the transducer's ability to handle typical speech and music program material.
[2] Usable acoustic power output at a given frequency in direct radiating systems is a function of piston surface area and linear axial displacement. Because music is periodic, acoustic power output is conservately calculated as the product of reference efficiency and sine wave maximum input power. Peak values will be considerably higher, but subject to driver mechanical displacement limits at the lowest frequencies. Unlike products of manufacturers that rate maximum SPL on the basis of noise signals that result in ambiguous or dimensionless specifications, full acoustic power and maximum SPL are available at all frequencies within the stated power response envelope.

Architect's and Engineer's Specifications

Model 4845
The low frequency loudspeaker system shall be of the vented direct radiator type, and shall meet the following unit performance criteria: Acoustic power output: 6.3 watts above 30 Hz. Power response; plus/minus 3 dB, 30 Hz to 250 Hz. Power Capacity: 300 watts sine wave above 30 Hz. The loudspeaker system shall incorporate a driver with a peak linear displacement of 9.5mm, and a cabinet tuning frequency of 27 Hz with a total duct surface area of not less than 110 square inches.

The cabinet shall be constructed of void-free birch plywood, stiffened internally and coated with fiberglass reinforced plastic. All exposed corners shall be rounded for damage resistance. Aircraft-type hanging fixture attachment points shall be installed through the cabinet to internal steel reinforcement plates. Fourteen hanging points shall be provided. Each hanging point shall have a load rating of 2000 lbs. at 90 degrees to the fitting. Cabinet width shall taper front-to-back, forming a 30 degree wedge frustum.

The modular VLF loudspeaker system shall be the JBL Concert Series model 4845.

UREI
ELECTRONIC
PRODUCTS

Features

Fully horn-loaded for maximum efficiency.

Concert-proven JBL componentry and design configuration.

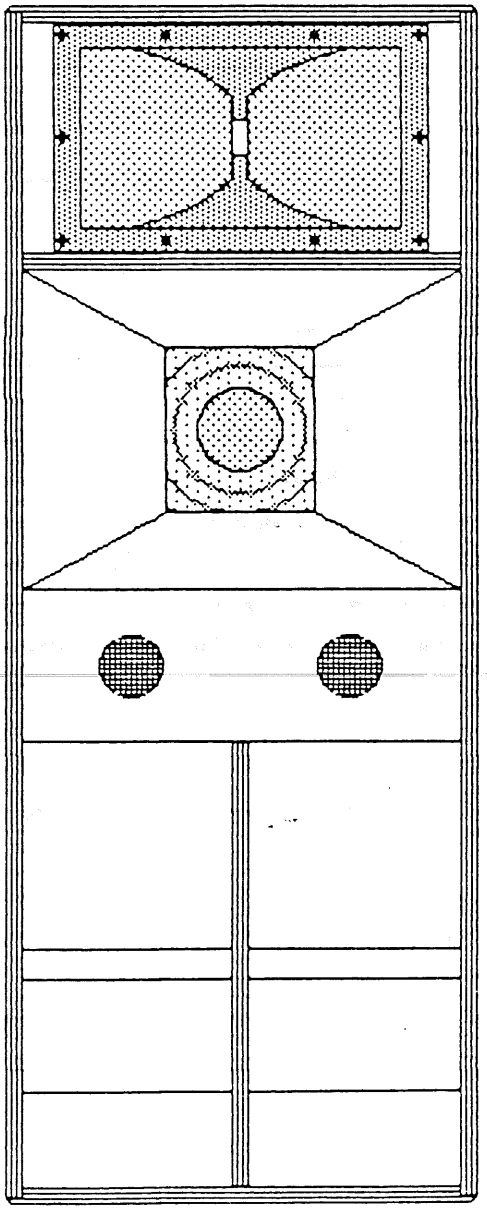
Constant coverage and uniform power response.

40 Hz to 20 kHz usable frequency range.

Ruggedized construction for touring sound reinforcement applications.

Equipped with castors and hanging hardware.

JBL Concert Series 4830

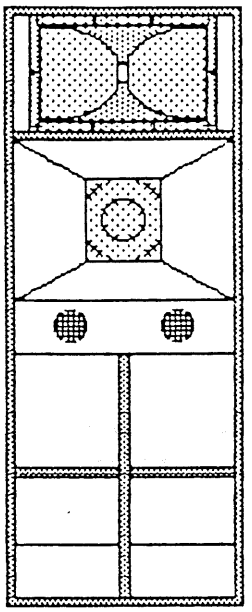


Description

The JBL Concert Series 4830 is an all-horn loudspeaker system of high performance and compact proportions. Designed for external triamplification, the 4830 features proven components in a system configured to deliver constant directivity and uniform power response for high-level sound reinforcement applications. Due to the exceptionally high component efficiency, fewer 4830s will be required for a given task than other loudspeaker systems. Systems are crafted from void-free hardwood plywood, and equipped with castors for ease of handling. Six hanging fittings are provided, consisting of flush mounted aircraft cargo control hardware bolted through the cabinet to aluminium reinforcement plates. System components are energized through one EP-8 input connector.

Low Frequencies

A folded front-loading horn driven by a JBL 2240 provides highly efficient and uniform output from below 60 Hz to 250 Hz. Porting further extends useful low frequency output to 40 Hz.



Mid Frequencies

The mid-frequency throat provides moderate loading, while forming an aperature small enough to avoid beaming at upper frequencies. Horn sidewall geometry results in constant directivity-frequency characteristics. Unlike mid-frequency horns that employ coaxially mounted loading devices that create interference at upper frequencies, the 4830 mid-horn provides uniform coverage and smooth on and off axis response over its entire operating frequency range.

The mid-frequency driver incorporates a rigid, low mass cone assembly and magnetic structure of unusually high strength using JBL's unique Symmetrical Field Geometry (SFG) design. These factors enable uniform power response to the recommended crossover frequency, and greatly reduced second harmonic distortion.

High Frequencies

Transitioning at 1200 Hz., high frequencies are reproduced by the 2445 compression driver and 2385 Bi-Radial™ horn. With a diaphragm of pure-grade titanium, unique distributed-stress compliance assembly and four-inch voice coil, the 2445 delivers response to the highest audible frequencies with reliability and efficiency that is without equal.

JBL's exclusive Bi-Radial™ horn assures uniform response within the nominal coverage angles to beyond 16kHz. The use of a single Bi-Radial™ horn/driver above 1200 Hz minimizes the need for coverage overlapping, and eliminates the lobing and comb filter effects associated with multiple horn systems.

Model 4830

System Type	Fully horn loaded three-way externally triamplified modular concert reinforcement loudspeaker system
Frequency Range (-10 dB)	40 Hz to 20kHz
Frequency Response (±3dB)	60 Hz to 16kHz
Axial Pressure Sensitivity	LF: 103 dB SPL/1w/1m MF: 106 dB SPL/1w/1m HF: 114 dB SPL/1w/1m
Power Capacity [1]	LF: 600 watts continuous program MF: 300 watts continuous program above 250 Hz HF: 150 watts continuous program above 1200 Hz
Recommended Crossovers	250 Hz LF-MF (12 dB/octave minimum) 1200 Hz MF-HF (12 dB/octave minimum)
Coverage Angles	60 degrees between -6 dB points, horizontal 40 degrees between -6 dB points, vertical
Nominal Efficiency	LF: 15% MF: 20% HF: 30%
Maximum SPL	138 dB SPL [1m, continuous program]
Nominal Impedance	LF: 4 ohms MF: 8 ohms HF: 16 ohms
Connectors	ITT Cannon EP-8 type, one each male and female
Dimensions	58" (147 cm.) H. 22-1/2" (57 cm.) W. 30-3/4" (78 cm.) D.
Weight	290 lbs. (132 kg.)
Finish	Dark gray impregnated fiberglass-reinforced plastic, black nylon protective grill

[1] Continuous program power is defined as 3 dB greater than continuous sine wave power and is a conservative expression of the transducer's ability to handle typical speech and music program material.

Architect's and Engineer's Specifications

4830

The loudspeaker system shall be of the three-way type, with all component drivers horn loaded. The mid frequency and high frequency driver loudspeakers shall be loaded into constant-coverage type horns, providing 60 degree horizontal and 40 degree vertical coverage. The loudspeaker system shall meet the following criteria: Frequency range: 40 Hz to 20kHz. Pressure sensitivity: 103 dB/1w/1m [LF]; 106 dB/1w/1m [MF]; 114 dB/1w/1m [HF]. Power capacity: 300 watts continuous sine wave above 40Hz [LF]; 150 watts continuous sine wave above 250Hz [MF]; 75 watts continuous sine wave above 1200Hz [HF]. Horizontal coverage: 60 degrees between -6dB points. Vertical coverage: 40 degrees between -6dB points.

