When Good Things Go Bad - Troubleshooting With a Cool Head

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This happens to everyone at some time or other – it was working fine the last time you used it, but it's not working now. In the good ol' days, most recording engineers were also good technicians and troubleshooting was all in a day's work, but that's rarely the case today. More people are coming to recording or live sound from a non-technical background, and today's equipment is more complex in function, design, and construction than it used to be. Going behind the rack, finding a cold tube, and swapping it out to get the session running again just doesn't work any more.

Today's modern studio equipment, even budget priced gear, is highly reliable. Solid state components have nearly an unlimited lifespan unless they overheat or get zapped because of an upstream problem. While there were some problems with offshore manufacturing early on, most modern hardware is pretty well built and doesn't fail because of loose or broken pieces. More often than not, a problem that pops up unexpectedly isn't a hardware failure, but something external.

In time of panic, common sense often fails us, but with a cool head and a logical approach, you can solve most problems and get back to work promptly. The first step to solving a problem is to isolate it. Let's look at common failure points and how to locate them.

What's The Problem?

There are some obvious failures (though not necessarily for obvious reasons) like the tape doesn't move or the there's an incomprehensible error message on the device's front panel display or on your computer monitor. Many faults with symptoms like that have unique solutions and require troubleshooting tools and techniques beyond the scope of this article. Problems that you can usually solve quickly fall into two broad classes: Either something's dead (or nearly so), or you're hearing something that you know isn't right such as distortion, hum, unusually low or high output level, or extraneous noise.

If a problem shows up immediately after you've made a change (moved or extended a cable, added another device in the signal chain, updated a piece of software, etc.) that's a clue, but it's not always that obvious. Let's get down to the business troubleshooting, assuming that there's a real problem, not a "caused" problem. Most troubleshooting techniques are obvious as you'll see, but the trick to solving a problem is to eliminate the possible causes in a logical manner.

Dumb Stuff

Is it plugged in? Is the power switch on? This isn't as condescending as it sounds. Everything used to have an on/off switch and a pilot light, and we were accustomed to turning anything on before using it. In today's cost-conscious designs however, if a piece of gear consumes fairly little power, the on/off switch, along with a pilot light, has gone by the wayside (except on retro gear, bless 'em). The presence of primary power isn't as obvious as it used to be. The "Green" movement may change this, but a lot of gear in my racks is switched on, along with a few other pieces, by a power strip.

Things are always getting moved around and it's easy to inadvertently dislodge a power connector (or any connector for that matter). Conventional power cords are usually pretty reliable, but for devices without a captive power cable (like the nearly universal IEC power cord), moving something in the rack might have snagged the power cable and pulled it far enough out of the chassis connector so it's no longer making contact. Check both ends of a power cable. Wall warts are notorious for falling out of power strips in the back of the rack or in a dark corner of the floor, nor do their connectors usually lock securely into the equipment they're powering.

More than once I've spun my wheels tracing out an input path to a signal processor whose only visual indication that it's working is a signal-present LED, only to find that its power cable had worked loose. One of these times, I'll remember to check that first.

Oops, Wrong Button

Is a mixer channel muted, or not assigned to the output you intended? Are you trying to record on Track 4 but with the signal actually going to Track 3 because the pan pot is turned the wrong way or you forgot to move a patch cable? Is the recorder switched to Input Monitor when you're expecting to hear playback? Is something patched into the signal path that's turned off or set incorrectly? More obvious stuff of course, but don't ignore it – it's only obvious once you find it. We all make dumb mistakes now and then. Just be sure that you actually have a problem before you go looking for it.

Cables

Cables and connectors are the most common source of problems. No wonder - a typical 8-track setup with a modest patchbay might involve nearly 100 cables with 200 connectors, each containing two or three wires soldered or crimped at each end. That's a lot of potential failure points. Cable faults can manifest themselves as several different kinds of problems.

An unbalanced cable with an open signal lead almost always results in a complete loss of signal (though occasionally it can be an intermittent loss), but if one signal lead of a balanced cable opens, the results are less predictable. Depending on the configuration

of the source and destination equipment, you might lose the signal entirely, have a substantial loss of both level and low frequencies, or it might just result in a 6 dB signal loss, which could go unnoticed for a while.

