Radio Guide

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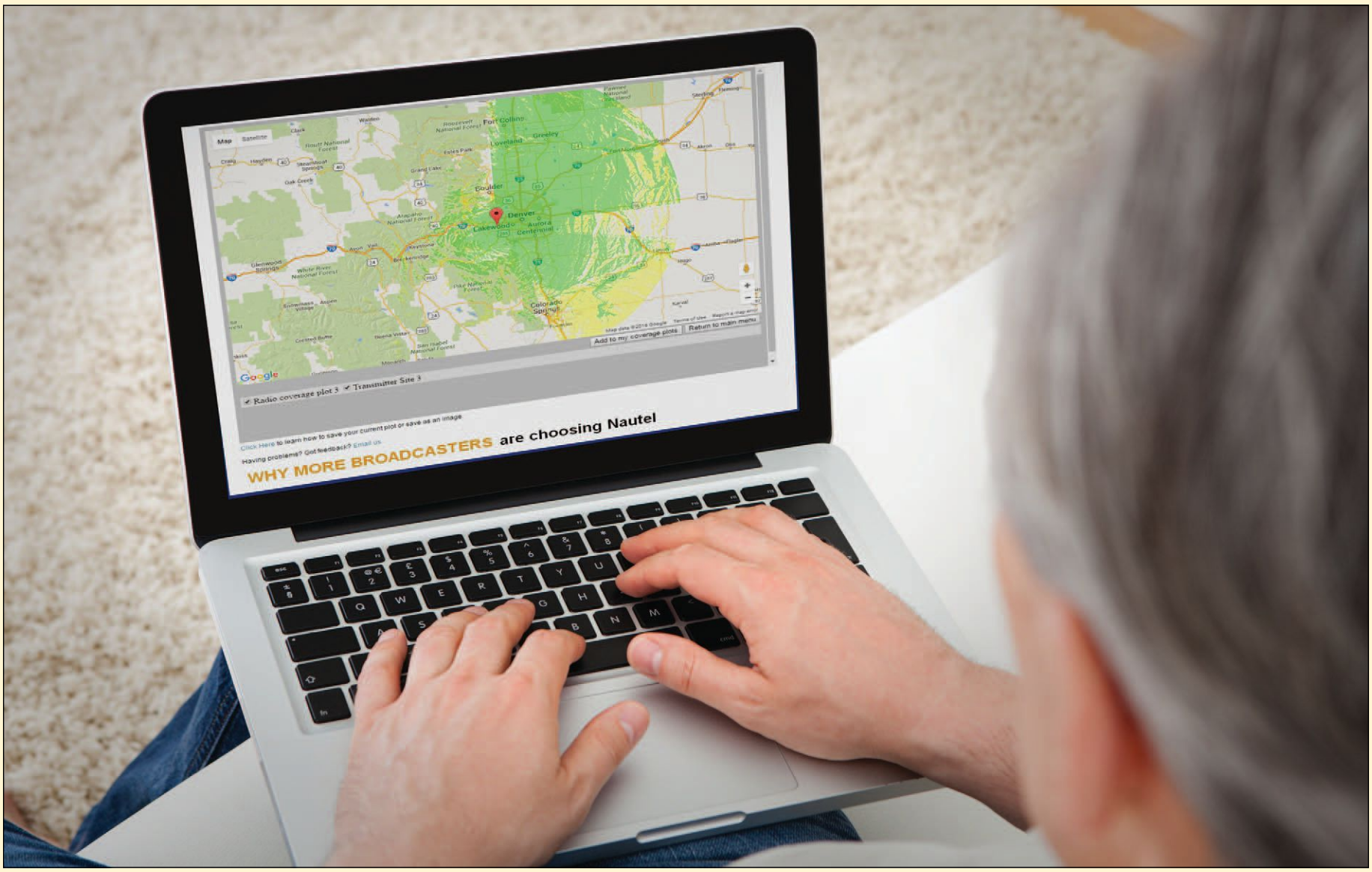
Digital Issue Now On-Line

July-August 2016 – Vol. 24, No. 4

Nautel RF Toolkit Answers Coverage Questions



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\di-jə\wi-jətz
noun

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2. really cool digital widgets that work great!

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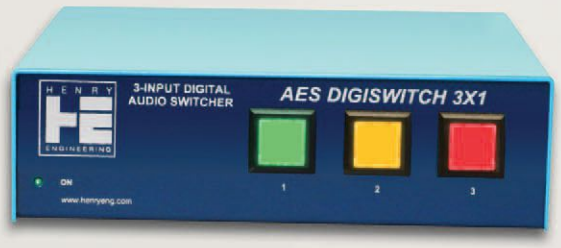

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Cover Story

Nautel RF Toolkit Tools Answer Coverage Questions

by Elaine Jones – President, Elaine Jones Associates

If you have any sort of work coming up at your transmitter facility – a switchover to HD Radio™, a change in antenna height, a new STL receive location, or perhaps that power increase you applied for ages ago – one of the many concerns you'll be facing is your signal coverage. Not only is it important for your station from an economical standpoint, it's critical to make sure you aren't interfering with other signals.

