

To Phase Or Not To Phase?

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To phase, or not to phase? That is the question faced by any audiofan in the process of setting up a stereo system. Whether it is better to ignore an out-of-phase system, or to undergo the agony of attempting to determine proper phasing by listening tests is a problem of stereophony that requires discussion and clarification.

ANYONE, EVEN SLIGHTLY CONVERSANT with the techniques of stereo sound reproduction has heard lip-service paid to the importance of proper system phasing¹. The idea is to have all speaker cones moving in the same direction at the same time when the system is reproducing a monophonic signal. If, for example, the speakers are out of phase; the left speaker cone may be moving away from you, at the same instant that the right speaker cone is moving toward you. The effect of out-of-phase operation of a stereo system has been called variously: "inconsequential", a "large hole in the middle", and a "complete collapse of the stereo curtain of sound."

In the author's eight-year acquaintance with the vagaries of stereophonic reproduction, it has been found that the effects of improper speaker phasing do in truth vary from inconsequential, to a general destruction of the stereophonic

phantom center-channel techniques will be much degraded if playback channels are not properly phased. Similarly, it is very important that proper phasing be maintained in recordings where only two or three microphones are used for the stereo pickup. In many popular music recordings, however, as many as fifteen or twenty microphones have been used. The phase relationships of the sounds captured by these recording methods are generally so confused that it matters little whether playback equipment is properly phased or not.

(2) *The size and acoustics of the listening room, and positions of the loudspeakers and the listeners within the room.* In certain rooms, when the listener's position is away from the stereo center axis (see Fig. 1), the out-of-phase mode sometimes sounds better than the in-phase mode.

(3) *The degree of aural acuity and*

ular articles imply. It is likely that more than one of us has been driven to distraction by attempting to follow the inadequate approach and sketchy instructions offered in these manuals and articles.

The following excerpt from a stereo amplifier instruction manual is better than most, but still somewhat misleading to the novice. "To check for proper phasing, play a monophonic recording so that one signal comes from both channels. Then move back and forth between the speakers. If the phasing is not correct, it can be rectified by interchanging the leads between one of the amplifier channels and its associated speaker. There should be no need to change the phasing once the system is set up properly." Fortunately, these instructions advise the use of a monophonic sound source. A few instruction books blithely ignore this fundamental necessity, and one or two make no mention of phasing whatsoever.

Let us suppose that we are novice audiofans in the process of checking our newly installed stereo system. The implication of the foregoing instructions is that by merely walking back and forth between our stereo speakers we will readily be able to discern whether they are working in phase. In actual practice, the chances of being able to do this seem to be poorer than fifty-fifty. Being novices, we are not sure whether the sounds we hear emanating from our speakers are in phase, or not. We decide that we had better reverse the leads to one speaker just for comparison sake.

We know that it is unwise to operate a power amplifier without its output load, so we carefully shut off the a.c. power before crawling behind our loudspeaker to reverse leads.

Two minutes later, if we are lucky; we are once more parading between our speakers and listening for some dramatic change in the quality of the sound. The only trouble is that we have already forgotten how things sounded before, and there is no obviously discernible difference in the sound. Now is the time for the crucial decision. To phase, or not

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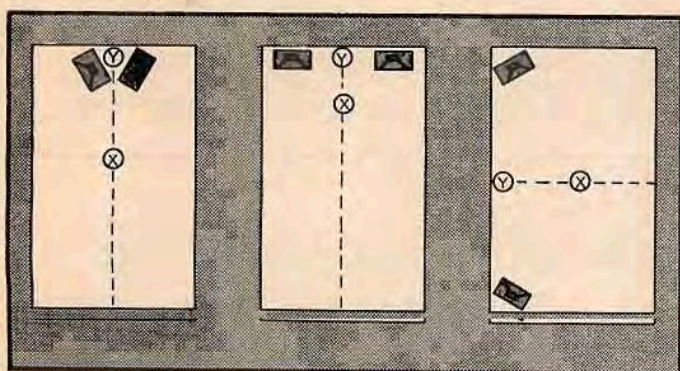


Fig. 1. Three typical stereo setups. Dotted line indicates stereo center axis. "X" indicates approximate position of listener. "Y" indicates apparent position of phantom monophonic source when system is properly phased and balanced.

curtain of sound. Factors governing the severity, and even the very noticeability of these effects, are:

(1) *The nature of the recording.* A widely separated two-channel stereo recording of the "ping-pong" variety loses very little by out-of-phase reproduction. It is quite impossible to detect a 180-degree phase reversal with many of the ultra-widely separated recordings being released currently. By contrast, a stereo playback of a recording made with

perception of individual listener. E. T. Canby has suggested, and the author's personal experience seems to confirm, that listeners sensitivity to phasing varies considerably from person-to-person, and within any given individual over a period of time. At certain times, attempts to determine proper phasing of two stereo channels for a given recording can be absolutely frustrating, especially if the listener is fatigued. After a night's rest, and with all other conditions held the same; the same listener has no trouble in determining proper phasing.

The novice stereofan soon learns that determination of proper phasing by listening tests is not always as easy as equipment instruction manuals and pop-

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¹Some authorities, notably Paul Klipsch, refer to "polarity" rather than "phase" in this context. Mr. Klipsch's terminology is technically correct, but for the purpose of this article we will adhere to the more popular usage.

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to phase? We can go on reversing leads in this fashion "ad nauseum," or we can decide that it is not worth the trouble for a difference in sound so subtle as to be almost non-apparent.

Fortunately, there are one or two approaches to the problem that are more sane than this.