A shorted cable can also cause varied symptoms. With a short between the signal lead and shield of an unbalanced cable, you usually lose the signal. But with a "high resistance" short circuit of a few ohms, (for example if one fine strand of the shield has worked loose and is barely touching the signal lead) the result may be a drop in signal level and some distortion, but not a complete signal loss. A short between the two signal leads in a balanced cable will usually result in no signal, however a short between the shield and one of the signal leads unbalances the connection. This might cause an increase in hum or noise pickup, a drop in signal level, or, depending on the configuration of the balanced output, might not audibly affect anything at all.

1/4" phone jacks are very common these days, and their quality varies widely. While they nearly all work fine when they're new, contacts can lose their springiness with age. After a while the jack won't grip a plug snugly, particularly if the jack normally has a plug living in it. Even the best plugs and jacks are subject to the evils of dust, dirt and oxidation. A jack-to-plug contact usually doesn't fail in a way that causes complete signal loss, but more often the connection becomes intermittent, causing the signal to come and go. A high resistance contact resulting from dirt or corrosion can cause the contacts to act as a semiconductor. This can cause distortion or static-like crackling as well as a drop in signal level.

Normalled patchbay jacks as well as channel insert jacks which have the send and return normalled have mechanical switch contacts built into the jack. These contacts make a connection between input and output when there's nothing plugged into the jack. Normalling contacts can get dirty too, particularly if they're not used (either with a plug either nearly always in or nearly always out). Distortion and crackling in a signal that passes through normalled jacks means it's time for a cleaning. Mixers and channel strips often have insert jacks that you've never used, and you may not even realize are there – one example is an insert jack ahead of a subgroup bus. A problem could exist for a couple of years without your knowledge until you assign something to that subgroup.

Isolating the Problem

Short of a major disaster like a lightning strike, most troubles can be localized to a single fault - a cable, a connector, one channel of a multi-channel device like a mixer, or a single stand-alone unit. Your first task is to find out which part of the system has failed. Here, I'm talking "system" like everything that's between the input and output. Start with the big pieces before opening up the case or posting on the Inteernet "Does anyone have a schematic for ….?" You may fix the problem in the process, but if you don't, at least you'll be able to focus your attention on where it lies. Replacing a bad

cable is simple once you find it. Repairing a faulty digital signal processor is usually a job for the manufacturer or an authorized service station.

Most problems can be stated simply: You're certain that you have input, but no output. Logical troubleshooting means tracing a signal from source to destination and determining where it gets lost. Most of the time, you can do this without any special test equipment, using what you already have in the studio.

Suppose you just sang a killer vocal. Hitting playback to bask in your glory, you hear nothing but your backing tracks. What happened? And will it happen again? Let's take a look at a hardware example first, since it's easier to troubleshoot (even on paper) when you have real connections and real indicators as opposed to virtual signal paths in a computer.

For the sake of this exercise, let's say you have a typical 8-track studio setup with a few outboards and a patchbay. The multitrack recorder might be a computer, the mixdown recorder might be the same computer, a handheld portable digital recorder, or even a DAT, CD-R recorder, or cassette. You might have direct connections rather than a patchbay, but the techniques are the same in any case.

Read The Meters

Your system has several built-in tools for monitoring signal level, or at minimum, for checking for signal presence. An indication on the recorder's record level meter shows that the signal got from the mic through the preamp or mixer and to the recorder. As an old-timer, checking meters as I work is second nature to me, but today the only meter available may be buried under a couple of layers of software screens. Don't ignore it as a test tool, however.

With the recorder set to Input Monitor mode (most DAW software also provides this function – it's often called something like "tape monitor mode"), speak into the mic, and watch the record level meter. A normal signal level means the chain is OK up to the recorder and the problem lies either with the recorder itself or in the playback chain. If there's no signal getting to the recorder, it's time to take a look at the input signal path. No signal at the recorder suggests that either the recorder is defunct or you need to look backward along the chain toward the microphone.

What's in the signal path? There's the mic itself, the mic cable, preamp (which may be outboard, in the mixer, or part of the DAW audio I/O interface), and the cable between the preamp output and the recorder input. If there's a patchbay, there will be additional cables and normalling contacts or patches in the path. You can start troubleshooting at either end, or even in the middle, but you must be systematic or you're likely to miss something.

A troubleshooting procedure that works well for me is to try an alternate signal path and see what works. Instead of using the mic preamp as the source, temporarily connect another signal source (a keyboard or maybe a CD player) directly to the recorder's input. If that tickles the meters, you know the recorder is working and the problem is between the mic and the recorder input. Try patching the mic preamp output to a mixer input or directly to the monitor amplifier (watch out for feedback!). If you have the mic signal, you've narrowed the problem down to the cabling between the mic preamp and the recorder, either a cable itself or a patchbay jack or contact. If you still don't have signal, check the mic cable, the mic, or the preamp.