The cabinet shall be constructed of void-free, hardwood plywood. All exposed corners shall be rounded for damage resistance. Six aircraft-type hanging fixture attachment points shall be installed flush with the outside cabinet surface, two per side and two on rear. Each hanging point shall be installed through the cabinet to aluminium reinforcement plates, and have a load rating of 2500 lbs. at 90 degrees to the fitting.

The loudspeaker system shall be the JBL Concert Series model 4830.

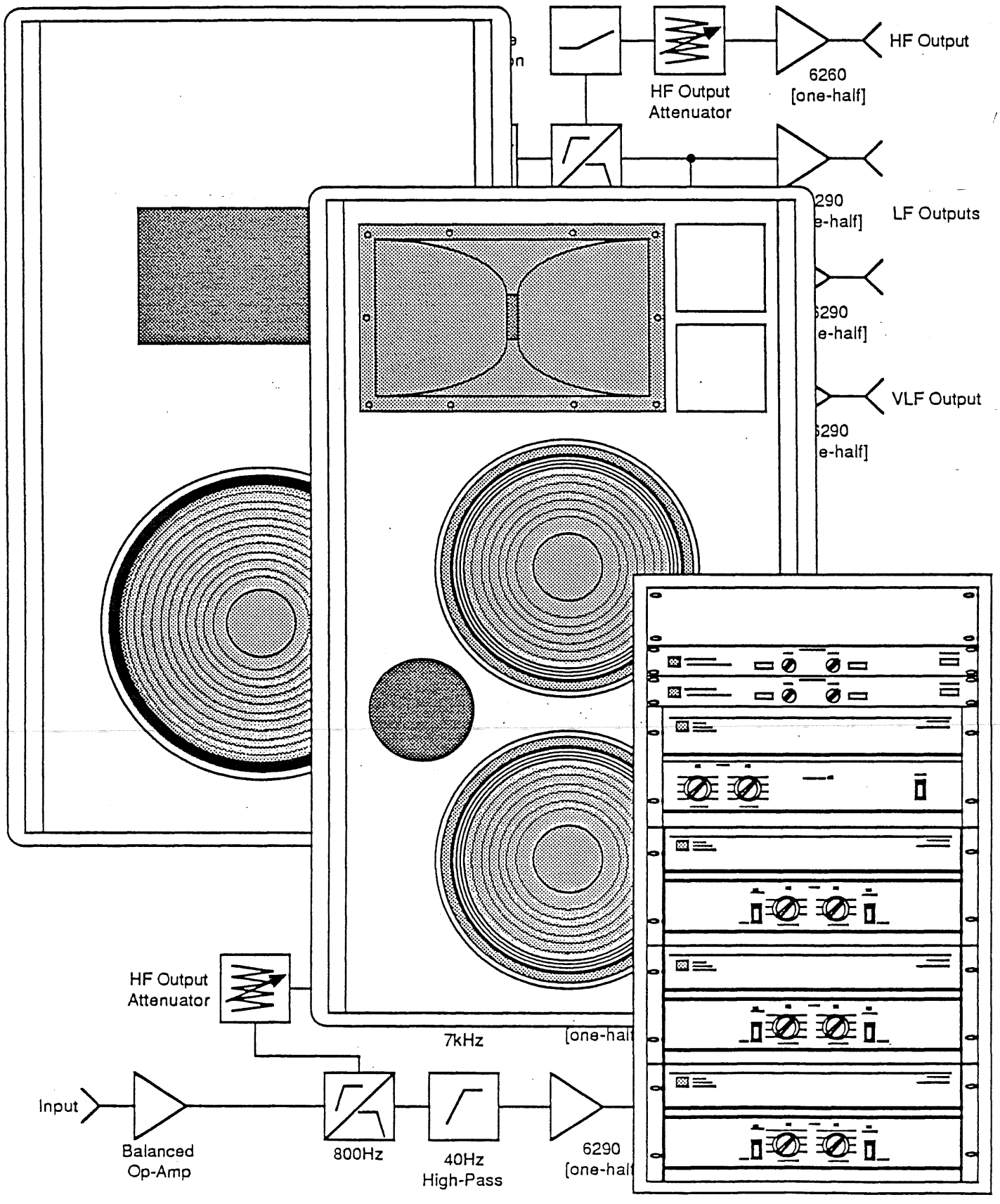

HF Output
6260
[one-half]
HF Output
Attenuator
290
e-half]
LF Outputs
290
e-half]
VLF Output
290
e-half]
HF Output
Attenuator
7kHz
[one-hal
Input
Balanced
Op-Amp
800Hz
40Hz
High-Pass
6290
[one-hal

TABLE OF CONTENTS

TABLES AND ILLUSTRATIONS

Concert Series Installation and Operating Instructions

(Continued...)

INTRODUCTION

JBL Concert Series products are designed to meet critical and demanding touring sound reinforcement and playback applications. Housed in rugged and road-worthy fiberglass-reinforced cabinetry, they will provide years of trouble-free, high-quality portable service.

The engineering design approach marries high-quality JBL/UREI electronic products with concert-proven JBL loudspeaker components for improved sound system performance, while assuring long-term reliability in touring service. Taking advantage of the 5234A's flexibility and programmability, we have designed bandpass filters and fixed equalization that result in optimum performance from Concert Series loudspeaker components. Reliable system operation is assured through thoughtful loudspeaker power apportionment, and conservative component operation throughout.

This manual provides information to install and operate Concert Series products for best performance in a wide variety of applications, both portable and fixed. Specific and detailed information on component products may be found in individual component owner's manuals.

CONCERT SERIES COMPONENT	COMPLETE SYSTEMS			
	4922	4923	4942	4943
4845 VLF Loudspeaker	-	[2]	-	[4]
4870 Loudspeaker System	[2]	[2]	[4]	[4]
4870DL Dolly Accessory	optional	optional	optional	optional
9805 Cable Assembly	-	[2]	[2]	[4]
9850 Cable Assembly	[2]	[2]	[2]	[4]
9916RC Rack Case	optional	optional	optional	-
9920RC Rack Case	-	-	-	optional
9922 Electronics Rack	[1]	-	-	-
9923 Electronics Rack	-	[1]	-	-
9942 Electronics Rack	-	-	[1]	-
9943 Electronics Rack	-	-	-	[1]

Figure 1—Concert Series Systems and Components

INSTALLATION

Electronics

Input Connections

Input connections to 9900 series rack equipment are via balanced XLR receptacles. A parallel loop-through connector is provided for each input to enable convenient system expansion. Each input has a polarity reversal switch and a ground lift switch to adapt to a variety of drive conditions.

NOTE: The input polarity and ground lift switches are after the loop-through connector wiring and only affect the input polarity and shield connection internal to the rack.

Balanced Source Connections

Most professional mixers incorporate balanced or symmetrical outputs, which may be connected directly to 9900 racks. When source equipment is some distance from the amplifier racks, and both are properly grounded to the AC ground, the potential exists for a system ground loop. Often, several volts can be developed between different AC grounds served by a common panel. Under these circumstances, hum, RFI and other parasitics can result when more than one path to ground is present. Good installation practice dictates that shields be connected at *one end only,* preferably at the load. Where this isn't practical, the ground lift switches may be used to isolate the source ground (shield) from the rack assembly.

Unbalanced Source Connections

The use of unbalanced sources for long cable runs is to be discouraged. Where unbalanced sources must be used, the potential for ground loops can be minimized by treating the source as a pseudo-balanced supply. This requires isolating the source chassis from the load chassis (except where they are connected through their respective AC grounds), and the use of two conductor shielded cable. The cable shield should be connected at the load end only, and *must not be used as a signal conductor.*

Because the 9900 inputs are symmetrical (floating), no ground connection will be made between source and load. Note that this may require the fabrication of