Before you call the consulting engineer to help do a thorough analysis and prepare your final plan (and you should always do this), it's a good idea to run some simulations to make sure your plan won't be derailed before it even gets started.

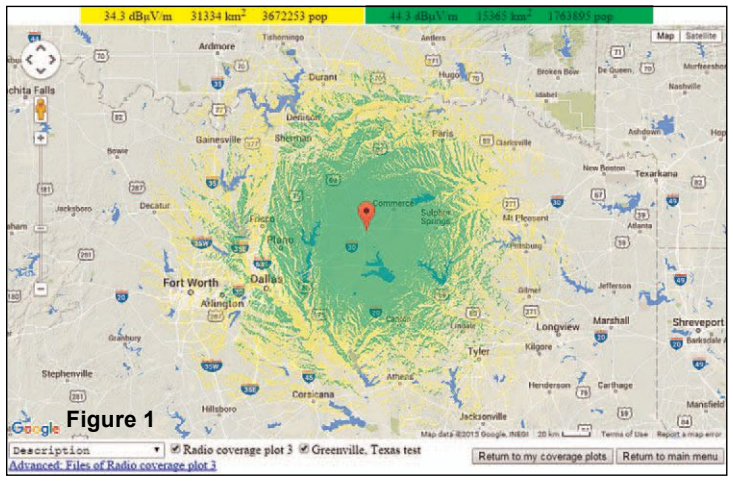


Figure 1

Nautel offers a free service for running those simulations as part of the company's on-line RF Toolkit. Originally introduced by Nautel in 2012 and updated several times (including a significant update this year), the Radio Coverage Tool and the HD Radio Calculator utilize powerful databases and easy-to-use mapping software to provide simple, fast coverage mapping and point-to-point analysis.

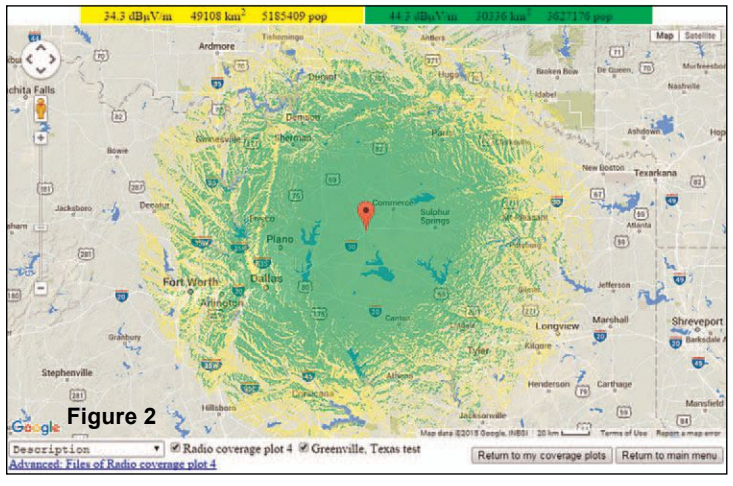


Figure 2

FM/TV Radio Coverage Tool – How Far Will Your Signal Go?

The Radio Coverage Tool includes topographic maps and population density information, and will give you a good idea of both audience coverage and whether you have a clear point-to-point path. The Radio Coverage Tool employs the Longley-Rice ITM Terrain method, which incorporates a gigabyte of digitized terrain database gathered through radar topography scanning from space shuttle missions, as well as ground cover information. The tool overlays population statistics provided from UN studies. While not guaranteed to be 100% accurate, these databases have been made as accurate as possible.

Developed for Nautel by Canadian engineer Roger Coudé, the Radio Coverage Tool has pull-down menus for antenna type, transmitter type and power, along with other options. The Nautel Coverage Tool is a simplified version of his Radio Mobile, an advanced terrain and coverage program for amateur radio operators. The available frequencies cover common FM, TV, STL and RPU broadcast bands.

A few simple steps will set you up with a free on-line account at Nautel. From there, you can create transmitter sites, save your information and edit sites at any time. Sites can be pinpointed on a map with geographic coordinates, map view and satellite view. Once a site has been identified, the parameters for the site are entered: frequency, antenna center height above ground, transmitter/antenna system and the type of receiver system for the coverage plot (for example, an FM car radio). Click on "Submit" and the coverage will be calculated. The generated map takes into account the terrain, showing reception "shadows" as well as coverage at different receive signal strengths. If you save your coverage plot and then re-open it, the tool adds information about the area covered for each contour, as well as the estimated population within that contour.

The sample map for an antenna randomly located in Greenville, Texas assumes an antenna at 100 meters up a tall tower, with a 20 kW FM transmitter and 4-bay antenna. Current population statistics are also shown at the top of the coverage plots for 34.3 dBµV/m (shown in yellow) and 44.3 dBµV/m (shown in green) at the defined receiver **(Fig 1):**

All other things being equal, if the antenna were placed considerably higher on the tower – say 300 meters – the potential coverage could be this **(Fig 2):**

Of course, this is a hypothetical location which does not consider the legality or practicality of this location; it is shown only to illustrate the differences in settings on the Radio Coverage Tool.