When substituting signal sources, it's important not only to reroute the signal, but to do it using known good cables. Connecting a good keyboard to the recorder through the existing preamp-to-recorder cable (which might actually be the bad apple) when you're not sure that the recorder is working properly could be misleading. When you still don't see an indication on the record level meter, you won't know if it's the recorder or the cable.

After you've verified that the recorder is capable of indicating the presence of a signal, you can start putting your input signal chain back together piece by piece and you'll quickly locate the faulty link.

If everything is OK up to the recorder, then the problem could be in the recording process itself, otherwise it lies on the playback side. Again, the recorder's meters are your first troubleshooting tool. Switch to Repro Monitor mode, start playback, and watch the failed track's meter to see if it's indicating the presence of a signal on tape or on disk. If it's not, load up another tape with something on that track (or open another file) and check for playback.

If the problem track doesn't play back with your known good tape or file, take another look at the meters. If the meter indicates that there's something there and you're not hearing it, you have a problem with the playback chain and it's time to do some more troubleshooting, piece by piece. If the meters still don't indicate, it's time to send the recorder to the shop or troubleshoot the computer.

Try connecting the track output (with a known good cable of course) directly to a different input - the tape return on a different mixer channel, a different line input, or auxiliary return - anything that you can route to the monitors. If you can then hear playback from that track, start putting the normal path back together a link at a time until you find what breaks the chain. By the way, you can plug a set of headphones into just about any ¼" jack and hear something if there's a signal present. You'll probably hear it in just one ear unless you've plugged into a headphone jack, but it's a quick check for a signal.

Another approach is to work the other way - substitute a keyboard or some other signal source for the recorder playback. If you can hear that, you know the console is OK. If you can't, try connecting your test signal source to a different tape return or line input.

You might have a console problem or a wrong button pressed. Moving the test signal back along the chain toward the tape deck one link at a time will verify all the cables and connectors in the path are OK, or point you to the bad one.

Those Pesky Intermittents

Not all cable and connector problems produce solid failures. Sometimes it seems that a problem just goes away by itself, but you can be sure that some time it will return to haunt you. Intermittents can be the nastiest of problems because you have to convince them to fail when you're looking for the fault, not just when you're trying to get some important work done. A poor solder joint can cause intermittent distortion or crackling. A cable that's been flexed so many times that its shield or a conductor is no longer solidly connected can cause intermittent hum, noise, or total loss of signal in a normally quiet system.

The most common approach to locating an intermittent cable or connector is to tug and wiggle the cable and unplug and reconnect the plug. Sometimes, try as you might, you just can't get an intermittent to fail. Don't forget about it though. It'll be back again some day, and your troubleshooting luck might be better then. In the meantime, pulling each plug in the guilty chain and giving its jack a shot of contact cleaner spray before reconnecting is good preventive medicine.

Wall Warts and Power Supplies

If a unit has failed totally (no lights or display as well as no output) and it's powered by a wall wart, that could be its problem. They don't last forever. A common failure mode is a break in a wire right at the connector or the lump, where bending stress is greatest. You might find that by pushing and wiggling the cable right at the point where it joins the connector or power unit you can bring a unit back to life intermittently. A break right at the wart end of the cable usually calls for a replacement of the whole assembly. A break at the connector end can be repaired by cutting the cable behind the break and replacing the connector with a new one. If it's a DC wall wart (most are), before you solder on a new connector, be sure you know which terminal is positive. Your multimeter will help here.

A word of warning – there are a whole lot of different sizes of coaxial power connectors, so be sure to get the correct replacement. It must be the correct diameter both outside and inside. Radio Shack® stores have a measuring jig for these connectors (if they can find it) which will help you to identify the proper replacement (which they may not sell). The power jacks on the equipment have a way of loosening up after a few years, too. They can be replaced, but it's not always easy.

Virtual Reality

I've been talking about tape decks and VU meters, but a computer-based DAW setup, while lacking those servicable hardware components, performs the same functions, so the same troubleshooting techniques apply. All recording programs and computer audio interfaces have some sort of metering, though it may be minimal, or a mouse click or two is sometimes needed in order to make the meters to appear. Back when computers were less powerful, often turning off metering, which needs continuous updating in order to be meaningful, made the difference between a clean recording and one that stuttered or clicked. That's not so much the case with today's powerful computers, but still, some users prefer a less cluttered display and rarely look at the meters. You can nearly always verify that something was recorded on a track by looking at the waveform display, but if nothing's there, you won't know if it's because the program didn't record or if a signal never arrived at the recording input. That's where meters come in handy.

