

## Studio Maintenance -- Getting Started

One day as you walk into work, one of the jocks (you know who, the one that's always complaining) corners you about how one of the cart machines doesn't sound right.

"Hey, Bob, that cart number 1 sounds funny. Can you do anything about it?"

"Well, maybe. What's it doing?"

"Whenever I play a cart in it, there's no bottom end. It sounds shrill, but kinda muffled."

"Does it stop at the right time?"

"Yes."

"I'll look at it later. I've got to get to the transmitter site to clean the tube socket in the aux."

You both go your separate ways, but you think to yourself that the jock should clean the wax out of his ears. On the other hand, the jock thinks that you've brushed him off and nothing will be done to the cart machine until the second Tuesday of next week.

This is a fictional story, but based on reality. Many engineers pay much more attention to the transmitter than they do to the studio equipment. The transmitter is kept clean and purring like a kitten, but the studio gear is only worked on when it completely fails. Some engineers would be hard pressed to tell if some of the audio gear is working right, since they do not have the right test equipment or know what normal operation is for the equipment.

Yes, the transmitter is important, and the heat is really on when it's down, but is the studio equipment any less important? The cart machines, consoles, turntables, CD players, and other studio gear all contribute to the sound of your sta-

tion. If your station is hard to listen to, people will tune out quicker, and that will be reflected in the ratings. No, you won't increase your ratings with better studio maintenance, but at least you won't decrease them, either.

"But I'm already overloaded with transmitter work, remotes, and other things," you say. Maybe you are, but then again, maybe it is just an excuse. Perhaps you don't feel comfortable working on audio gear, or even around other people. Many times you have to work on studio equipment when other people are trying to use it, so you get in each other's way. Could better scheduling on your part, or perhaps even a cooperative approach help solve the problem? You will have to answer that.

So, where do we start? We start with you, the engineer. You have to come up with an intelligent plan for studio maintenance. Just fixing things when they break is not adequate. You need to keep them from breaking. The solution to this is two-fold:

1. Know your equipment and what normal operation is for it.

2. Anticipate problems before they develop and deal with them.

In order to keep a good working relationship with others in the station, and to allow yourself to get some quality work done, schedule a time for studio maintenance. If you only have one control room and nothing else, this may be difficult, but it is absolutely necessary. If you don't work on the equipment before it breaks, it will break, and probably when least convenient for all concerned. If you have more than one room that can be put on the air, it becomes easier to schedule. You may only need an hour or two at a time, or you may need more time, but be sure to schedule it. If you don't schedule it, you will sooner or later end up getting in someone's way and eventually getting them mad at you. Work with your on-air staff and your production staff to come up with a mutually agreeable time. If they don't want to cooperate, convince them that you are doing this for their own good.

Getting to know your equipment takes time. Ideally, you should make a complete performance check on every new piece of equipment that enters your station. Keep this on file for future reference. Look in-



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side the equipment and find out how to open it for service quickly if you have to. If you don't have a complete service manual, get one. If you have more than one item of the same type, number them for easy reference.

Every piece of audio equipment is a little different. Two supposedly identical tape recorders will behave in slightly different ways. Manufacturer's specifications are usually not a good indication of normal performance, but are really a minimum performance standard. I have seen many examples of equipment working within the manufacturer's specifications, but it was not working properly. This is usually an early warning of more serious trouble to come.

Good record-keeping is important to knowing your equipment. You may not work on a certain piece of equipment for over a year, and by then you have probably forgotten most of what you knew about it. Keeping good records will help solve this problem.

The way you keep your records will depend on what you have available. A good computer data-base system helps with quick retrieval and cross referencing of information, but is frequently not where you need it. A manual file can contain some things (such as frequency response charts) that are difficult to store in a computer data-base system. However, a manual file can become bulky and more difficult to use.

Keep a file for each piece of equipment. This should include complete check-out data when new, a record of all service performed on the equipment, and data from periodic performance checks. Of course, manufacturer's data such as model and serial number, date purchased, and your own refer-

ence number should be included. The type of check-out data required is different for different types of equipment. The information included by the manufacturer in the specification sheet should serve as a guide to what is useful information.

Keep another file for quick analysis and trouble-shooting. This record should be keyed to trouble symptoms you have encountered on certain types of equipment, such as cart machines. Knowing the problem that was encountered, the brand and model number of the piece of equipment that had the problem, and the eventual cause and cure may help you find the cause of a similar problem in the future on another machine. As you use these files you can fine-tune the system to be the most useful to you. Remember that these files are only as good as they are complete. Failure to enter information in the file, using the excuse "Oh, I'll

remember it next time" is the best way to make the file useless.

Audio maintenance requires audio test equipment. You may already have some of it on hand, but there are a few items that are frequently missing from an engineer's arsenal. Each piece of test equipment has its own use, and you can frequently get by without certain items. Let's look at this equipment and the function of each item.

**1. Audio (sine wave) generator.** You need to be able to produce fairly low-distortion sine waves (less than .01% THD) to test most audio equipment. Better audio equipment will require lower distortion levels to show the true performance. The generator should be able to provide a number of frequencies across the audio band, and should do so with virtually no variation in output level. Other considerations should be evaluated in choosing a generator, such as balanced or unbalanced outputs, output impedance, range of output levels available, and multiple outputs.

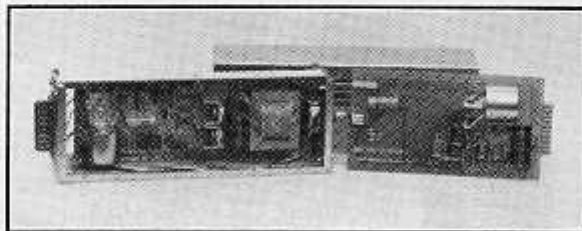
Sometimes you can get IMD (intermodulation distortion) test signals from the same generator for little additional cost, and this is helpful for some testing. So-called function generators can be helpful, but generally do not have low enough distortion figures for audio testing. Some people have advocated using a special test CD (compact disk) to generate test signals, and they can be useful in a pinch, but do not give you the best versatility.