Another practical application of the Nautel Radio Coverage Tool is determining point-to-point signal strength for STLs and other RF devices. In this application, two transmitter sites are defined including the antenna center height, frequency, transmitter power, line loss and antenna gain, and receive antenna gain and line loss. The minimum receive threshold and required reliability are also entered. Nautel recommends leaving the required reliability number at 70%; this allows the fade margin calculations to define the reliability.

After submitting the parameters, you will receive a large page of information including a profile of the path which shows the terrain. The color along the ground identifies landforms and vegetation; white ellipses are the calculated Fresnel zones which help to note the effect of ground reflection on the path; a green line, such as the one shown in **Figure 3**, indicates that the signal is above the required threshold.

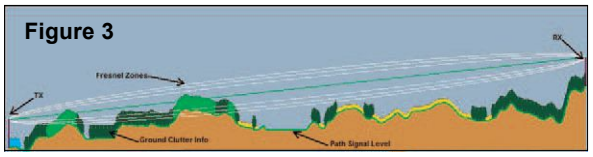


Figure 3

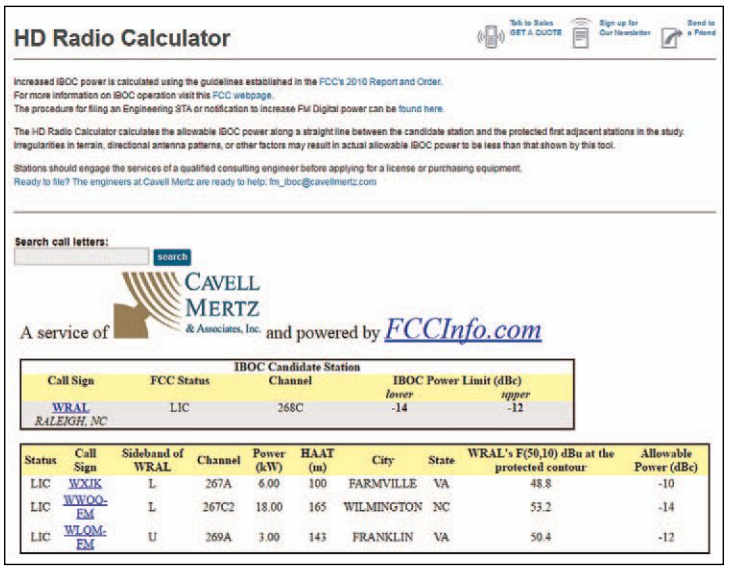
Other data supplied on the page include geographic results of the analysis, RF calculations (also known as the link budget) and the actual calculation of the fade margin, followed by an overhead view of the path.

An update to the RF Toolkit in early 2016 allows you to generate a printable coverage report which consists of a chart of technical parameters selected (including both the area and population within each selected contour), a zoomed-in coverage map, and a zoomed-out coverage map. If you use the Chrome browser, you should be able to save the report as a PDF file as well.

HD Radio Calculator – Can You Increase Your IBOC Power?

The HD Radio Calculator was originally developed by NPR Labs and is now hosted by Cavell Mertz & Associates, Inc., a broadcast technology consulting and engineering firm. Cavell Mertz updates its broadcast database weekly, including both commercial and noncommercial stations. The database includes pending applications as well as licensed facilities. Nautel's Gary Liebisch explains the value of this calculator: "While all stations are permitted digital power of -14 dBc, higher powers are possible with a showing that no interference will be caused to adjacent channel stations. The tool provides a first look at which adjacent channel stations, if any, would impose limits on a station's desired sideband power."

Mr. Liebisch notes that the HD Radio Calculator was designed to be fast and easy to use – just enter the call letters, and answers pop up. An example is shown below for WRAL in Raleigh, North Carolina:


HD Radio Calculator

Increased IBOC power is calculated using the guidelines established in the FCC's 2010 Report and Order.
For more information on IBOC operation visit this FCC webpage.
The procedure for filing an Engineering STA or notification to increase FM Digital power can be found here.

The HD Radio Calculator calculates the allowable IBOC power along a straight line between the candidate station and the protected first adjacent stations in the study. Irregularities in terrain, directional antenna patterns, or other factors may result in actual allowable IBOC power to be less than that shown by this tool.

Stations should engage the services of a qualified consulting engineer before applying for a license or purchasing equipment.
Ready to file? The engineers at Cavell Mertz are ready to help: fm_iboc@cavellmertz.com

Search call letters: search

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IBOC Candidate Station				
Call Sign	FCC Status	Channel	IBOC Power Limit (dBc) lower	upper
WRAL RALEIGH, NC	LIC	268C	-14	-12

Status	Call Sign	Sideband of WRAL	Channel	Power (kW)	HAAT (m)	City	State	WRAL's F(50,10) dBu at the protected contour	Allowable Power (dBc)
LIC	WXJK	L	267A	6.00	100	FARMVILLE	VA	48.8	-10
LIC	WWQQ-FM	L	267C2	18.00	165	WILMINGTON	NC	53.2	-14
LIC	WLQM-FM	U	269A	3.00	143	FRANKLIN	VA	50.4	-12

The HD Radio Calculator calculates the allowable IBOC power along a straight line between the candidate station and the protected first adjacent stations. Cavell Mertz cautions that irregularities in terrain, directional antenna patterns, or other factors may result in allowable IBOC power to be less than what may be initially indicated.

