

## Technical Notes Volume 1, Number 12

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# Polarity Conventions of JBL Transducers and Systems

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### 1. Historical Background:

When James B. Lansing left Altec Lansing in 1946 to form what is now known as JBL Incorporated, he brought with him the basic technology and traditions which had been a part of his previous affiliation. The early JBL transducer complement included a HF driver similar to today's 2425 and a LF cone transducer similar to today's E130. Like the Altec Lansing devices of that day, the new HF and LF transducers had polarity conventions which resulted in opposite signal polarity when both transducers were fed positive-going signals to the same terminals. Since the predominant type of dividing network used with these transducers had 12-dB/octave transitions, the phase shift produced by the network at the crossover frequency was 180 degrees. Thus, the summation of the two acoustical outputs at crossover was zero degrees, or, as we say, in phase.

This was a convenient arrangement, as long as it could be assumed that the transducers would always be used with a compatible network. All the installer had to do was remember that black went to black and that red went to red.

There were, however, industry pressures to standardize, irrespective of network considerations. While the industry in general adopted the convention of a positive-going voltage to the colored terminal producing a positive pressure at the transducer's output, JBL adopted the opposite convention of having a positive-going voltage at the black terminal produce a positive pressure at the output. The reasons for this are not at all clear at this point. There was, however, some discussion of the matter in the company's early days, and two transducer models, the D123 and D208, were designed with polarity conventions which matched those of the rest of the industry.

Hardly a week goes by at JBL without some degree of discussion of our unique polarity position. Suffice it to say that a change at this point would cause mass confusion in the field. Probably no manufacturer of transducers has a larger population of functioning devices in the field than does JBL, and any change would create more problems than it would solve.

How important is it, anyway? All JBL literature clearly states the polarity convention, and it is assumed that any specifier of our professional components is aware of this and that he will design accordingly.

### 2. The Present Status of Transducers and Systems:

The polarity of all current JBL transducers is consistent and will not change; our literature will continue to spell out the convention quite clearly.

The polarity of engineered systems is another matter. One has a choice of poling the system independently of the transducer polarity simply by the labeling of the input terminals of the system's dividing network. All of JBL's 3100 series passive networks carry through the same convention in color coding as our transducers. That is, the black input terminal is common to the two black output terminals. If transducers are connected red to red, and black to black, then the system polarity will be the same as the transducer polarity.

Note that HF components are often wired red to black in order to maintain proper phase relationships at crossover, due to path length differences between HF and LF acoustical centers. The theater models 4670B and 4673 are examples of this. Assembly instructions for these theater systems clearly indicate how the wiring is to be done. Thus, when we speak of the polarity of a system, we are referring to the polarity of the LF section only, and this can be easily tested with a 1.5 volt battery.

With the exception of the 4311 and 4312 systems, all JBL monitor systems follow the positive-to-black JBL polarity convention. The 4311 and 4312 are different because they were both based on the old D123 LF transducer, which had the positive-to-red convention. They are the oldest systems in the professional line, and even when their LF transducers were made to conform with the positive-to-black convention, the LF wiring was changed inside so that the systems exhibited positive-to-red poling.

Since monitor systems are normally used in matched sets, the polarity convention is relatively unimportant, inasmuch as all like systems will be in phase with each other.

However, when JBL introduced the Cabaret series, a wise decision was made to pole them in the positive-to-red convention. The reasoning here was obvious. Like so many MI products, the standard input connector is the two-terminal 6.3mm (1/4-inch) phone plug, which locks in the polarity of the system to its electrical feed. Further, in the MI business, there is considerable mixing and matching of systems from different manufacturers, and they must all have the same polarity.

It is appropriate that we present a list of which transducers and systems follow which poling convention:

### A. Positive-to-black:

1. All JBL transducers which have color coded terminals
2. All 4300-series monitor systems (except the 4311 and 4312)
3. All 4400-series monitor systems
4. All 4600-series user assembled systems
5. 4660 system
6. 46710K system (please note that the Specification Sheet for the 46710K incorrectly identifies its polarity)
7. All JBL L-series consumer systems

### B. Positive-to-red:

1. Cabaret series systems (positive is tip of 6.3mm plug)
2. MI-series systems (positive is tip of 6.3mm plug)
3. 46120K (consistent with the 4612 Cabaret model)
4. SLT-1 miniature system
5. 4311 monitor system
6. 4312 monitor system
7. 8316 foreground music system
8. 8325 surround system

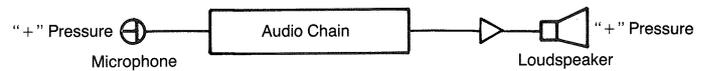
**C. The Industrial series of loudspeakers for distributed systems have a polarity convention related to terminal placement on the frame. See specification sheets for details.**

## 3. Recommendations:

### A. Absolute Polarity:

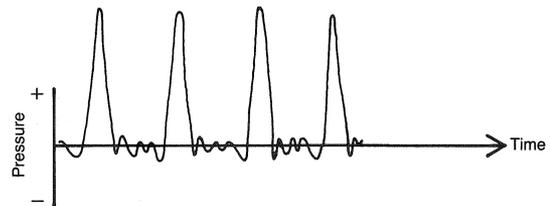
Absolute polarity is concerned with maintaining the relationship shown in Figure 1 throughout an audio recording, transmission, or reinforcement chain. A careful accounting must be made if the playback is to be in absolute polarity, and much of the signal processing which may have taken place in a recording cannot be inferred from an examination of the recorded program. On the other hand, a reinforcement system can be designed so that absolute polarity is maintained throughout.