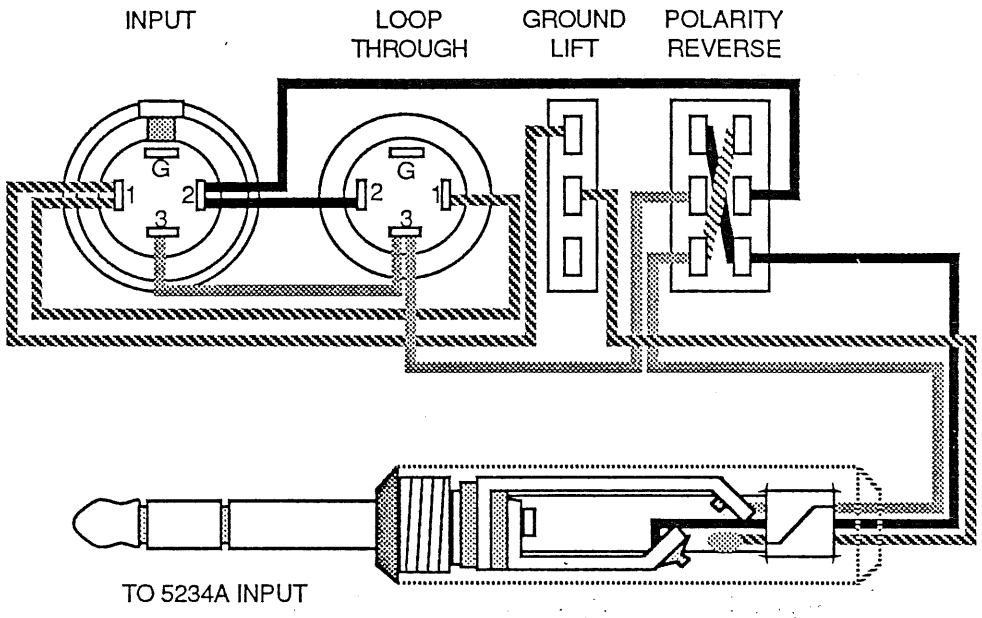


Figure 2—Input Wiring (typical)

special cables, and standard (unbalanced) pre-wired cable adapters must not be used. If these measures prove unsuccessful, the output of the source device may be isolated and balanced with an external transformer, following the transformer manufacturer's instructions. Under no circumstances should an AC "cheater" adapter be used, as this removes the path to ground for fault currents which could occur within the instrument, resulting in a shock hazard.

Output Connections

All outputs are wired to 8-pin Cannon EP-8 receptacles. Each rack assembly provides for two output channels and either two outputs (models 9922, 9923), or four outputs (models 9942, 9943). A single 8-conductor cable assembly connects one 4870 to each output. Where 4845s are used (4923 and 4943 systems), connections to 4845s are made via the loop-through connectors in the 4870s. All 8-pin

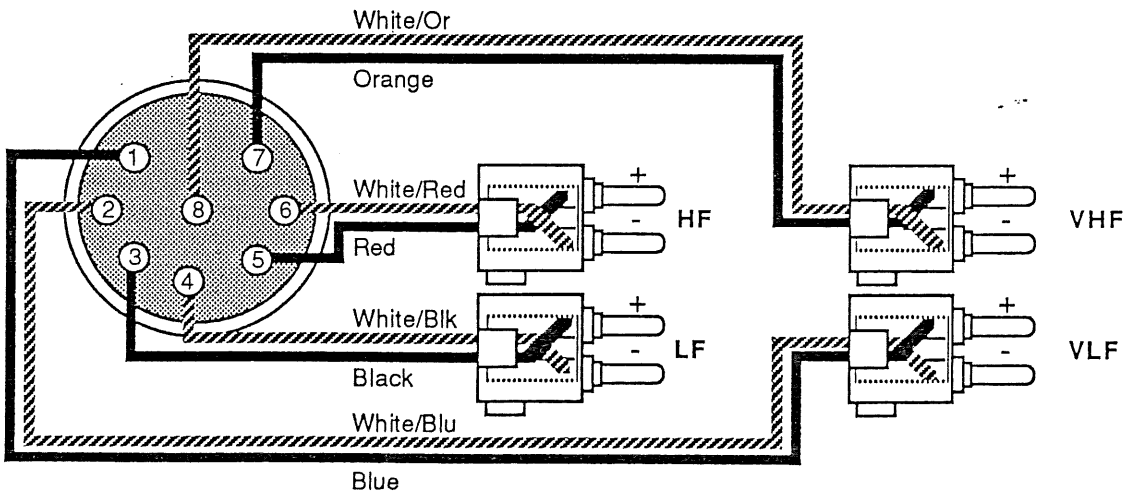


Figure 3—Output Connector Wiring

receptacles are pre-wired for four-way system operation for convenience of future expansion, with the unused cables tied off within the rack.

Figure 3 shows a typical output connector, as viewed from inside the input/output connector panel. Note that the "+" and "-" designations refer to the amplifier terminals, and not necessarily the loudspeaker terminals. For connection to other than JBL Concert Series loudspeaker systems, refer to the loudspeaker manufacturer's terminal designation data.

Connection of 4870 systems is limited to one unit per output receptacle. This presents a 4 ohm load to the LF amplifier, which is the minimum impedance that can be safely driven.

NOTE: In the 9943 rack assembly, output receptacles [1 and 3] and [2 and 4] are parallel-connected within the rack for VLF loudspeakers. The 9943 system is limited to [4] model 4845 loudspeakers, two per output channel of the VLF amplifier. Because parallel connection is also possible at the loudspeaker, 4943 system owners are encouraged to adopt the convention of looping to only one 4845 per 4870 loudspeaker. This will prevent the inadvertent connection of four 4845s to one VLF amplifier output.

Absolute Polarity

All Concert Series rack assemblies and loudspeaker systems are wired so that a positive-going signal applied to pin 3 of the input receptacle(s) will result in a corresponding forward diaphragm movement at the loudspeaker(s) when the input polarity switch is in the normal position.

Loudspeakers

General

The consistent successful deployment of Concert Series systems requires that owners and installers familiarize themselves with the performance capabilities of individual loudspeaker systems, and gain a working insight into the performance gains and losses associated with multiple loudspeaker systems. Readers are encouraged to review the performance specifications of Models 4845 and 4870.

Ideally, we would be able to place as many loudspeaker systems into the same physical location as needed to deliver the required acoustic power. Since two objects cannot occupy the same space at the same point in time, we have no choice except placing our loudspeaker systems in different locations. While a detailed engineering analysis is beyond the scope and purpose of this manual, the following guidelines have been developed to assist owners and installers to gain maximum performance from Concert Series products:

Group Loudspeakers Together

Where wavelengths are long compared to the size of the array (i.e. at low frequencies), separate sources behave as though they were one large source, and the outputs of individual drivers sum coherently. Conversely, when wavelengths are short compared to the array size, interference will take place. The interference takes on a comb filter characteristic, alternating between reinforcement and cancellation as frequency increases. The larger the array is, the lower the frequency of interference onset will be. Place loudspeaker systems as close together as possible consistent with achieving the desired coverage.

Use Fewer Loudspeakers

Using more systems than is necessary for the application will lower the frequency of interference onset by virtue of (the larger) array size, and decrease sound system intelligibility for most of the audience. Use only the quantity of 4870 loudspeakers needed to achieve the desired coverage and SPL.

Take Advantage of the Cabinet Shape

The 4845 and 4870 cabinet "footprint" describes a 30 degree wedge frustum. This enables moderate horizontal splay angles, while placing loudspeaker components close together. This increases the frequency of interference onset and, therefore, reduces overall interference.

Split Clusters

Split loudspeaker clusters are a fact of life in entertainment systems. They broaden the sound field for an audience, and lend a quality of warmth to performers on stage. They are separate sources, however, and they will interfere with one another, lending a slightly "muddy" quality to a performance by decreasing the ratio of direct-to-reverberant sound energy for most of the audience. We recommend that the distance between split clusters be held to a minimum, consistent with stage width and system gain-before-feedback considerations.

Group VLF Systems

Whenever possible, it is advantageous to group the VLF systems into a single VLF array (4923 and 4943 systems). This will result in increased VLF output over the entire VLF range, as the array will remain small relative to wavelengths within the bandpass.

Hanging Systems

Concert Series loudspeaker systems come equipped with aircraft-style pan fittings to facilitate rigging and hanging. Each fitting carries a manufacturer's load rating of 2000-5000 lbs. (depending upon pull angle), and terminates in a round head stud. Load-rated mating hardware is available in a variety of ring and stud fitting configurations from:

Stanal Sound, Ltd.
7351 Fulton Avenue
North Hollywood, CA 91605
(818) 764-5200

The design of hanging systems for loudspeaker clusters is beyond the scope of this manual. Remember, that anything that is mounted overhead carries certain (and significant) liabilities to owners, installers and operators. **JBL assumes no responsibility for damages, either direct or consequential, that may result from accidents associated with the design, installation and operation of hanging loudspeaker systems.** Where hanging systems are to be fabricated, the following guidelines should be used:

1] Obtain the services of a licensed structural engineer for the design of all hanging systems, grids, and the location of appropriate hard points in the facility in which you plan to hang loudspeakers.

2] Use professional riggers for all hanging assignments. This work is dangerous and demands the services of an experienced professional.

3] Always insist upon backups to the primary rigging hardware in the event of mechanical or structural failures.

4] Always use premium-grade hardware and equipment, appropriately rated for the loads being carried. Your structural engineer will be able to advise you as to details.