Caveat Emptor!

The Nautel RF Toolkit is intended to aid broadcasters in analyzing approximate coverage and determining potential IBOC sideband levels. While the RF Toolkit uses well proven modeling techniques and databases, it cannot be guaranteed and Nautel cannot assume any liability for the results. Please consult with a qualified consulting engineer before applying for a license or ordering equipment.

For more information, visit: www.nautel.com

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Studio Site

VoxPro Popular

Wheatstone Gives Editor a Makeover

by George Zahn

The radio giveaway contest, be it tickets, cash, or other goodies, is decades old. In the eighties and nineties, it became vogue to record the winner – usually caller number something – and play back the excitement on air. Problem was that no one really wants to hear an extended conversation with the winner (except maybe the winner him or herself). Being able to quickly and efficiently trim the conversation to fit over an instrumental intro or jingle trailer was a real issue in the early days.

In 1991, Seattle DJ Charlie Brown modified a Mac computer to record, and do some rudimentary editing of callers, so he could play their voices on air. It helped create concise, punchy, audio drops, and became a groundbreaking "value added" to radio programming. Brown and a colleague Buzz Hill collaborated on making something that could be marketed to broadcasters and, in 1993, a company named Audion Laboratories was born. Since the first "VoxPro" unit in 1994, the device has grown to be a widely used device.

The VoxPro evolved into a simple, fairly intuitive controller, with simple record and play commands, a jog wheel and shuttle controls and basic edit commands. Some program hosts can use that basic user interface to turn a caller into a drop for air in less time than an expert typist can type, "The quick brown fox ..." or than I can struggle through the first letters of "QWERTY..."

Full Circle With 360

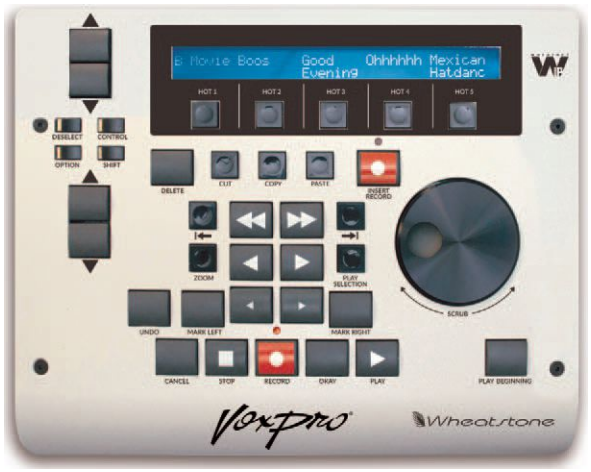
There are other devices that do similar work such as the newer 360 Systems Instant Replay 2, and some vintage 360 Systems ShortCut editors that are still in use out there. Does anyone else still remember the abject joy of tucking an editing device, complete with speakers, under your arm and taking it just about anywhere to edit? Compared to audio apps we have today, it seems silly, but I remember editing an interview in a hospital waiting room while a family member was undergoing routine surgery.

These recorders/editors offer some simple two-track editing, head and tail trims, highlighting then cutting or pasting, fades (in and out), and even audio level manipulation. These devices allowed DJs to record, and quickly edit contest callers and phone-in requests for easy playback. The 360 Systems device's hardware included up to 50 on-board assignable hot keys for sounders, sound effects, and other staples – from the wildest morning zoo to the most staid fine arts format.

Another device that has been used widely is the SADiE, acronym for Studio Audio Disk Editor. The SADiE system was used for larger applications and dates back to the days when Roland was first introducing the older DM-80 and others were coming out in the '80s. The SADiE seemed more widely used for multi-track digital production.

Wheatstone Whistles

The newest version of VoxPro, the VoxPro 6, has some new bells and whistles, and was a hit at the NAB 2016 show. Audio console manufacturer Wheatstone acquired Audion's product in October of 2015, and added some features that had been requested, without changing the basic interface. Keeping what has worked for many DJs and hosts is a big plus. The control unit, which has a relatively small footprint (8.25 x 10 inches) is now black. In addition to adding a sleeker look, it likely shows a little less residue from users' finger oils. It also matches the Wheatstone surface colors for other devices in the company.



Having seen a few demos of the device, Wheatstone's choice to keep the controls "as is" is a keystroke of genius. It allows those hosts already using one of the older VoxPro products to almost seamlessly transition to the new box, as stations might upgrade. The package from Wheatstone includes software (now on PC platform, not Mac) and the VoxPro6 controller. The list is just under $2,900.

The minimum PC criteria is not too hard to hit: a P3 or better processor (P6 highly recommended), Windows 7, 8, or 10, DirectX 11, a few USB ports, Microsoft.Net Framework 4.0, a minimum of 4GB of RAM and a decent size hard drive – each GB of hard drive space will yield a little more than 90 minutes of recording time. It's obvious that Wheatstone is gearing for worldwide distribution in that it has added a wide variety of languages for the software.

Left Versus Right

One of the neat features of the VoxPro 6 is the left-right assignability when recording. Many stations have the phone interface, hence the caller, go to one channel and the mix minus or microphone of the DJ to the opposite channel. Even if the caller talks over the DJ or vice versa, the tracks can be manipulated individually to make the segments less congested and fix what may be an otherwise unusable segment.

