



Powering The VT4889

The VT4889 is designed to be tri-amplified. All midrange transducers are energized as a group, as are all high frequency transducers. Each low frequency transducer in the enclosure terminates individually at the NL8 connector allowing individual testing in your shop or warehouse facility as well as maximizing the capacity of the individual wires in the speaker cable.

The transducers used in JBL's VERTEC system are conservatively rated. Each transducer in the VERTEC system has been tested with pink noise with a crest factor of 6 dB, over its intended range, simulating realistic operating conditions with music program peaks of double the RMS voltage.

Transducer power ratings are calculated based on a minimum impedance (when the driver is cold) and the RMS voltage of the noise input signal. The Audio Engineering Society's commonly-used power test specification requires the transducer to operate at its rated power level for 2 hours with no degradation in performance. The transducers developed by JBL Professional for the VT4889 are required by JBL Engineering to pass 100 hours at full rated power.

JBL recommends that amplifiers have a peak voltage capacity of double the RMS voltage at full power in order to avoid clipping the signal. For this reason maximum Recommended Power Levels per Transducer (RPL/T) may exceed the AES power rating of individual drivers.

Recommended power levels for individual transducers are:

<u>Loudspeaker component</u>	<u>Recommended power level</u>
LF (Low Frequency)	1000 watts per driver
MF (Mid Frequency)	500 watts per driver
HF (High Frequency)	200 watts per driver



Transducer specifications

<u>Band</u>	<u>Driver</u>	<u>Frequency in Hz</u>	<u>AES Impedance (per driver)</u>	<u>Driver power rating (1w/1m)</u>	<u>Sensitivity 1w/1m</u>
LF	2255H	40-200	8 ohms	600 W	99 dB
MF	2250H	200-1k	8 ohms	300 W	102 dB
HF	2435H	1-20k	5.3 ohms	75 W	116 dB

Power Amplifier Requirements

When choosing a power amplifier, you may want to use identical amplifiers for all frequency bands in the system. This is perfectly permissible since the upstream signal processing, if set properly, limits the maximum output of each amplifier channel to the maximum level that is safe for that bandpass. This design approach maximizes amplifier redundancy at the expense of unused amplifier capability in the mid and high-frequency bandpasses.

You may elect to set your system up to drive blocks of four loudspeakers. This may make sense since the suggested minimum number of enclosures recommended for use together in typical applications is four VT4889 array elements. This number is recommended to take good advantage of the Line Array Summation Effect, and to maintain good array coverage characteristics and directionality.

For moderately-powered applications, four VT4889 three-way speaker systems can be driven with only four channels of amplification, as follows:

<u>Band</u>	<u>Type</u>	<u>Total Qty.</u>	<u>Total Impedance</u>	<u>Minimum W/driver</u>	<u>Total Watts</u>	<u>Sensitivity</u>	<u>Spl@1M</u>
LF-1	2255H	4	2 ohms	600	2400	99	136
LF-2	2255H	4	2 ohms	600	2400	99	136
MF	2250H	16	2 ohms	200	3200	101	136
HF	2435H	12	4 ohms	100	1200	116	147



Two-Ohm Loads and Amplifier Performance

Many amplifiers are capable of running two-ohm loads for extended periods of time. Some amplifiers are more capable of doing this than others. One consideration about two-ohm operation is a particular amplifier's distortion specifications. Another consideration is long-term reliability. For this reason, if you intend to operate your system on a long-term basis with amplifier loads lower than four ohms you should consult with the amplifier manufacturer. Carefully consider the power available per transducer, the distortion specification at the amplifier's two-ohm rating, and the potential for system trouble should an amplifier fail with the hookup scheme you elect to use.

The LF section of the VERTEC system can be configured to present a 2-ohm load to the power amplifiers when 2 only two boxes are paralleled. This is permissible as long as the amplifier has significant 2-ohm power capability (in excess of system requirements) and the system controller's limiters prevent the amplifier from operating at full power on a continuous basis. For maximum signal path reliability in critical-use situations, you may even choose to power each section of a VT4889 enclosure from its own amplifier channel.

CAUTION! System setup requires careful adjustment of the limiters for each bandpass to protect against transducer overload and amplifier clipping. See Chapter 5, "VT4889 Signal Processing".



Speaker Cable Requirements

Speaker cables terminate at the speakers with 8-conductor Neutrik NL-8 connectors. One cable reaches from the amplifiers to a single VT4889. Short jumper cables then connect additional VT4889 speakers in parallel to the first. Connecting 2 speakers in this manner multiplies the amplifier's 4-ohm power dissipation by 2.

If you are using sub-woofers, it is usually ideal to have one cable each from the amp rack to every subwoofer. Under heavy-use applications, jumpering sub-woofers in parallel may reduce system performance capabilities.