5] Make certain that you have liability insurance that covers this kind of work, and that premiums are kept up to date.

For more information on hanging loudspeaker systems, contact your JBL Concert Series dealer, or:

Stanal Sound, Ltd.
7351 Fulton Avenue
North Hollywood, CA 91605
(818) 764-5200

Typical System Configurations

In the following examples, loudspeaker system array techniques are shown, along with performance characteristics for each example. Although the configurations shown do not exhaust all available possibilities, they are indicative of typical applications.

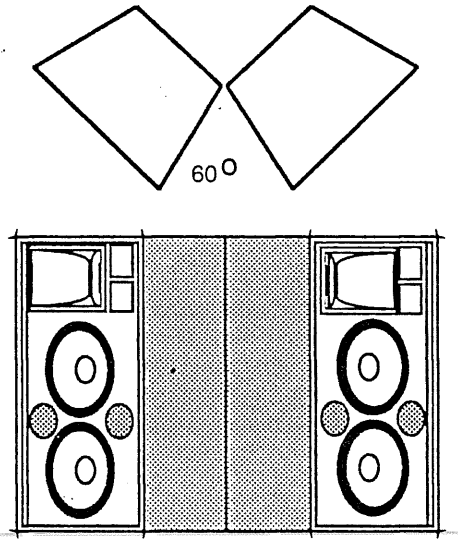


Figure 4—Two Loudspeaker Wide-Coverage

Frequency Range:	35 Hz to 20 kHz
HF Distribution	
Horizontal:	170 Degrees
Vertical:	40 Degrees
Continuous Pgm. SPL:	132 dB @ 1m.
Total Amplifier Power:	1350 watts

In this example, the 4870 systems are splayed 90 degrees between each loudspeaker's principal axis. This requires a 60 degree angle between adjacent cabinet sides. Performance characteristics will be essentially those of individual 4870 systems, with minor response aberrations in the forward quadrant.

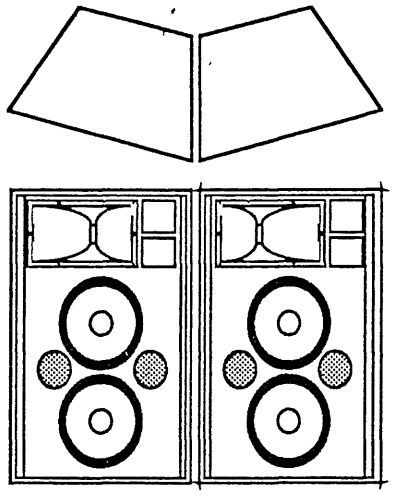


Figure 5—Two Loudspeaker Medium Coverage

Frequency Range:	35 Hz to 20 kHz
HF Distribution	
Horizontal:	120 Degrees
Vertical:	40 Degrees
Continuous Pgm. SPL	135 dB @ 1m.
Total Amplifier Power:	1350 watts

In figure 5 the two loudspeaker systems are placed side-by-side, such that there is a 30 degree angle between each 4870's principal axis. This results in nominal 120 degree horizontal coverage, but with a 3dB to 4dB lobe in the frontal quadrant—useful in many applications.

The system configuration shown in figure 6 employs all of the 4943 components in a single array. Because the array is quite large, there will be some middle and upper frequency "fingering" of horizontal coverage. However, this will be less than would result if the enclosures were to be separated. Vertical coverage remains that of single units. Low frequency coupling will be excellent.

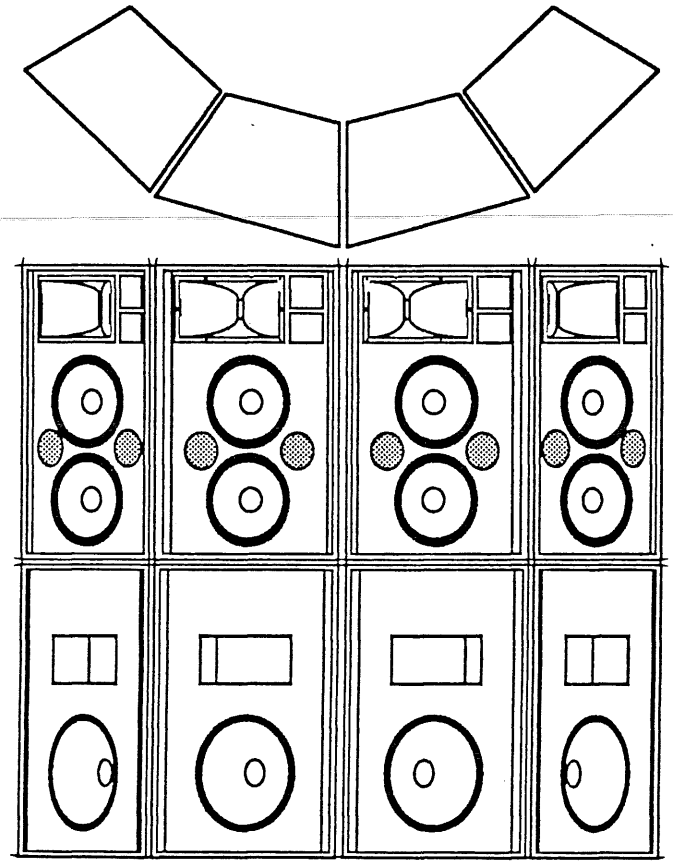


Figure 7 Illustrates one technique for increasing vertical coverage. The vertical angle between cabinets can vary between 20 and 40 degrees to achieve the desired coverage. Some on-axis lobing is to be expected, along with "fingering" of coverage along the vertical axis. Horizontal coverage will remain that of single units.

Figure 6—Four Loudspeaker Wide-Coverage With VLF

Frequency Range:	20 Hz to 20 kHz
HF Distribution	
Horizontal:	170 Degrees
Vertical:	40 Degrees
Continuous Program SPL:	140 dB @ 1m.
Total Amplifier Power:	5100 watts

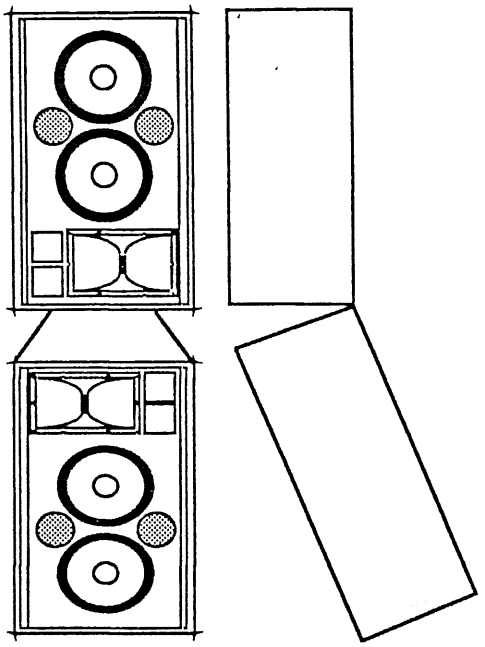


Figure 7—Two Loudspeaker Wide Vertical Coverage Array

Frequency Range	**35 Hz to 20 kHz**
HF Distribution	
Horizontal:	**90 Degrees**
Vertical:	**60-80 Degrees**
Continuous Pgm. SPL:	**135 dB @ 1m.**
Total Amplifier Power:	**1350 watts**

SETUP AND OPERATION

AC Power Connections

Systems prepared for North America operate on 120V (nominal) AC mains, and are equipped with three-conductor supply cords and plugs.

NOTE: All 9900 series rack assemblies are wired for balanced input connections. Removing the ground pins will serve little purpose in preventing ground loops, and could present a shock hazard under certain conditions of operation. The grounding pins afford added mechanical integrity to receptacle connections, and should be retained for that purpose, as well as for safety reasons.

The supply of AC mains power distribution to 9900 series racks is the responsibility of the owner/installer. Figure 8 lists AC requirements for domestic and international (220/240V) versions of 9900 series rack systems. Installers should check local regulations for circuit and conductor current limitations, and design the AC service accordingly.

System	Power Consumption (watts) Idle	Rated Output	-10 dB Power	Current (amps) 120V	220V/ 240V
9922	175 w	2600 w	875 w	22	11
9923	300 w	4000 w	1350 w	33	17
9942	300 w	4600 w	1500 w	38	19
9943	425 w	6600 w	2000 w	55	23

Figure 8—Table of Power and Service Requirements

Three tabulations of power consumption have been listed to aid in system planning. Power consumption at idle is provided for users that don't plan on switching the system off. (Many contend that leaving the system powered up at all times greatly extends the service life of electronic components.) Consumption at rated output is calculated on the basis of rated load impedance, reflecting a worst-case (although somewhat unrealistic) usage situation. Power at -10dB reflects a realistic demand for actual operation, and is useful for planning electric power and building heat loads. Current has been calculated for 120V and 220/240V operation, and indicates wiring and service requirements.