The same feature allows the DJ to fix his/her flubs when speaking to the caller. In a matter of seconds, the DJ can re-record a comment or question to the caller after the caller is gone, so that they can make the conversation more concise or correct a misspoken word or phrase. It can be done with a few simple key strokes on the controller with a decent graphic display on the PC. The discreet channels also allow for easier level adjustment between caller and host. Keeping the caller and DJ on separate tracks until playback really expedites the editing process and allows more facile editing than a strictly "to stereo" recording.

The monitor screen of the PC (PC and monitor obviously not included in the list price) can display everything from a detailed digital audio editing screen, to routing controls for recording into the VoxPro 6 to file lists. It can also display a series of hot keys which can be shown along with the edit window and file menu. You can also hide Edit and File features for a screen full of just Hot Keys, for those hosts who do not edit. You can copy, move, rename and delete as well. You can drop markers for editing purposes and color code them if needed. Undo and redo features are naturally part of the software.

Taming the Screamers

Some other additions to the VoxPro 6 include automatic silence remover, or "Gap Buster," effect. There are some other very handy features including a mute feature, a bleep, the ability to reverse audio, and normalization. Some basic reverb/echo effects are also in the package along with pitch change and time stretch, to help the recorded material hit the post. If you like to use Automatic Gain Control or even an expander, the unit has AGC that can allow the more quiet callers to be boosted – and tame the screamers.

While not every station will use these effects, it is a nice addition, as some stations double up on the VoxPro 6 to also do some basic quick radio production. You can also import and export most popular media files, including MP2, MP3, WAV, WMA, and AIFF, and there's a plug in to allow conversion of MP4 files.

Another use that has sprung from the use of one of these editing devices involves live event broadcasts, especially sports or press conferences. The marker features allows the user to drop marks at key points in the recording, for instance a dramatic home run or a signature sound bite from a debate or presser. That marker allows you to go back and grab/highlight the appropriate segment you want, create a new file from that selection, and assign it to a hot key for post-game or post-event analysis.

Background in the Forefront

So the questions are: "What happens if something else big happens while I'm editing the sound bite that I wanted? Will I miss what's happening during editing?" The solution to that Murphy's Law query is one of the notable features of the VoxPro 6. You can stop to edit a recording at any time and start a new file recording in the background, while you're grabbing your clip. The background recording starts over with a new file and does not affect or overwrite the already-recorded files. Many stations use this software and the controller for highlight shows and game wraps. You can basically select, trim, edit, and store your track all in one set of key strokes.

The unit also allows set up of password protected accounts for each host using the device. Another feature that some station may find attractive is the ability for the VoxPro 6 to be a basic multi-track editor/mixer, allowing for some basic spot production even when someone is already on the air. The multi-track allows for some fade-in and fade-out features, muting of selected tracks, and basic mix down and hot key assignment.

Wheatstone calls the VoxPro 6 unique, and it would be interesting to gain input (pun intended) from users who have been long time VoxPro users now switching to the VoxPro 6. Feel free to share some feedback on how well the old or new works for you and your station!

George Zahn is a Peabody Award winning radio producer and Station Manager for WMKV-FM at Maple Knoll Communities in Springdale, Ohio. He is a regular contributor to ***Radio Guide*** *and welcomes your feedback. Share your stories with others by sending ideas and comments to: gzahn@mkcommunities.org*

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Operations Guide

Avoiding the Single Point of Failure

Part 2 – Building a Studio Checklist

by Stanley B. Adams

Identifying and resolving Single Points of Failure (SPFs) is an important part of a broadcast engineer's job. In this follow-up, from page 26 of the Jan/Feb-16 issue, Stan Adams shows how to start a studio checklist for each part of the audio chain.

Finding and getting rid of Single Points of Failure may not be on the top of your To-Do list, but it should not be far from the top. A regular program to attack SPFs is essential to keep any facility running smoothly over the long haul.

We want to share some ideas and solutions that have worked for others. In this series, I have the favor of a number of engineers who have offered supportive suggestions – even a manufacturer chipped in with some helpful tips from experience.

Failure, Reduncdancy, Restoration

The concept of a Single Point of Failure is summed up in the following questions: How likely is any component in the program chain to fail? If one does fail, how likely is it to interrupt your programming – and how long will it take to restore service?

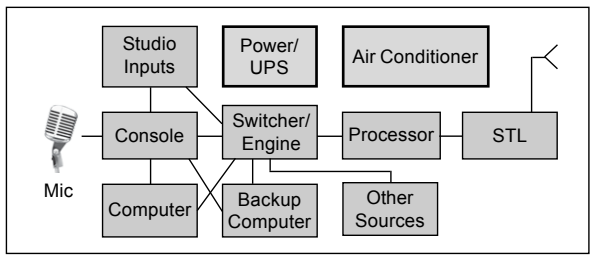
Components with a "soft failure" mode are best – keeping you on-air, even at a reduced capability. This is similar to "run flat" tires, which contain a solid rubber core that prevents a complete flat if the surface is punctured. They can only be used for a limited time at a reduced speed, but at least they still roll.