Color-coded leads. If all components of a stereo system from source to speakers are matched, phasing becomes easier. A very simple expedient is to use color-coded connecting leads between the amplifier output terminals and speaker terminals. The color coding merely insures that both speakers are connected to the amplifier terminals in an identical fashion. If the common terminal of amplifier channel A connects to terminal 1 of our left speaker, we must similarly connect the common terminal of amplifier channel B to terminal 1 of our right speaker. It may reasonably be assumed that if the speakers are attached in an identical manner, the system is properly phased.² This is all well and good for completely matched stereo channels. What about non-matched stereo systems using components which differ from one channel to another?

The phase-reversal switch. With non-matched stereo systems, a listening test is the most practical way to determine proper phasing. A phasing switch will make such a listening test easier and more practical to perform; and regardless of whether a system is matched, the switch is a useful adjunct. Most recently marketed stereo amplifiers incorporate a phasing switch as one of the front panel controls. While this is convenient, it is not necessarily the best place in the system for such a switch. An otherwise good stereo amplifier should not be rejected merely because it has no phasing switch. Such phase reversal is usually accomplished between the output transformer and the speaker, but at least one recently introduced stereo preamplifier incorporates a phase-reversal control that operates by selecting between cathode or plate output of one of the electron-tube stages in one stereo channel. This method of phase-reversal opens up a whole new realm of control possibilities for stereo, including

² If you are unsure which is terminal 1 on a particular speaker take a flashlight battery and attach leads to the positive and negative terminals. Touch leads to terminals of speaker. Note which way the speaker cone moves. Mark positive terminal. Repeat the procedure with the other speaker, marking the positive terminal when speaker cone moves in same direction as previous speaker. Consider the positive terminal as terminal 1.

phantom center-channel output from conventional two-channel amplifiers null balancing of system levels, and positive determination of program source phasing. Discussion of this method of phase-reversal is beyond the scope of this article.

We can make a phase-reversal switch of our own that will be easier to use than the built-in variety. An inexpensive double-pole double-throw toggle switch wired according to Fig. 2 is all that is needed to reverse the phase of one stereo channel quickly and at will. The advantage of this home-made variety is that it may be made with leads long enough to reach the stereo center-axis where listening tests must be performed. In most setups the stereo amplifier is located at some distance from this critical listening zone, and if the phasing switch is mounted on the amplifier it will be necessary to enlist the aid of an assistant to throw the switch while you take up a fixed listening position along the stereo center-axis to make A-B listening comparisons.

Balancing the system. Before the system can be phased by ear, it must be properly balanced for levels. Although there are numerous meters and null devices being offered as aids in setting stereo system balance, the best method still involves a listening test using monophonic program fed to both channels. In fact, nearly all meters and null-balance devices must be initially calibrated by ear. The monophonic source can be fed to both channels simultaneously or individually. It is important to sit

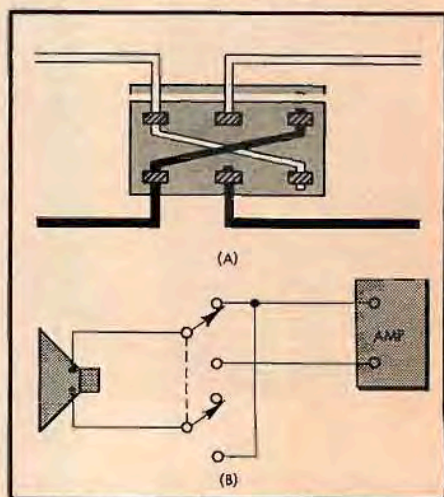


Fig. 2. Wiring and schematic diagrams for double-pole double-throw toggle switch used to reverse polarity in one channel of a stereo system. One pair of leads is attached to the amplifier output terminals, the other pair to the loudspeaker terminals.

along the stereo center axis when balancing the system by ear. It will help to have an assistant switch back and forth between channels and adjust levels, while you maintain a fixed position along the axis. If you prefer to feed both channels simultaneously rather than individually, your assistant will merely adjust levels at your direction until you are satisfied that the apparent source of sound is roughly centered between speakers, so that neither speaker is overpowering the other. It is suggested, that a final touch-up balancing check be made from your favorite listening chair, after the system has been properly phased.

Proper use of the phase-reversal Switch. Continue to feed a monophonic signal to both channels. It may help to employ a substantial amount of bass boost, being sure to boost both channels equally. A recording of a single male voice or solo instrument seems easier to phase than some other program sources. In some cases, it may even help to play the recording at a slower speed. Place yourself along the stereo center-axis and at about the middle of its length. Switch the phase-reversing switch back and forth while listening carefully to the sound. If you cannot reach the switch from your listening position, have your assistant switch according to your instructions. The difference between in-phase and out-of-phase operation should be readily discernible. The in-phase mode will cause the sound to come from a definite spot about half-way between

the speakers. In the out-of-phase mode the sound will lack this apparent single, centrally-located source; and will float vaguely about the room. It will seem to come from the two speakers that it is really coming from, rather than a single phantom source between the two speakers. Many people find it helpful to close their eyes while listening for this single, phantom-source that indicates proper phasing. If you have trouble determining the properly phased mode of operation; move in or out along the center axis and try again. Also, try a different source of monophonic program. If this fails, and you find yourself becoming increasingly confused; it is better to give-up temporarily and try again at a later time.

Chances are, however, that if you follow the foregoing instructions you will have little trouble in phasing your system. Once properly phased, you will be able to sit back and enjoy your stereo system, fully confident that it is not suffering the sometimes subtle, sometimes acute degradations of improper phasing. Be sure to mark the phasing switch, or remember its normally-phased setting. The only time you need to change this setting will be to accommodate an odd-ball, out-of-phase stereo program source. If you are ever in doubt about the phasing of a particular program source, be sure to return to monophonic operation when making a listening check of that source.