

Microphone Phasing

A Standard for the Motion Picture Industry

A landmark decision was made by the SMPTE Committee on Audio Recording and Reproduction Technology at its November 1980 meeting in New York City. The following statement was issued by Michael Strong, Chairman of the Committee:

For some time now, in the motion picture industry, there has been a need for standardization of the connection for microphone phasing used by manufacturers of condenser microphones and sound recorders using the XLR 3-pin connector. Standardization of microphone phase has already been obtained in the radio and audio recording industries. In the film industry, however, there are various connections in use for powering microphones — some of them nonstandard — and this results in a reversal of phase of some microphones with respect to others.

Modern condenser microphones can be powered from batteries using either "phantom powering," or A-B or T powering, power being drawn from an associated amplifying or recording device. With the early method of phantom powering, the condenser microphone used the grounded shield of the microphone cable for one conductor of the 12-V dc supply. A difficulty arose with the introduction of the early *Nagra* recorders, widely used in the film industry. Their original design had a positive ground in the battery power supply, which contrasted with the now standard method of phantom powering with a negative grounded shield. The *Nagra* recorder uses its existing battery supply to provide the phantom power in the preamplifiers designed for condenser microphones. The earlier *Nagras* provided a polarity that was opposite to that now recommended by sound-recording studios and microphone manufacturers. (The latter recommended that the phantom power be of negative polarity on the shield and positive on both audio conductors.)

A difficulty of phantom powering, however, is that if long microphone cables are used, and if two XLR connectors happen to touch intermittently, then the slight difference in polarity caused by differences in the resistance of the conductors can produce noise, which will then become amplified.

The A-B or T powering system was invented to eliminate the need for using the ground connection. With the XLR-3 plug the standard for this wiring is for pin 2 to be positive and pin 3 to be negative. The *Nagra* recorder provided the T powering also in reverse in its built-in power supplies, so many studios made use of external battery supplies, for use with *Sennheiser* and other condenser microphones. Some studios made special cables with pins 2 and 3 reversed at one end so that the condenser microphones would work with the *Nagra* recorder. The confusion mounted when, under pressure from the distributors, *Sennheiser* provided specially wired microphones with pins 2 and 3 reversed and a red dot to indicate the wiring change. Another newcomer to the film industry, *Schoeps Microphones*, provided their microphones with pins 2 and 3 reversed as their standard direct from the factory. A difficulty created by this reversal of pins 2 and 3 is that the audio phase of the microphone becomes reversed.

Some existing standards for microphone phasing* outside the film industry indicate that the correct phasing for microphones is such that an increase in pressure on the diaphragm produces a positive voltage on pin 1 of the European DIN connector and on pin 2 of the U.S. XLR-3 connector.

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Standards & Recommended Practices

Approved American National Standards

Revisions of six American National Standards were approved by the American National Standards Institute on October 6, 1980: ANSI PH22.109-1980, Dimensions for 16-mm Motion-Picture Film Perforated 1R; ANSI PH22.110-1980, Dimensions for 16-mm Motion-Picture Film Perforated 2R; ANSI PH22.169-1980, Dimensions for 35-mm Motion-Picture Film Perforated 8-mm Type S, 2R-1664 (1-0); ANSI PH22.171-1980, Dimensions for 35-mm Motion-Picture Film Perforated 16-mm, 3R (1-3-0); ANSI PH22.185-1980, Position, Dimensions and Reproducing Speed of Six Magnetic Sound Records on 70-mm Motion-Picture Release Prints; and ANSI PH22.146M-1980, Method for Determining Speed of 16-mm and 8-mm Reversal Color Camera Films Intended for Direct Projection in Motion-Picture Photography.

Copies of the standards may be obtained for a nominal fee from

the American National Standards Institute, 1430 Broadway, New York, NY 10018.

Approved International Standard

The International Organization for Standardization (ISO) recently approved an International Standard, the technical content of which is published here for your information. ISO 5761-1980, Cinematography — Sound Motion-Picture Camera Cartridge, 8-mm Type S, Model 1 — Pressure Pad Flatness and Camera Aperture Profile — Dimensions and Characteristics, is in agreement with American National Standard ANSI PH22.199-1980.