In evaluating the system, we also consider **Redundancy**. This means having backup components which automatically "kick in" should one component fail. For example, large cargo trucks can lose a tire – except for the front tires, which are used to steer – without major consequences. Of course, in many cases, cost becomes a significant factor in how much redundancy can be afforded.

And lastly, we consider **Restoration**. This word is, in a sense, contrary to our theme. But all engineers and even other operational people must know what to do when you have an actual failure along any point in your system.

A Systematic Approach

The best way to start is to look at the signal flow of your facility in a block diagram format. This sort of linear "picture" will help identify many of the SPFs you want to avoid.



A generic signal flow diagram.

If you start, as they say, at the beginning, there is at least one microphone. It is not often a microphone will fail in a studio, but it can happen. For example, what is your plan of action if your morning show gets silly and shoots it with a fire extinguisher or a stun gun? Then, too, microphone cords can and do fail from constant handling.

If either situation happens, how would you get audio back on the air? And how quickly?

Some announcers might think fast enough to grab a cord from the Production Room, but only if the cord were accessible and easy to move. And, there is no reason for the Chief Engineer to have to come in at 3:00 a.m. when a competent board operator/announcer can do it with some preliminary training.

What is the best solution? A spare cord – or a spare microphone wired in the Control Room? Or, perhaps an "emergency bag" with a variety of cords and adaptors in a convenient place is the answer. As I said, each situation is different.

Hub and Spoke

Moving along the chain, not only the microphones but virtually every audio source filters through the console – or the engine in digital systems, where servers and hubs have matrix switching so any input may go to any output. With such a digital environment, we no longer think solely in terms of broadcast engineers but also of IT people being involved in the construction and operation of the studio gear.

Fortunately, like microphones, consoles are usually reliable. But one lightning strike could reduce the hub of your audio chain to a dead end.

One way to keep this SPF from knocking your station off the air is to pay special attention the connections with the outside world. Filtered power from a UPS, and surge suppression on the audio or Ethernet cabling, goes a long way to protect the electronics.

Spare Hub

Some stations wire the production console so that it can be switched quickly to the air chain. Sometimes the Production Room is laid out exactly as the Control Room to make things easier. Analog systems may feature a patch bay to connect or bypass parts of the system. (Make sure patch cords are available!)

On the other hand, with digital systems, it is even possible for the engineer to use an Internet connection to bypass a dead console and switch another studio – or even a single source – directly to the program chain. Even a mono signal is better than nothing.

Some stations will have a mix of analog and digital equipment because they add equipment as they can afford it. Patching around some equipment may present the problem of matching the analog to the digital. Perhaps using a Henry or some other A/D converter will help you recover.

No matter what plan you have in mind, this is a place where proper documentation is crucial. It might be years before you need to activate a backup plan. Will you remember where each input and output are located? A posted Assignment Log (inputs, outputs, direction, purpose) will save a lot of time during an emergency.

... And Those Other Spokes

Each audio input presents its own set of potential concerns. If a computer provides the majority of your audio, there ought to be a plan for what to do in case of failure of a hard drive, sound card, power supply, etc.

A CD player or two in the control room might get you back up with "something" – sort of like the solid core spare tire – but to restore normal operations might well require more. A second, mirrored computer that can be brought on line and control all the program elements might be a better plan. More than a few stations are now setting up such a computer out at the transmitter, as a way to withstand a compete loss of the studio.

What about IT security? Is it possible for internal or external damage to disrupt all programming? This is receiving more attention daily because of outside links. If your programming equipment really needs to be on the Internet, a secure firewall is critical.

Depending upon the format, other spokes that feed the console hub might include telephone lines, digital editors, program loops, RPU receivers, satellite receivers, etc. Each of these needs to be evaluated for dealing with SPF issues. While some stations rely on a single satellite receiver (perhaps as they have but a single transmitter), it only takes that one lightning strike, for example, to cause a lot of dead air.

Handling Phone Woes

Talk stations should consider what happens if a phone cable is cut. If all the incoming lines are on one cable, anything from a backhoe to a fire could change your format in an instant.

Should something happen, do you or your staff know whom to call at the phone company to get a quick response from the repair crews? Meanwhile, recovery options range from separate cables to VoIP, or even a lash-up to get a cell phone or two into the console. Avoid putting all your eggs in one basket, so to speak. In a major power outage, you could lose VoIP – or a drained cell-tower battery could end that input source.

And how about your remotes and sports events? The equipment at some stations I know is generally thrown into a tote bag and forgotten about until the next time it is needed. Not only can you lose a lot of money (and maybe the client) from a "blown" remote, but it sure makes the station look bad to the listeners.

Batteries Not Included

One thing is certain: without power, you will have a hard time getting any audio anywhere. Power and UPS systems cannot receive too much attention.

This is why many stations have a flock of little UPSs, hanging off all the mission-critical stuff. But how would you know if they will keep you on the air if Mains power were to fail? For some stations, the SPF might be a battery in an old UPS. These batteries have a definite lifespan. So they need periodic checking and replacement.

Perhaps a better question: Will they last until the generator kicks in? Maybe even a better question: is there a generator available should the power fail? Or do you have a contract with a company to provide power generation upon demand?

