Monitoring Audio Distribution

• The audio output of the modulation monitor is an important signal because this represents the program, at the output of the station, that is now on its way to the public. Since it is an important signal, it is distributed to various places within the station where it serves a number of different purposes. This month we will discuss this distribution and some of the methods and problems involved.

SIGNAL USE

The primary function of the signal, of course, is aural monitoring, but it will be put to other important uses also. It is vital that the operator make sure that the program is on the air and *hears* what it sounds like. There's a similar need to monitor the air audio from other operational positions, so the air audio is distributed to the control room, as well as to the news room and recording booths. Besides these positions, the air audio is also channeled to various speaker locations throughout the building by a house monitoring system.

Although aural monitoring is an important function, the audio produced by the modulation monitor is often also recorded for various reasons, for example, air checks, a verification tape of a special program or speech, or by slow speed audio recorders for program logging or verification.

THE SIGNAL

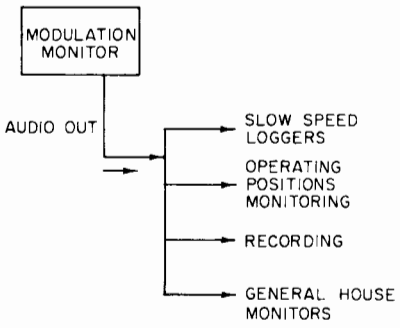
The audio which the modulation monitor provides—the station's program audio which has been demodulated from the transmitter's modulated carrier—makes the modulation monitor a very special off-air receiver.

There are no operational gain controls on the monitor; the amplitude level of the audio output is controlled directly by the modulation of the carrier wave. If, for example, the audio were very loud and distorted or perhaps very low, adjustments of the audio *ahead* of the transmitter are required—not of the monitor, since the monitor is an aural monitoring facility, not an audio amplifier. Should the announcer be busy gathering program material instead of watching the meters and there is a sudden change in the audio heard from the monitor, this *change* in level will alert him to the fact that something is wrong with the modulation and requires his attention.

OUTPUT LOADING

The audio output stage of the modulation monitor provides a signal level

Figure 1. Some typical uses for off-air audio.



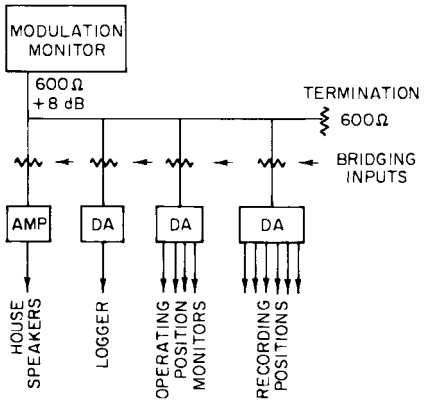


Figure 2. A typical d.a. system. The type and number of d.a.s. depends upon system needs.

of +4 or +8 dB (according to the model) into a 600 ohm load. This level is not high enough to drive a speaker directly, although it is suitable for earphone monitoring and is a standard broadcast program distribution level. As a standard level, it can be handled by normal distribution methods.

The manner in which the distribution is done will have a direct bearing on both the quality and amplitude of the signal available at various locations. Here we are talking about the load presented to this output stage by the various distribution circuits connected to the monitor. Unless this is done with care, too many low impedance loads may be connected across the output stage so that it is looking at a near short-circuit. This would severely overload the stage, cause it to draw heavy current (and possible create damage), resulting in a signal level at various locations that is so low as to be unusable.

CROSS TALK

When monitor audio is routed throughout the studio system for various purposes, this must be done carefully so as to avoid crosstalk problems. The monitor level is a high level signal, so its routing should avoid microphones or other low level circuits. Particularly when the audio has been amplified to speaker levels for distribution, extra special care must be taken since this is a very high level and it can crosstalk into normal high level program channels.

Crosstalk is undesirable in any audio system, but the monitor audio is also the output audio of the station and so it has some additional factors of phase

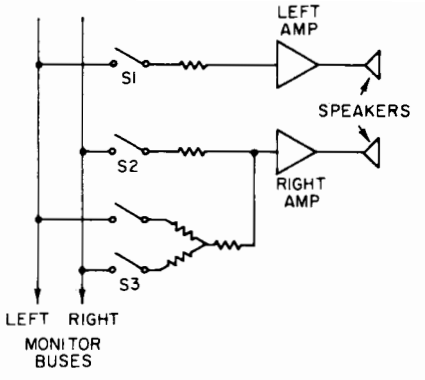


Figure 3. A switch arrangement can be set up to monitor left or right channel alone, in normal stereo fashion, or bridged together for a SUM or mono signal for detecting phasing problems.

and time delay. When this audio couples to earlier sections which carry the same audio, the delay can produce an echo in the resulting audio signal. If the crosstalk is in phase with this earlier audio, then we can have plain old fashioned feedback oscillations.

DISTRIBUTION

The distribution of the air audio depends upon the station and its needs. A very small station, for example, may only have one or two speaker locations, so the audio may be simply routed to the control room and to one or two speaker locations. But a larger station may be dispersed over a wide area and will also require the audio for many other purposes. This requires some type of distribution system.

When a considerable amount of distribution is required, the best arrangement is a system made up of d.a.s (distribution amplifiers). There are several commercial models to choose from when designing a d.a. system, so the station should have little problem in selecting those that will fit its needs. Individual amplifiers are available in a variety of configurations, for example, one-in/one-out isolation amplifiers, one-in/multi-out amplifiers, some with gain and others as unity gain. Most of these will provide for both a bridging input or a terminating input.