AC Connections for Portable Applications

Connecting to an unknown power source is a potential hazard to equipment and operator, and can result in total system failure (and loss of show). To prevent such a disaster, system operators are urged to obtain an electrician's circuit tester, and to verify that each and every AC receptacle to be used is of the proper voltage and correctly wired with respect to neutrals and safety grounds.

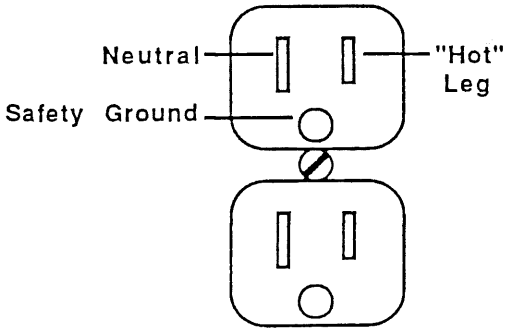


Figure 9—North American AC Receptacle Wiring

Figure 9 shows a standard duplex receptacle common to North America. The large pin on the left is the "neutral" connection, which is wired to the neutral bus at the power panel, which is grounded by means of an earth ground located nearby. The power transformer secondary center tap is also carried to earth *at the power pole.* The "safety ground" is normally strapped to the receptacle frame and physically connected to the neutral (hence ground) via mechanical conduit connections. In installations that do not use metal conduit, a separate ground wire is returned to the neutral bus in each "leg" that is fed from the power panel. The "hot" leg is wired to the power transformer secondary through circuit breakers. In the U.S.A., the white wire is "neutral", the green wire is "safety ground", and black is "hot" (although any other color except white and green may be encountered as "hot").

In earlier receptacles the vertical pins are similar in size, however, the neutral should always be on the left. Checks for AC power should include:

1] Verification that the neutral pin is the left-hand pin (receptacle oriented as above).

2] Verification that all neutrals in the system are at the same voltage potential.

3] Confirmation that the voltage between "hot" and "neutral" is 120V (nominal).

4] Confirmation that no voltage potential exists between "neutral" and "safety ground".

5] Verification that the wiring and service breakers are of a current rating sufficient to power the system (see load table).

Powering the System Up

After verification of AC supply integrity, and before energizing AC power to rack-mounted equipment:

1] Verify that all source equipment is powered up. Many mixing consoles and signal processing devices have severe turn-on and turn-off transients, which could prove hazardous to loudspeaker components if switched on or off while the power amplifiers are energized. This also holds true for microphone and pickup power supplies, should a fader channel be open.

2] Rotate all power amplifier level controls fully closed. This is further loudspeaker protection should a high-level source signal be present at the system inputs. If the mixing console is manned, be sure that the operator is aware that amplifiers are being powered up. (The operator could be adjusting compressor thresholds with 0VU of 1kHz at the console outputs.)

3] With the power amplifier level controls fully closed, switch the AC power on. For large systems, we recommend that the amplifiers be switched on individually, as the instantaneous surge required to charge the filter capacitors of many large amplifiers could result in a substantial AC over-voltage of short duration.

4] Slowly raise the amplifier level controls to their pre-set positions. Should a signal be present at the input, this procedure will enable its detection before damage occurs.

Powering the system down is simply a matter of switching the power amplifiers off first.

Level Setting Procedure

The adjustment of loudspeaker drive levels is easily accomplished with a spectrum analyzer and measuring microphone. Once levels have been set, little or no further adjustments will be required.

NOTE: There are several places within a sound system where levels can be set. The following procedure operates power amplifiers with the level controls fully open. This greatly reduces the possibility of inadvertent mis-alignment, and enables rapid confirmation of level settings. In the remote possibility of a power amplifier failure, a similar amplifier may be quickly substituted, and the system returned to its correctly balanced operation, even in the dark.

The 5234A crossovers used in the Concert Series have been fitted with HF power response correction, enabling substantially flat power response from 4870 systems, but it is seldom possible to measure this on site. Atmospheric absorption of short wavelength energy at typical measurement distances can attenuate the 10 kHz region 10-12 dB below levels at 1 kHz (a perfectly natural phenomenon, that generally should not be compensated for), and the directivity-frequency properties of microphones can lead to significant high frequency measurement errors. If in doubt, listen to the system using familiar program material.

NOTE: Often engineers adjust the LF and HF level controls in combination with adjustment of house EQ devices. This practice leads to inconsistent and poor system performance, and is to be discouraged. All level settings should be performed with house and program equalizers bypassed.

For permanently installed systems, it is advisable to install security covers to safeguard the amplifier level control settings. The model 6200SC security cover kit is available from JBL dealers for this purpose. Refer to the 6260 or 6290 Owner's Manual for installation

instructions.

Models 4922 and 4942
After preliminary checks for signal continuity, freedom from hum or parasitics, and with the system powered up, rotate the Channel 1 and Channel 2 high frequency level controls of the 5234A electronic crossover system fully closed (counter-clockwise).

Rotate all power amplifier level controls fully clockwise (open). Using pink noise as a program source, adjust the system level at the mixer for a comfortable level from the Channel 1 LF loudspeakers. Observe the microphone output on the analyzer. Adjust the Channel 1 HF output level (Channel 1 of the 5234A) until the level of the 1 kHz to 2 kHz octave closely matches that of the 200 Hz to 400 Hz octave. Alternately, the levels can be balanced using familiar program material.

Repeat this procedure for Channel 2.

Figures 10-13 show component mounting locations and output assignments. The number associated with each output assignment refers to the 8-pin output receptacle on the input/output panel, which is mounted to the rear rack rails of each respective cabinet.

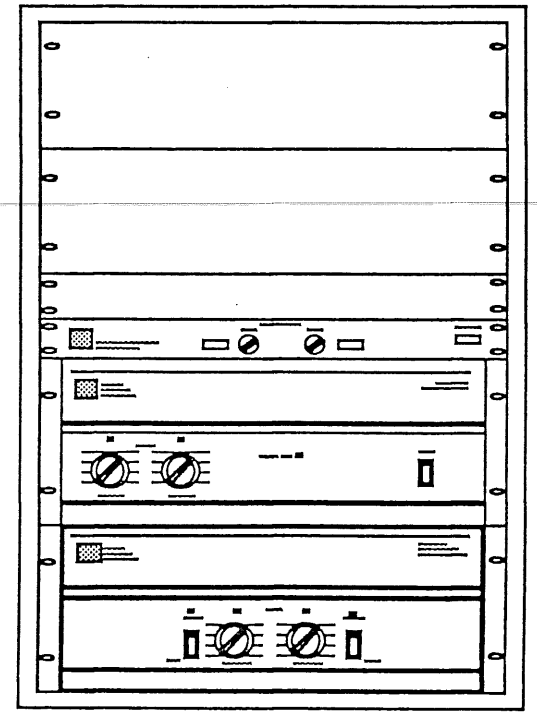


Figure 10—9922 Equipment Rack

9922 Output Assignments
6260
Channel 1—HF Output 1
Channel 2—HF Output 2
6290
Channel 1—LF Output 1
Channel 2—LF Output 2

The 9922 equipment rack is shown in Figure 10, along with output assignments and component designations. The 5234A is operated as a two-channel crossover system, with Channel 1 driving power amplifiers that service output connector #1, and Channel 2 driving power amplifiers connected to output connector #2.

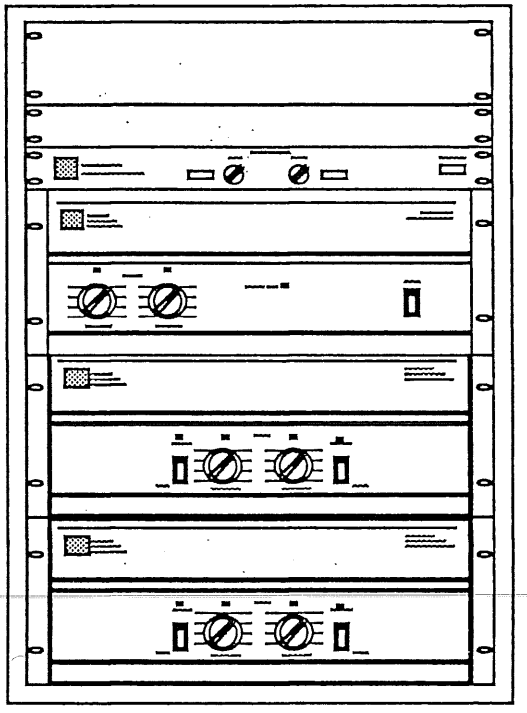


Figure 11—9942 Equipment Rack

9942 Output Assignments
6260 (Top)
Channel 1—HF Outputs 1 & 3
Channel 2—HF Outputs 2 & 4
6290 (Middle)
Channel 1—LF Output 3
Channel 2—LF Output 4
6290 (Bottom)
Channel 1—LF Output 1
Channel 2—LF Output 2

Figure 11 shows the 9942 equipment rack, along with component designations and output assignments. Note that there is one LF output assignment per 6290 output channel (the 4870 is a 4 ohm LF load), and two HF output assignments per 6260 output channel (16 ohms per 4870 HF). The 5234A is operated as a dual-channel crossover, with Channel 1 driving power amplifiers serving odd-numbered outputs, and Channel 2 driving power amplifiers that serve even-numbered outputs.