**Figure 1. Maintaining Absolute Polarity.**



The audibility of absolute polarity is questioned by many workers in the field. Generally, when it is audible, it is fairly subtle and depends a great deal on the nature of the program and the monitoring conditions. Stodolsky (1) discusses the subject in detail and presents examples of waveforms whose monophonic polarity can be fairly easily detected. Most audible are those signals which have highly asymmetric waveforms and which are auditioned at fairly high levels. In general, an asymmetric waveform, such as that shown in Figure 1, will exhibit its highest pressure in the positive direction. It is easy to see how a strong positive pressure, especially at low frequencies, may be sensed quite differently than a strong negative pressure, or rarefaction.

**Figure 2. Asymmetrical Waveform**



It is JBL's contention that there will be more concern for absolute polarity in the future, and any competent system designer should be concerned with it. As a matter of good engineering practice, JBL recommends that all systems be installed in such a manner that all signal inputs are maintained in absolute polarity through to the output.

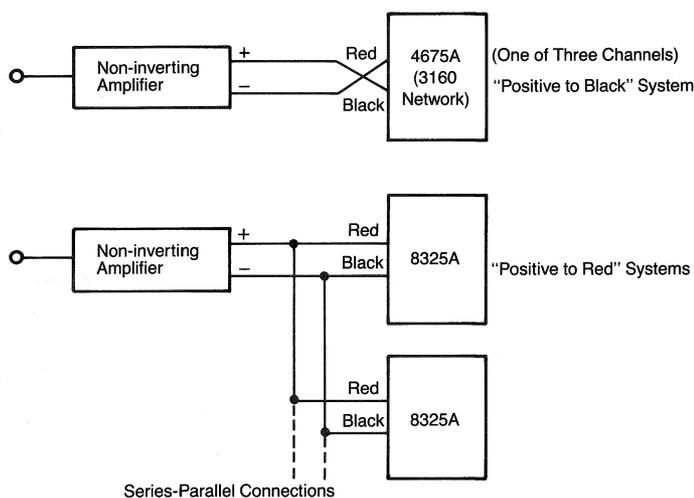
All recording and modulation mediums have polarity standards, and presently most amplifiers and signal processing devices are of the non-inverting type. All console patching points are likewise assumed to be non-inverting, and laying out a system which maintains absolute polarity is straightforward. Microphones are uniformly Pin-2 hot, which means that a positive-going pressure at the microphone will produce a positive-going potential at Pin 2. The majority of microphone inputs in consoles are configured accordingly.

At the output of the system, assuming that polarity conventions have been strictly followed, the ground or common terminal of the amplifier should be connected to the red input terminal if JBL systems of the positive-to-black convention are used. If the systems are of the positive-to-red convention, then the common amplifier terminal should be connected to the black system terminal. JBL strongly recommends making the necessary polarity change between the amplifier and the network input terminals inasmuch as this will be consistent with all previous wiring instructions for field assembled systems.

## B. Combining Different Elements in Multi-channel Arrays:

While the screen systems in any multi-channel motion picture theater should be of the same model, the surround loudspeakers will almost always be of a different model. For example, let us assume that a theater dealer has installed three 4675A systems behind the screen and 12 8325 systems for the surround channel. Since the 8325 system is of the positive-to-red convention, proper systems engineering dictates that the feed to the 8325's be red to red and black to black, while the screen channels will be connected to the amplifier black to red and red to black, as shown in Figure 3.

**Figure 3. Proper Poling With Mixed Systems, Maintaining Absolute Polarity.**

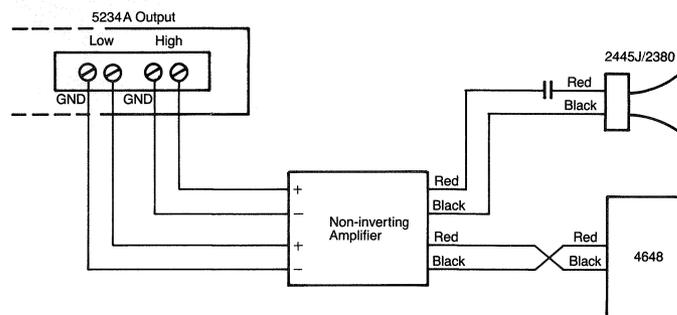


## C. System Wiring Using the 5234A Electronic Dividing Network

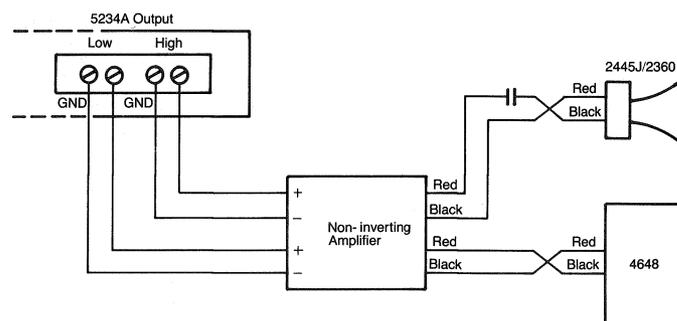
Figure 4 shows details of wiring the 4670B and 4675A systems in a bi-amplified mode. Since the 4670B system requires that the HF section polarity be reversed relative to the LF section, we have shown that reversal between the HF amplifier output and the transducer input terminals. Note that the 4675A system maintains like polarity between its HF and LF sections.

**Figure 4. Maintaining Absolute Polarity in Bi-amplified JBL Systems.**

### A. 4670B System



### B. 4675 System



## Reference:

1. D. Stodolsky, "The Standardization of Monaural Phase," IEEE Transactions on Audio and Electroacoustics, AU-18, Number 3 (September 1970)



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