An important consideration in the design of a d.a. system is the output driving stage of the modulation monitor. If all the d.a.s in the system are to perform adequately, their input levels must be consistent. The best way to handle this is by using the output of the monitor to drive only a single 600 ohm-terminated bus—nothing else. All other distribution, whether by d.a.s or through other amplifiers or loads, should be bridging connections to this bus. With all connections bridging, am-

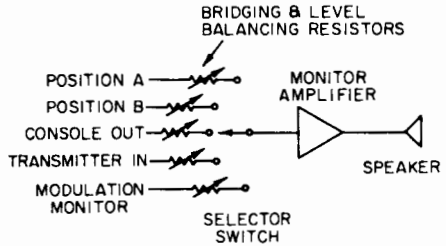


Figure 4. A multi-switch monitor test arrangement. (May be part of a console or added to a console.)

plifiers or loads can be connected or disconnected from the bus at any time without affecting the signal levels on the bus, or the rest of the system.

HOUSE MONITORING

Distribution throughout the station for general house monitoring is usually done with a power amplifier driving a speaker distribution system. A number of locations, such as the control room, have their own monitor amplifiers. These monitor directly from the air monitor bus. The house monitor feeds speaker locations throughout the building which have less importance than the operating positions.

A simple speaker system that requires only one or two speaker locations can simply connect the speaker by running directly to the power amplifier output terminals. The impedance tap should match the speaker or speakers. Remembers that when more than one speaker are in parallel, the output tap must be selected to match the combination impedance. If two 8 ohm speakers are parelleled across the output, use the 4 ohm tap of the amplifier.

For a larger system of many speakers, either the 70.7 volt or the 25 volt constant voltage distribution is normally used. This is not a difficult system to design and the component parts are readily available. The design parameters for the system are these: the distribution bus is a constant voltage bus (either 70.7 or 25 V)—the amplifier maximum power rating is divided up among all the speakers of the load. Each speaker connects to the bus by a transformer which matches the speaker to the bus and, through primary taps, channels the desired power to the speaker. Power distribution does not have to be equal, but the total of the power distributed must be equal to the maximum power rating of the amplifier.

STEREO

A station in stereo distributes the

monitor audio by stereo and sometimes by a SUM (monaural) signal. There can be a number of locations where the stereo is not needed, so the left and right are properly bridged together to provide a monaural feed.

For testing and other critical listening, there may be at least one monitor position which can monitor the left or right channel separately, in normal stereo fashion, or SUM the two for checking on phase conditions. Such a test position may be at the transmitter, or perhaps in the shop. By the use of a stereo amplifier and speakers, and by a suitable switching arrangement at the monitor's inputs, these various tests can be performed. By SUMMING the channels, a tape recorder that has the head leads out of phase, for example, can be easily detected, for as soon as a tape that was made on this machine comes on the air, the signal will suffer a serious drop in level at the output of the SUMMED amplifier.

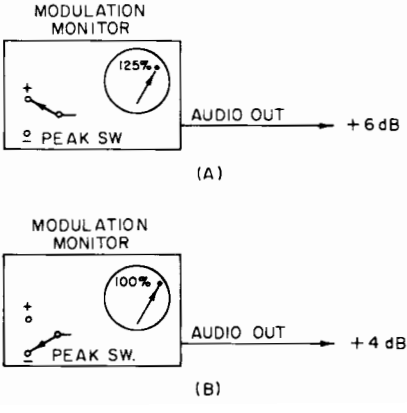
The important factor in stereo distribution is retaining proper identity of the left and right channels and maintaining the correct polarity of each of the runs.

TESTING

Any large audio system will have a test arrangement so that audio from various parts of the system appears on a selector switch to feed a monitor amplifier and speaker. The modulation monitor output should be on one of these switch positions. An arrangement such as this allows for "switching through the system" and gives an excellent before and after observation of the program over the program path. For troubleshooting problems of distortion and poor response curve, such an arrangement can help quickly to isolate the problem to a particular section of the system.

To be most effective, the audio from each of the sources should be at the

Figure 5. Asymmetrical modulation is about 2 dB difference between positive (A) and negative (B) modulation peaks.



same level as the switch. This will not require changing the amplifier gain each time. All inputs to this switch should be a bridging arrangement and also use these resistors to balance the audio from different busses so that the output of the switch is of the same amplitude in each case.

ASYMMETRICAL MODULATION

A situation peculiar only to the a.m. station is the asymmetrical modulation technique. With this technique, the negative modulation peak is limited to 100 per cent, while the positive peak is limited to 125 per cent modulation. The audio output from the a.m. modulation monitor depends upon which peak is selected for observation by the monitor. If the modulation peaks are hitting 100 per cent respectively, there is about a 2 dB difference in the audio output signal between these two. For normal system operation, the station should decide which peak will normally be observed by the monitor and the switch left in this position. If the engineer happens to notice that the air monitor bus seems to be low but the modulation appears correct, he should check out the position of the monitor switch. Someone may mave forgotten to place the switch back into the correct monitoring position.

SUMMARY

The off-air audio is an important signal that will be distributed to many places in the station for monitoring and recording purposes. This should be done by a properly designed distribution system that will deliver the signal to where it is needed and at the correct levels, but watch out for crosstalk into program channels. ■