Digital connections aren't as friendly to test equipment as analog connections – you can't plug headphones into a Firewire or ADAT Optical output and hear something. When troubleshooting a computer-based system, it's often impossible to determine whether a problem is within the computer or with something external. If you've eliminated problems with external hardware or cables, you're still left with determining if the computer-related problem lies in the hardware itself, the operating system, related software components like drivers, the application program, and input or output connector, or the user (that's you). All too often, a problem turns out to be that a setup parameter like an input-to-track assignment was inadvertently changed and you simply didn't notice.

Sometimes installing or updating a program can make changes to the existing system configuration, causing something that was previously working to stop working. Consumer "multimedia" software such as media players or games don't have much respect for sophisticated multitrack audio recording applications - they try their darndest, when istalled, to make sure that something comes out of the loudspeaker when you start the game or movie. If you've lost audio playback from your DAW, think about software you've installed recently. A new program may have changed the setting that sends audio to your high priced sound card, diverting it to the built-in sound card that it expects every computer to have.

In general, software doesn't break, but things can be changed without your knowledge (or maybe you just forgot what you did last time you were working). Files on disk can be corrupted, but this rarely happens spontaneously. Scrambled or lost data is usually the result of another problem that needs to be fixed before you can successfully restore the files. There may be an impending disk drive failure, a loose or dirty disk cable, faulty memory, or a malicious program that somehow crept in.

"Get the latest drivers" or "Get the latest version of the program" is one of the most common pieces of net (and Tech Support as well) advice when your computer based DAW stops working. This is definitely a valid recommendation when installing a new

program or a new piece of hardware and can't get it working. However, if things have been working fine and and then doesn't, unless a file has become corrupt for no good reason, reloading or updating software usually won't fix the problem and may cause a new problem.

Open Heart Surgery

While many problems can be traced to bad connections, now and then a piece of real hardware dies. More and more hardware is less and less user serviceable, but there are still fuses that can be replaced and internal connectors or socketed IC's that can be reseated.

If you're handy with tools, remove the cover and look around. If you see ICs installed in sockets, it never hurts to press them down to refresh their contacts. Often fuses are mounted in clips inside the equipment rather than in panel-mounted fuse holders. They're easy to replace once you find them. While fuses occasionally die of old age, most of the time when a fuse is blown, its replacement will blow and you'll need to find out why.

When it comes to working under the hood, the usual warnings about shock hazard, electrostatic discharge, and voiding warranties apply (If I had lawyers, they'd make me say that). Be sure the unit is unplugged before removing a cover. Examine the case screws carefully. Some that look like common Phillips head are actually Reed and Prince, a cross-slot with a different taper. A Phillips screwdriver will work if they're not too tight, but may slip out if you need to apply a lot of torque, bungling up the screw head. What look like Allen socket screw heads might actually be Torx or some other "secure" type screw which requires a special driver in order to keep people like us from messing with the inner workings. If you're going to try a DIY repair, at least have enough respect for the manufacturer to use the correct tools. It's a good idea to have a few containers for the screws that you remove, particularly if they're of different diameter or length. A muffin pan is great for this, as are pill bottles or tin mint boxes.

If you're inclined to doing some internal troubleshooting, get out your multimeter and start checking voltages both at the input (AC) and outputs (DC) of the power supply. Equipment must pass safety inspections and certifications today in order to be sold in either the US or Europe so there's going to be a reasonable amount of protection from shock hazards even with the case open. In fact, it may be so "safe" that you'll have difficulty measuring the AC input to a power supply. Still, be careful when working inside a powered-up unit. Power supply problems typically result in total failure, though if the power supply provides multiple voltages, voltage might be present for the lights but not the audio circuitry, or vice versa. Or phantom power may be missing. Often there are separate power supplies (though they may be in the same enclosure) for analog and digital circuitry. Sometimes power supply inputs are fused, sometimes outputs, sometimes both (check for a dedicated phantom power fuse). Fuses are best checked by removing them (power off first!) and measuring for continuity.

If it Ain't Broke

You've surely heard the expression "If it ain't broke, don't fix it". A corollary when it comes to troubleshooting is "If you don't fix it, it's still broken". Most problems are easy to fix if you don't go around in circles solving them. I've given just a couple of examples here, but a systematic approach works every time. May all your failures be simple ones.