Models 4923 and 4943

The 4923 and 4943 are triamplified systems, employing two 5234A signal-processing electronic crossovers. The uppermost 5234A in the rack handles Channel 1 signal processing and the lower 5234A, Channel 2. Each 5234A provides controls for LF and HF levels. The LF level control is on the left, the HF control is on the right.

The recommended set-up procedure for three-way systems is similar to that previously described for the 4922 and 4942, except level setting begins with the VLF loudspeakers. A good-quality calibrated omnidirectional condenser microphone will be required if an analyzer is to be used, as most dynamic microphones roll off in response above the VLF range.

Rotate all 5234A controls fully counter-clockwise (closed). Raise all power amplifier level controls to their full open (clockwise rotation) positions. Using pink noise as a program source, adjust the level at the console for a comfortable output level from the Channel 1 VLF loudspeakers.

WARNING: Human tolerance for high levels in the VLF region can easily result in over-driving of the VLF loudspeakers, especially on band-limited pink noise. Raise the drive level slowly, and be on the alert for "popping" sounds, which are indicative of loudspeaker "bottoming" or clipping of the signal.

With a reference level established on the analyzer, adjust the Channel 1 LF level (upper 5234A, left-hand control) so that the region of 80 Hz to 400 Hz closely matches the level of the 40 Hz to 80 Hz octave. The HF level (upper 5234A, right-hand control) may then be adjusted in accordance with the procedure outlined for 4922 and 4942 systems.

NOTE: In 4923 and 4943 systems, the 5234As are operated in the triamplified mode, in which raising or lowering the LF level control also affects the level of the HF signal. Thus, if more or less VLF output is desired, it is simply a matter of adjusting the LF level control to achieve the desired result. The HF signal level will track the LF level setting directly.

Repeat the above procedure for Channel 2 adjustments using the lower 5234A.

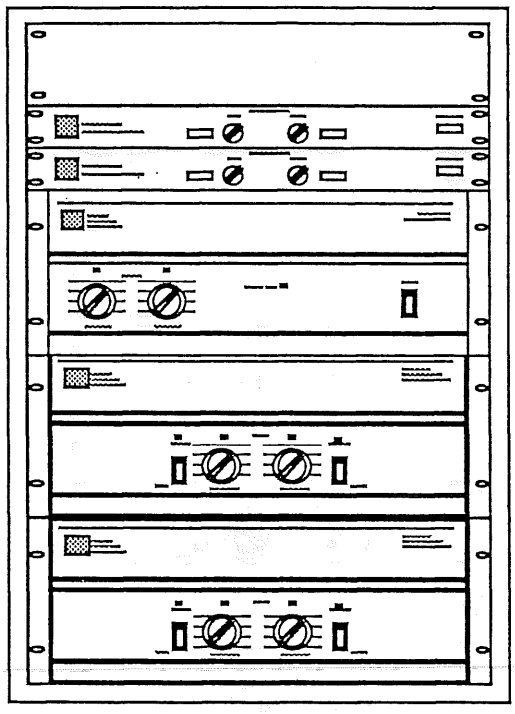


Figure 12—9923 Equipment Rack

9923 Output Assignments
6260 (Top)
Channel 1—HF Output 1
Channel 2—HF Output 2
6290 (Middle)
Channel 1—LF Output 1
Channel 2—LF Output 2
6290 (Bottom)
Channel 1—VLF Output 1
Channel 2—VLF Output 2

In the 9923 system, two 5234A crossover systems are provided for three-way operation. The upper 5234A drives the Channel 1 inputs of each of three power amplifiers terminated by output connector #1, and the lower 5234A drives the Channel 2 inputs of power amplifiers terminated by output connector #2.

The 9943 is a two-channel three-way rack system, with component designations and output assignments as shown in Figure 13. The 5234As are operated as three-way crossover systems, with the upper 5234A driving power amplifiers assigned to odd-numbered output connectors. The lower 5234A drives amplifiers serving even-numbered output connectors.

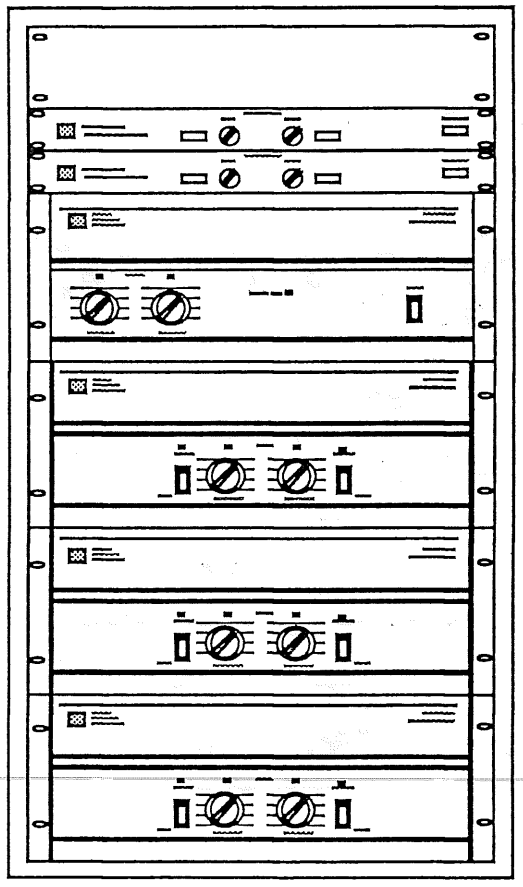


Figure 13—9943 Equipment Rack

9943 Output Assignments

6260 (Top)
Channel 1—HF Outputs 1 & 3
Channel 2—HF Outputs 2 & 4

6290 (Second)
Channel 1—LF Output 3
Channel 2—LF Output 4

6290 (Third)
Channel 1—LF Output 1
Channel 2—LF Output 2

6290 (Bottom)
Channel 1—VLF Outputs 1 & 3
Channel 2—VLF Outputs 2 & 4

Maintenance

Concert Series electronic products are assembled from all solid-state components, ruggedly constructed with only the highest quality parts. As such, they will provide years of trouble free service with normal care. No special preventive maintenance is required, other than regular cleaning.

Loudspeaker systems should be fully tested before each performance. Touring systems in regular service should be routinely dismantled and examined for shipping and handling damage, including removal and careful inspection of compression driver diaphragms. These procedures should be done by qualified personnel, and in accordance with published methods.

Component interconnections are the greatest source of potential difficulties in portable sound systems. Cables and rack component connections should be carefully inspected and tested prior to sound checks for each new show installation. All internal rack wiring is labeled with the appropriate channel number, and color-coded in accordance with the following convention:

Blue:	VLF
Black:	LF
Red:	HF
Orange:	VHF

Troubleshooting

Because most Concert Series products are used for the amplification of live performance, defective components need to be rapidly identified and the defects quickly corrected. While there is no best technique for troubleshooting large systems, we encourage the development of procedures that can be used to systematically isolate system defects.

It is a matter of priority for operators to become familiar with the functions of each component in the system, and to understand their functional relationships with other components. Carefully study the appropriate function-block diagram in this manual, and commit it to memory. Keep a copy of this manual with the equipment at all times as a handy reference.

OPTIONS AND ACCESSORIES

VHF Transducers

The 4870 comes equipped for the optional provision of [2] JBL Model 2404H VHF loudspeakers for applications that require increased output above 10 kHz. Installing the VHF transducers requires the removal of the grill assembly which is held in place by [4] #10-32 screws and protective washers. Remove the two blanking plates located to the right of the 2380 horn and release the cable ties holding the two VHF

cable pairs. Bring one cable pair through each mounting hole, and connect the orange wire to the black terminal, and the white-orange wire to the red terminal of each 2404H. Mount the 2404Hs using the screws provided in the horn mounting kit.