The VT4889 full-range speaker connections are labeled on the rear connector panel. One Neutrik NL-8 connector is wired as follows :

<u>Bandpass</u>	<u>NL8 connector</u>	<u>Load Impedance / Box</u>
Lows	conductor pairs 1+/- and 2 +/-	8 ohm / 8 ohm
Mids	conductor pair 3 +/-	8 ohm
Highs	conductor pair 4 +/-	16 ohm

You may also want to consider sub-walker power requirements when configuring your amplifiers racks. Considering the Neutrik connector format used on VT4889 enclosures, here is a typical scheme for sub-walker connections on the rear connector panel, using two (2) Neutrik NL-8 connectors wired as follows :

<u>Amplifier Channel</u>	<u>NL8 #1</u>	<u>NL8 #2</u>
A	1+/- and 2+/- parallel connected	
B		1+/- and 2+/- parallel connected

NL-8 Speakon Couplers can be used to extend cables by joining two together. For flying array "mults", custom harnesses can be fabricated using connectors from manufacturers such as Veam.

Ready-made cables are available from any number of manufacturers. Many of these same manufacturers offer connector panels made to your specifications.

When planning speaker cable requirements, it is typically a good idea to ensure that each conductor in the cable is a minimum of #13 AWG, depending on cable length.



System Interconnection Tips

A labeled panel on the back of each amplifier rack fitted with individual female XLR connectors for each channel is a good idea. This puts them in plain view for system technicians, and saves wear to the amplifiers' connectors. Along with individual connectors, multi-cable disconnects wired in parallel with the XLR connectors can be used to distribute signals in portable systems to make setup quick and infallible. By placing all signals onto pre-assigned channels of a multi-core snake dedicated for sending signals to the amps, the sound system can be repeatedly connected correctly and rapidly. Dedicated send snakes with 10 or 20 channels are common, with extra lines in the send snake often used for fill-in zones of speaker coverage, intercom and talk-back functions. If you're on the road, spare lines never hurt.

Multi-conductor 13-gauge cable can be used with fan-out and fan-in NL-8 tails. Amplifier rack speaker connector panels with NL8MPR connectors can be wired with 3-foot, 4-pair fan-outs, with labeled and color-coded banana-type plugs (or whatever connector your particular amplifier requires). The minimum recommended panel is 4 Neutrik NL8 Speakons wired for use with four two channel power amplifiers. This would power four VERTEC VT4889 enclosures connected as two paralleled enclosures each, and two dual-component subwoofers.

Other amplifiers may be chosen for use with different passbands. This consideration is often made with the high frequency section. You need to weigh the cost savings against the advantage in redundancy created by using the same amplifier model and the same electrical gains for all system amplification needs.

Total system output capability will be determined by the amount of amplifier power available to the loudspeakers. The maximum peak output of only one VT4889 is 136 dB to 146 dB (Frequency/bandpass dependent).

NOTE : Your system configuration needs may suggest that 2 or 3 boxes per power amplifier circuit are jumpered together (or even 4 in less demanding lower-power applications where amplifier redundancy is not a primary consideration). Think about your own system application needs carefully when configuring power amplifier channels and wiring inter-connection schemes.



Amp Rack Example

This example assumes the use of Crown MA5002VZ amplifiers for each bandpass of the system, with only two VT4889 enclosures being jumpered together. For a 16-box VerTec system with 8 subs (4/side), you would require two amp racks per side, powering a total of 8 x VT4889's plus 4 subs per side.



Typical power amplifier rack setup, showing 4 Crown MA500VZ amplifiers in each rack. If set up for high-power operation with VT4889 enclosures jumpered in pairs, these two racks could power one side of a 16+8 system (8 VT4889's plus 4 subwoofers).

Assumptions:

- Each amp rack has 4 Crown MA5002VZ amplifiers. The MA5002 amplifiers can deliver 1775 watts per channel into 4-ohm loads (20-20khz, 0.05% THD). They deliver somewhat more power short-term (tone burst), especially at low frequencies. 2-ohm loads are not a problem.
- Each amp rack is meant to drive 4 VT4889 and 2 JBL 2 x 18-inch subwoofers
- Each amplifier in the rack is configured in stereo (2-channel) mode.
- There are four NL8 output connectors in each rack. Connector 1 is connected to one channel of amplifiers 1, 2, and 3. Connector 2 is connected to the other channel of amplifiers 1, 2, and 3. Connector 3 is connected to one channel of amplifier 4. Connector 4 is connected to the other channel of amplifier 4.
- Each rack has a 3 phase/120 vac/30 amp per phase power connection.



In the above example, the amplifier loading in each rack would be:

<u>Amp #</u>	<u>Usage</u>	<u>Ch. Load Impedance</u>	<u>Speakon 1</u>	<u>Speakon 2</u>	<u>Speakon 3</u>	<u>Speakon 4</u>	<u>Power Phase</u>
1	HIGHS	2 x 8 ohms	Amp L to 4 +/-	Amp R to 4 +/-	nc nc	nc nc	A A
2	MIDS	2 x 4 ohms	Amp L 3 +/-	Amp R to 3 +/-	nc nc	nc nc	A A
3	LOWS	2 x 2 ohms	Amp L to 1 +/- & 2 +/- (paralleled)	Amp R to 1 +/- & 2 +/- (paralleled)			B
4	SUBS	2 x 4 ohms			Amp L to 1 +/- & 2 +/- (paralleled)	Amp R to 1 +/- & 2 +/- (paralleled)	C

In this example every two boxes are jumpered together in the hanging arrays, and driven from either Speakon 1 or Speakon 2. One sub is driven from Speakon 3 and the other sub from Speakon 4. It is usually best that the subs be individually wired to minimize the effect of the wire resistance on the amplifier's damping factor.