**2. Audio meter.** You need to be able to measure your audio levels accurately, and this is the device to do it.

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Many multi-purpose meters claim to do audio, but be sure to check the frequency response of the AC range. This should be flat up to at least 50 kHz, if not higher, to allow for accurate measurements in the audio band. Input sensitivity is an important specification as well, since the audio levels are frequently in the millivolt range. Many newer digital meters provide a very useful option of reading AC (audio) in db. This is made even more useful with a relative mode, which allows you to set a reference and make all readings with that as your zero.

**3. Distortion analyzer.** A distortion analyzer allows you to determine the amount of distortion on the sine wave being fed to it. This is an important indication of how well a piece of equipment is working, especially analog tape recorders. You need to be able to resolve distortion at least as low as your generator, if not lower. Most distortion analyzers are primarily for THD (total harmonic distortion) but some are made for IMD (intermodulation distortion). If you can only have one, THD is the one to get, but IMD has its own set of uses. Most distortion analyzers have some filtering capability to help weed out hum and high-frequency noises which can give misleading readings. All THD analyzers need to provide some nulling of the fundamental frequency (they notch out the fundamental frequency and read what is left) and this can be either manual or automatic. Automatic is usually more expensive, but it can save a lot of time. Frequently your distortion analyzer can double as an audio volt-meter.

**4. Oscilloscope.** A scope that is good up to 500 kHz or more is a great time saver when trouble-shooting audio equipment. It can help

pin-point a problem quickly. However, a scope has very little use in simple performance testing.

**5. Wow & flutter meter.** This is the simplest and cheapest way to check the mechanical performance of analog tape systems. Any increase in wow or flutter is indicative of a bad bearing, pinch roller, motor, guide, or anything else in the tape path. A few simple tricks with one of these can help you locate the offender in a matter of minutes. Flutter is a frequently over-looked parameter in broadcast studios, but it can really make you sound bad on the air.

**6. Test cables.** I cannot over-emphasize the importance of good test cables. I have seen good engineers waste hours of valuable time looking for the right audio adapters and trying to get a hum out of a piece of equipment that was due entirely to incorrect hook-up. You should have a set of cables to go from your test equipment

to any type of audio connectors you may encounter, such as XLR, RCA, and phone plugs. Using adapters is just asking for trouble, since they provide more chance of a bad contact. Make sure they are properly wired to eliminate hums and allow them to work as intended.

If you need to add to your test equipment, and are working on a tight budget, don't give up hope. Keep your eyes open in used equipment directories and at local ham fests. Some great bargains can be obtained if you are patient and informed.

A number of manufacturers are now making some very sophisticated audio test equipment, much of it computer controlled. While this equipment is rarely found on the used market, it has certain advantages that make it worth considering. Depending on the specific equipment, many common audio tests can be automated, saving quite a bit of time. Also, some of these allow for easy data collection and presentation in graph form, which can be a useful part of your service records. You will have to decide if the time savings are worth the extra cost.

We have discussed scheduling regular maintenance with the on-air and production staff. When your scheduled time comes, be there and be ready to work. Have a list of the equipment you are going to work on and what you are going to do with it. Keep track of what you get done, and what you don't. Remember that while a control room is made up of a number of pieces of equipment, they have to all work together. Make sure you test the entire system, as well as the individual pieces.

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No matter how good your regular maintenance is, something will break eventually. When it does, you may not be there, or you may have more pressing things to do. Many times a malfunctioning piece of equipment can be worked around for a while, thus not having to call you in. Sometimes it is vital that the item be fixed immediately.

When someone finds something that is not working correctly, or that they think is not working correctly, have them fill out a trouble report form. Keep these forms in a handy place, so there is no excuse for not using them. Have a place for them to be put to get your attention quickly, such as on your shop door. The form should contain information as to the piece of equipment and its identification number (if used), time and date the problem is noticed, nature of the problem, and who is making the report. Include a response section that has the date and time you receive the report, your findings, and the date and time the report is cleared. We use a three-part carbonless form. The first copy (white) is for engineering files. The second copy (yellow) is a response to the person initiating the report. The third copy (pink) is put on the machine when the report is filed and should only be removed when the problem is solved. This alerts others to the possibility of the problem.

Getting everyone to work with a system like this takes time, and you will have to be consistent and prompt with your responses. After using this system for a while your people will learn that it gets results. Just think how much easier this would have been than our opening fiasco.

Probably the single most important part of studio maintenance has nothing to do with engineering. It is communication. Learn to communicate with your co-workers and management. Let them know that the work you are doing is to help them do their jobs easier and more efficiently.

When they have a complaint or comment, be sure to give them a response, not just a put-down or a brush-off. They will then be better able to understand just what it is you are doing and why you are doing it. That will lead to more confidence in you, and maybe (no promises) that long-awaited raise (or at least a good "Atta boy").

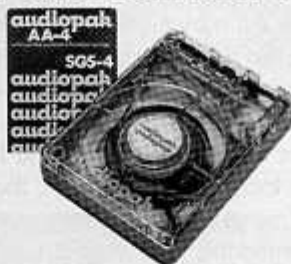
A well-planned and well-executed studio maintenance program is much more visible, and just as important, as good transmitter maintenance. Knowing your equipment and how to test it properly will help keep the plan moving, and good communication to others will keep them informed as to what you are doing.

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