The two 2404Hs are series-connected within the 4870 for 16 ohm impedance. The VHF loudspeaker input is across terminals 7 and 8 of the loudspeaker system input connector, with *terminal 7* for connection to the amplifier's "positive" output terminal. A series capacitor with a polypropylene shunt provides DC blocking and single-pole bandpass filtering for signals one octave below the recommended crossover frequency of 7 kHz.

WARNING: Do not connect the VHF drivers to an amplifier that does not derive its input from a high pass filter having at least 12 dB/octave roll-off below 7kHz. To do so will subject the 2404H diaphragms to excessive mechanical displacement in concert service, and probable failure.

Adding VHF loudspeakers requires the addition of [1] 5234A with [2] 7 kHz crossover cards (JBL part no. 52-5127) and [1] 6215 amplifier to the system electronics rack. Figure 14 illustrates the recommended hook-up for 9923 systems.

In Figure 14 (showing one-half of the system), the input panel connects to the newly added 5234A, which is equipped with two 7 kHz crossover cards. The high pass outputs drive the 6215 VHF amplifier. The low pass outputs drive the second (numbered from the top of the rack) 5234A, fitted with two 800 Hz crossover cards and HF response equalization. The middle 5234A high pass outputs drive the 6260 HF amplifier, while the low pass outputs feed the bottom 5234A for LF and VLF processing.

Signal flow is similar for adding VHF transducers to 4922 and 4942 systems, except the VLF crossover and amplifier stages are omitted.

Loudspeaker Dolly

An optional loudspeaker dolly, Model 4870DL, is available from JBL Concert Series Dealers. The 4870DL fits both the 4870 and 4845 loudspeaker systems. To use the 4870DL with either 4870 or 4845 loudspeakers:

1] Install the wheels to the dolly frame using the hardware provided.

2] With the loudspeaker system upright, tilt the dolly on end in front of the loudspeaker and lift the dolly to engage the Velcro fasteners at each of the four

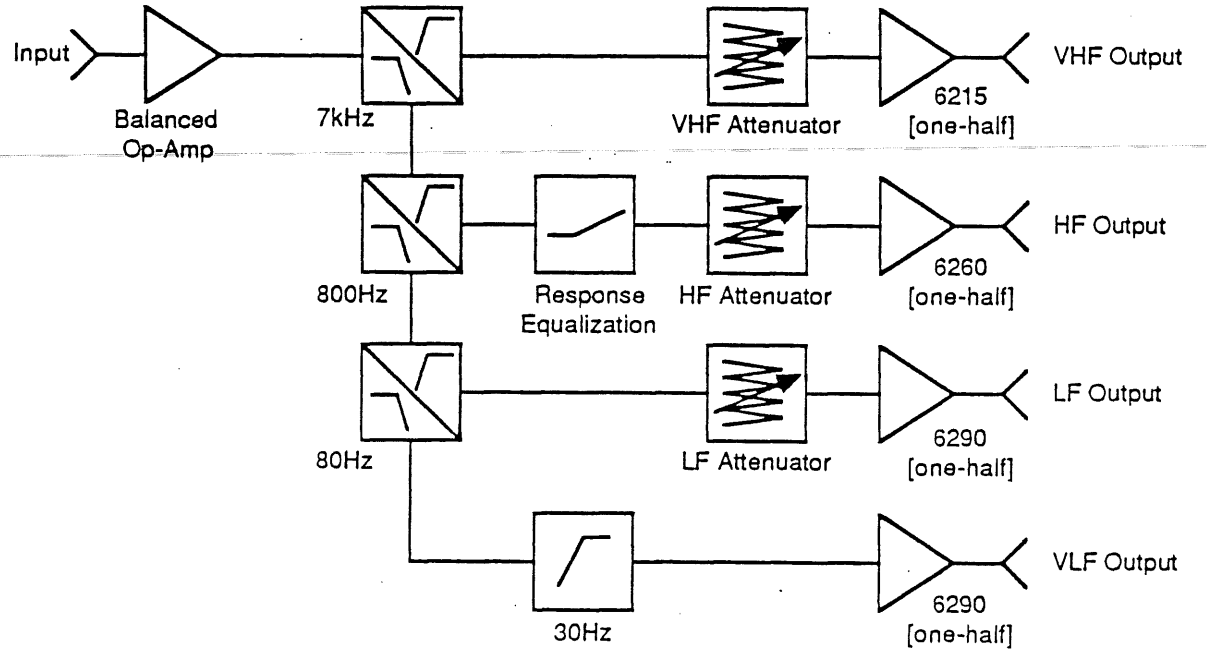


Figure 14—Block Diagram for 9923/9943 Rack Systems with VHF Loudspeakers

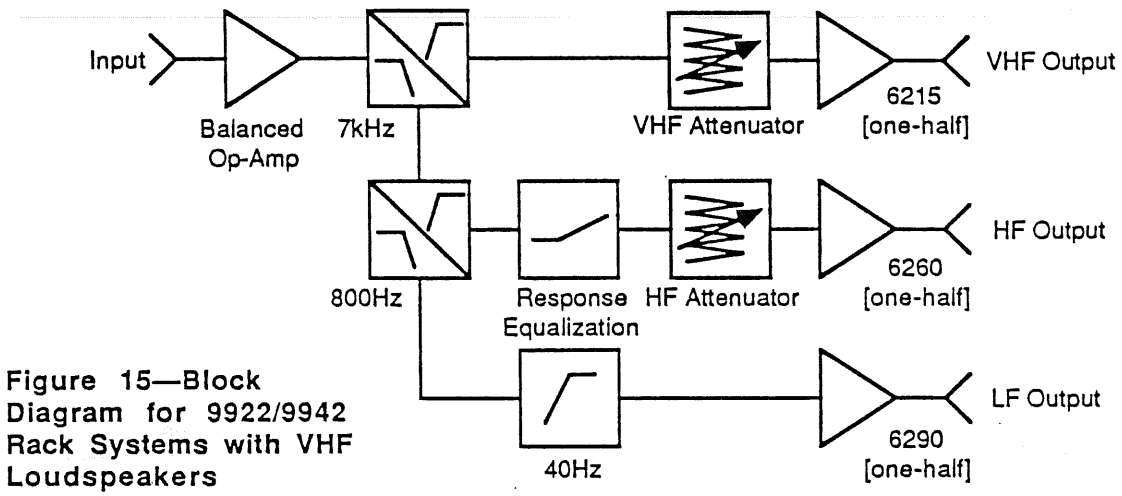


Figure 15—Block Diagram for 9922/9942 Rack Systems with VHF Loudspeakers

corners of the grill assembly.

3] With the dolly firmly attached to the loudspeaker assembly by the Velcro, tilt the loudspeaker forward until the cabinet is horizontal and resting on the dolly. Pulling on the dolly will only remove it from the loudspeaker.

4] To remove the dolly from a loudspeaker, tilt the loudspeaker upright, and extract the dolly by pulling it away from the cabinet, starting at the top.

5] The 4870DL was designed to allow stacking of 4870s and 4845s for transportation and storage while mounted. The underside of the dolly frame is shaped to index with the rear of the underneath cabinet, and is padded with rubber to prevent sliding.

Loudspeaker Cable Assemblies

Two standard loudspeaker extension cable assemblies are available for Concert Series use. Model 9805 is a 5 foot extension, and the Model 9850 is 50 feet in length. Cables are 8-conductor 12.5 AWG wire, terminated with 8-pin Cannon™ EP-8 connectors, one each male and female.

Loudspeaker cables should be kept to the minimum length required in the interest of efficient power transfer. 12.5 AWG cable has a resistance of less than 4 ohms per 1000 feet, which will result in less than 1/2 dB loss over a 50 foot cable run with a 4 ohm loudspeaker load.

Electronics Cases

Two accessory cases are available to protect Concert Series electronic racks in portable service. Both cases are constructed from fiberglass reinforced plywood and mounted on heavy-duty casters for ease of handling. Cases part near the bottom of the rack, allowing rack assemblies to remain in the lower pod during operation. The 9916RC fits 9922, 9923 and 9942 racks. The 9920RC fits the 9943 rack. Installation and operation are straightforward.