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Until this most recent decision, both correct and incorrect phasing have been in use in the motion picture industry, while correct phasing has been adhered to in the television, music, and public-address industries. As a result, the rental houses have lobbied for unified standards. Some studios have changed their microphone polarity to conform to the *Nagra* power supply, whereas others have not.

Now mixer manufacturers are trying to reduce the confusion by providing phase reversing switches and A-B powering reversing switches. Unfortunately the *Nagra III* and *IV* microphone preamplifiers cannot be made to work with the standard wiring, but most of the recent *Nagra 4.2* and *IV-S* recorders can be rewired to conform to the standard. With an increasing sound pressure on the microphone diaphragm, the XLR-3 connector should have a positive voltage on pin 2, and according to existing standards,** pin 2 is also positive for the A-B or T power supplies, with pin 3 negative.

The SMPTE Audio Recording and Reproduction Technology Committee is requesting manufacturers to provide equipment according to the existing international standards so that new equipment will be correct. It is recommended that users of the older *Nagra* equipment use external power supplies for condenser microphones, wired correctly. If only one microphone is to be used, the microphone should be according to the standard wiring, but a specially marked cable can be used which reverses pins 2 and 3 at one end using the XLR-3 connector. This is the only way the older built-in preamplifiers should be used.

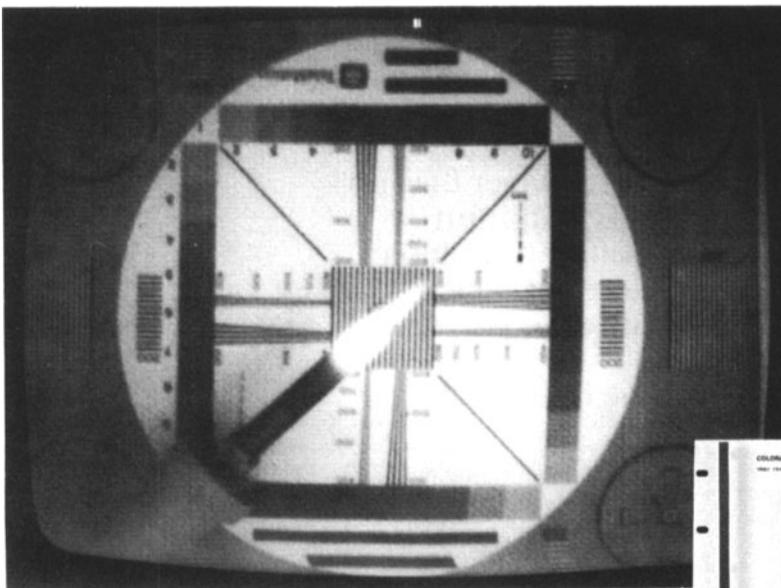
It is hoped that studio sound departments will make a special effort to check the phase polarity of all their microphones. This can be accomplished by first making one dynamic microphone into a comparing standard. Then, with two channels of a mixer, compare the standard microphone with all other microphones. Two in-phase microphones will add, whereas out-of-phase microphones will subtract when held with their diaphragms side by side.

One standard suggests the following method for creating a comparing standard: Using a dynamic microphone that does not contain an output transformer and that allows a visual indication of diaphragm motion, determine the polarity and terminal connections that cause the diaphragm to move inwards. The in-phase terminal is that terminal which results in an inward diaphragm motion when a positive voltage is applied to it. This will be pin 2 of the XLR-3 connector. A 1½-V battery can safely be used with a microphone having an impedance equal to or greater than 150 Ω.

*The IEC 268-4-1972 European standard and the U.S. standard ANSI/EIA RS-221-A-1979.

**IEC 268-12-1975 and DIN 45-595-1979.

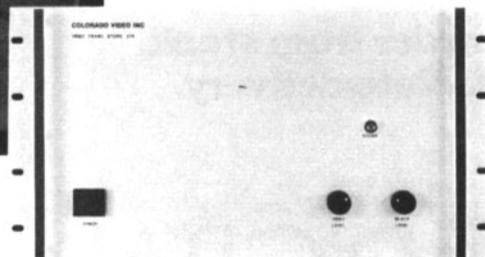
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