If you are considering a small UPS system, what type of backup reserve time in hours are you planning to have ready? Time equals battery amp-hours divided by the load. As you do the calculations, you will want to be conservative and think in terms of about 80% of the rated capacity to supply your maximum use time.

Either way, once again, having the appropriate contact numbers at the local utility can save a lot of down time.

Get The Checklist Started

As you can see, we are only part-way through the studio evaluation; we have only considered the various program source originations. Once you start thinking about each component of the program chain, all sorts of things to consider pop up.

Since the goal is to help you develop a useful checklist that you can adapt to your specific needs, begin it with brief notes on the items discussed here. As you build your list, you can add points and comments to each item – documenting everything as you go.

Next time we will move further along the program chain and consider some additional studio issues that might come into play during an emergency. If you have some ideas, or thoughts on aspects we have missed, please send me an email with your comments. As we pool our knowledge and experience, everyone benefits.

You may contact Stan at: stanleybadams@yahoo.com

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Transmitter Site

Dehydrators 101

by Steve Callahan

I wish I had a dollar for every dehydrator that I have seen turned off or unplugged at a transmitter site. When I ask why the dehydrator isn't operating, the answer I get most often is, "because it runs all the time." Well, that should tell you something, shouldn't it?

A dehydrator isn't an intimidating piece of equipment. If you can trouble shoot a smoking transmitter, you can certainly figure out what's happening with a simple dehydrator. However, on a radio engineering discussion board recently, there was a revealing interchange about dehydrators. One engineer said his dehydrator wasn't working and another engineer responded with "plan on spending $1,000 to get it fixed." Another engineer responded, "just buy a new one." Well, that really tells you something, doesn't it?

Let's discuss why the dehydrator is even in your transmitter building in the first place. If you don't have foam-filled transmission line, you need to keep the line pressurized. The dehydrator dries out and pressurizes air that is then pumped into your transmission line, keeping it at a set pressure. It keeps moisture out and increases the power handling capability of the line. Some folks choose to use nitrogen to pressurize their lines, but that requires tank changes, and if there is a leak, an on-going cost. There are valid plusses and minuses for either system, but we'll focus this time on the dehydrator-fed system.

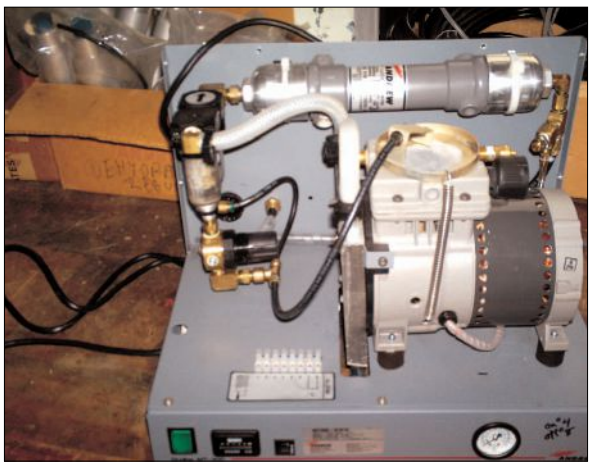
New Dehydrator

Your transmission line, whether it's hard copper line or flexible coaxial cable, has several important parts. If your FM antenna is also to be pressurized, there will be a "bleeder" valve at the top of the antenna, usually set to open at 10 pounds of pressure. You use it to bleed the air from the line if it's unpressurized for any length of time.

Next in line is the "gas pass" connector, which is usually located where the transmission line and antenna connect. It allows the air to travel up the line and into the antenna. Next comes the transmission line and then at the bottom is the "gas block" connector. That's where the pressurized line connects to the unpressurized part of your transmission system, which is usually inside your building.

The gas block is also where you get the pressured dry air into the line via a small brass fitting and a plastic tube from the dehydrator. All of these points, along with any connectors in the run of the line, are all potential points where the dry air can leak out and cause your dehydrator to run too much.

There are three basic sections to a dehydrator, no matter which manufacturer made it. It's the compressor, the desiccant for drying the air, and the pressure switch for turning the compressor on and then off when it reaches it's preset pressure. If your dehydrator is one of those that runs all the time, here are some tips to narrow down the cause of the constant run time.



Inside an Andrew dehydrator.

First, determine if your have a leak in your transmission line. There's no sense in taking apart the dehydrator if you have air leak somewhere up your tower. It's really handy to have a valve and a gauge permanently connected between your dehydrator and gas block connector. Turn off the valve and see if the pressure goes down real fast. If it does, call your favorite tower crew and have them come fully equipped with soapy bubble water. Turn the dehydrator back on and open the valve and pressurize your line. Have your tower crew check the line and antenna for any obvious damage and liberally soap up all the connectors to see if any large bubbles have formed. When you see bubbles, you've found your leak.