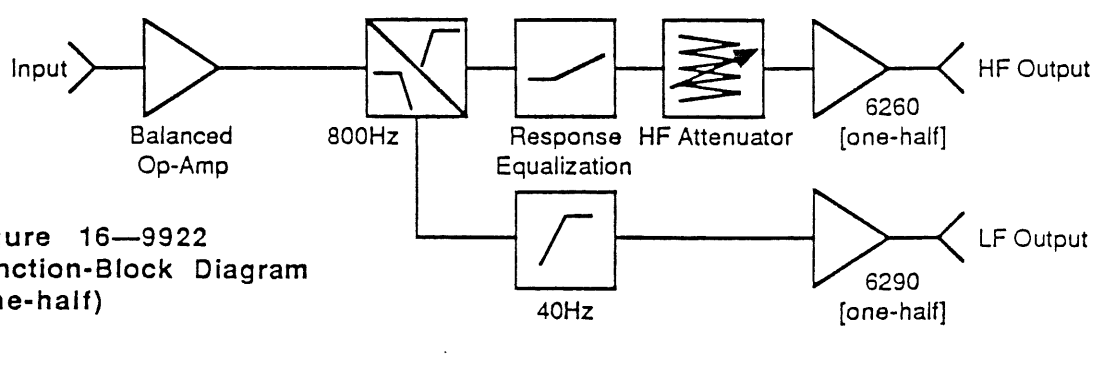


Figure 16—9922 Function-Block Diagram (one-half)

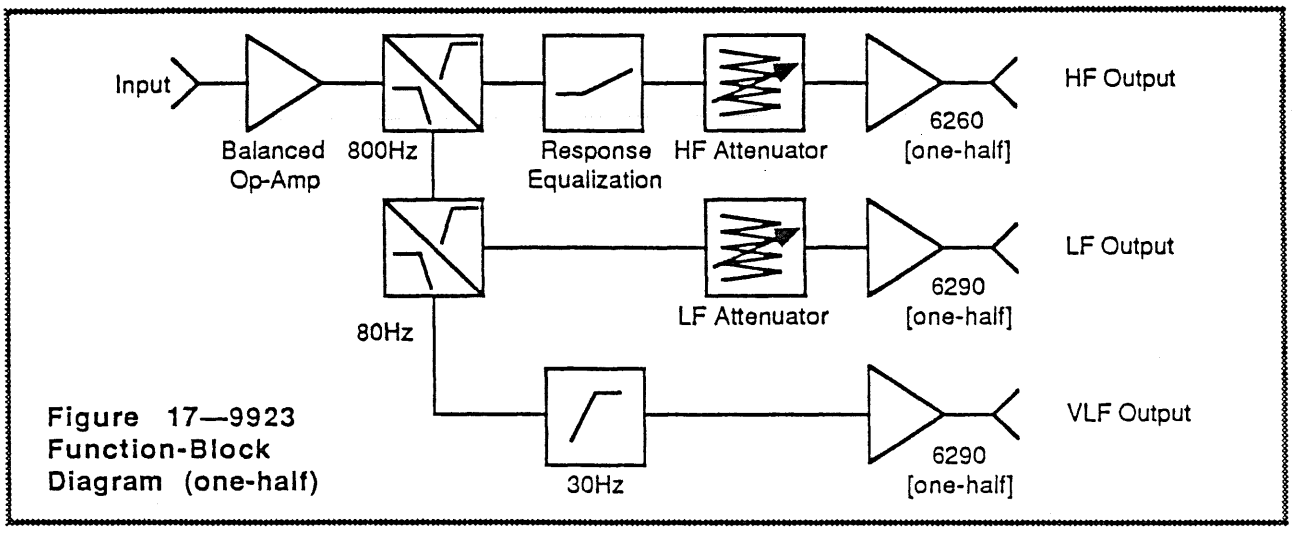


Figure 17—9923 Function-Block Diagram (one-half)

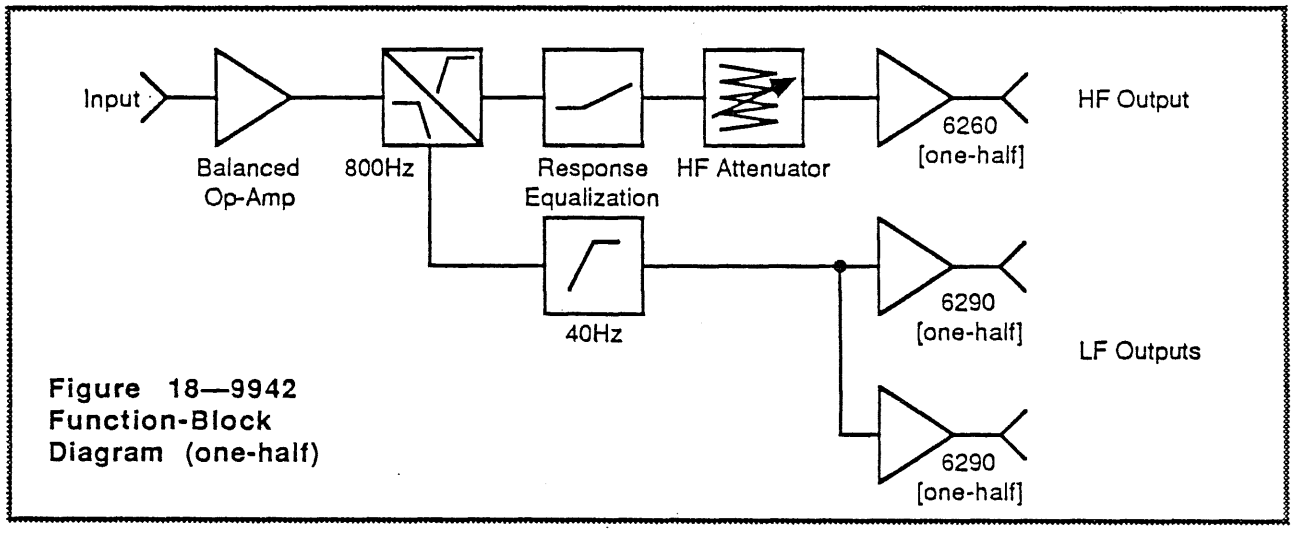


Figure 18—9942 Function-Block Diagram (one-half)

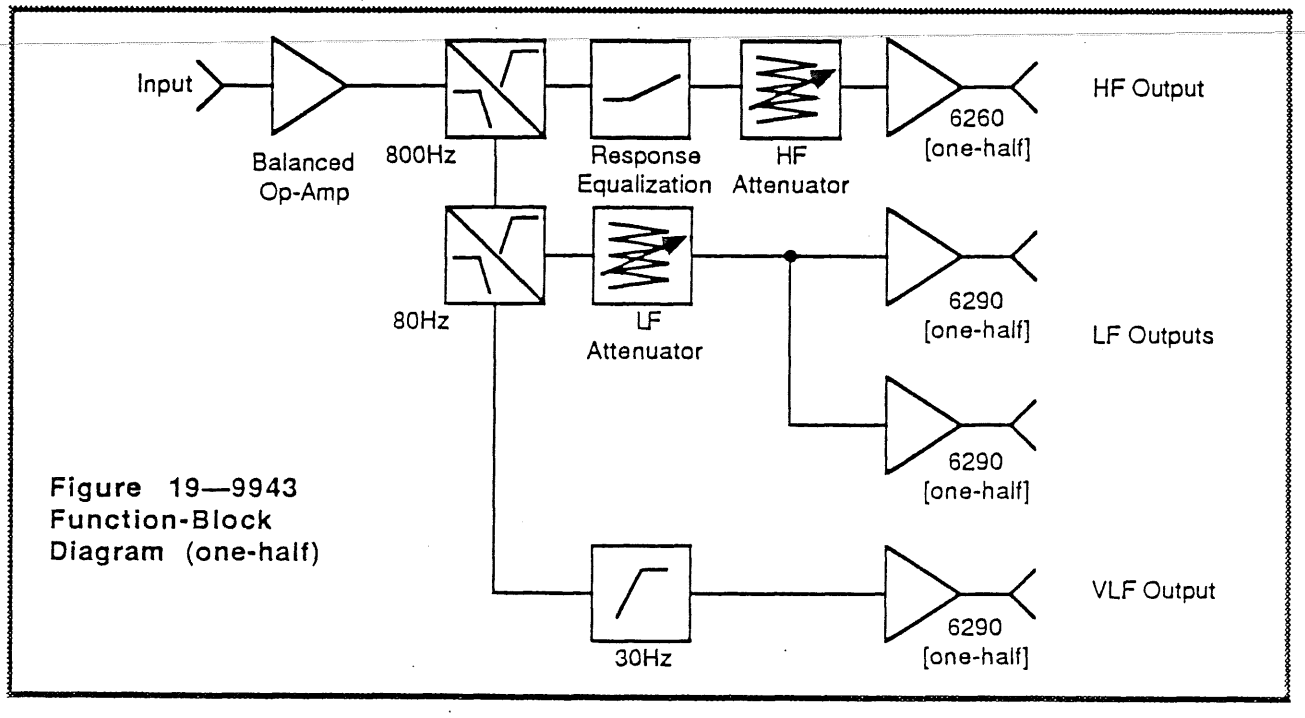


Figure 19—9943 Function-Block Diagram (one-half)