If the pressure gauge between your gas block and dehydrator does not go down that indicates that the leak is inside the building. The first place to look is the plastic tubing between the pressure valve and dehydrator. So many times that tubing gets brittle because of the heat and then cracks. Pull out the soapy bubble water and check the brass fittings on the gas block and on the dehydrator. Next, turn off the valve on the line and disconnect the dehydrator. Take off the top, sides and bottom, and look for anything obvious like loose connectors or cracked plastic tubing. Soap up all the tubing fittings and joints. Chances are very good that you'll find a loose connector, so have some small hose clamps handy. By the way, you can get almost all of the parts you'll need, like elbows, valves, and ferrules to fix your dehydrator, at your favorite home center. Look in the plumbing section for the brass or tubing fittings area.

If your dehydrator runs all the time, it's either because of a leak or the pressure switch is defective. I was at a beautiful transmitter site recently and when the site manager and I entered the building we heard what he described as "small arms fire" in the building. It was actually a dehydrator with a defective pressure switch. There's a high pressure blow- off valve in the dehydrator which should be set for ten pounds of pressure. Seems that dehydrator had a defective pressure switch which didn't stop the compressor, and it continuously ran up to the ten pounds the blow-off valve was set to. A quick trip to Grainger yielded a new pressure switch and a solution for less than $50.

I once had a real puzzling dehydrator problem. This station had a dehydrator in a most inconvenient location – on a shelf in the corner of a room, up by the ceiling. It seems that every time the dehydrator was turned on, the circuit breaker tripped. That sounds like a shorted compressor motor, doesn't it? Well, the compressor checked out just fine. However, the dehydrator had a 120 VAC Sonalert buzzer that was supposed to audibly signal when the pressure was too low. It turns out that the Sonalert was shorted and as soon as the dehydrator was turned on, and of course, the line pressure was too low, the bad Sonalert tripped the breaker. A new Sonalert was a quick and easy fix that solved the problem.

If you prefer, you can get complete rebuild kits from the manufacturer of your dehydrator and you can also get instruction manuals and parts drawings on-line. One extremely valuable tool when you work on dehydrators is an air pressure tank. It's really frustrating to try to work on a leaky dehydrator while it's still connected to the transmission line. A portable air tank, which is available at your local neighborhood home center, and is often used as a source of compressed air in a workshop, will make the job much easier when you make up the necessary connectors and fittings to connect the dehydrator under test to the air tank.

Dehydrators on the bench.

I once got called to an FM station with a non-functioning dehydrator, which was also suffering from increased reflected power. The black coaxial cable had a small leak and during the day the sun heated up the line and it pulled in warm, moist air. At night, the moisture in the now cool black line condensed and the water ended up at the lowest point in the transmission line. This whole scenario could have been avoided with an operational dehydrator that would have kept the line pressurized and also indicated a leak.

Steve Callahan, CBRE, AMD, is the owner of WVBF, Middleboro, Mass. Email at: wvbf1530@yahoo.com

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FCC Focus

- *Migrating radio public files to FCC's on-line site.*
- *Unauthorized advertising text messages.*
- *Failure to pay regulatory fees.*
- *Relaxation of rules limiting foreign ownership.*

by Peter Gutmann

One consequence of migrating radio public files to the FCC's on-line site has become apparent from the experience of TV stations. Recall that they were required to lead the way to the future by posting their public file material in the FCC's on-line website beginning in 2012.

Recently, FCC staff has been fining TV stations for failing to timely post quarterly children's programming reports. No longer do such fines await a field inspection or a public-minded citizen (or, more likely, a competitor) attempting to view the file and noticing missing materials. Nor does it await a licensee admitting a lapse in its license renewal application. Rather, the staff simply checks the on-line file from the comfort of their desks and can immediately and definitively see whether the file in fact is complete – and when lapses occurred in the past.

Once radio files go on-line (beginning this December for top-50 market commercial stations with five or more full-time employees), FCC staff can easily determine whether public files are complete.

One related warning – until now many licensees have been able to get away with inaccurately certifying on their license renewal applications that in fact all required materials were timely placed in the public file. Unless someone knew differently, there was no ground to challenge such a certification. But don't even think about failing to 'fess up in the future. Each upload to the FCC website is automatically dated and so its staff will be able to easily verify the accuracy of the public file certification at any point in time. Lack of candor remains high on the list of FCC sins and carries a heavy price.

Text Messaging of Ads

Speaking of paying a heavy price, you may have read that iHeartMedia has settled a class action lawsuit for having sent unauthorized advertising text messages to its listeners. (Although it admitted no wrongdoing, even large companies rarely pay $8.5 million just to avoid defending a nuisance suit.)

Apparently, after listeners would text song requests or contest entries, iHeart would text back an acknowledgment. That much was fine. But iHeart went further to include an ad in the return text. That part is not.

Here's the problem: the same Federal statute that seeks to limit telephone robo annoyances also prohibits most automated text messages containing advertising.

Text messages are treated the same as robocalls. Advertising may be included only if the texted party has previously provided its express written consent. That is a tough standard to satisfy. Merely initiating contact with a company doesn't suffice. Rather, consent requires a signed, written agreement specifying the phone number and clearly authorizing the delivery of ads via robotexts. Advertising is defined for this purpose as anything encouraging investment in property, goods or services. A text is considered an ad requiring written consent even if it is only a small part of a non-advertising message (such as a weather warning). Moreover, consent cannot be conditioned upon the purchase of any goods or services.

With that in mind, you can't couple consent to a contest entry, song request or any other value a listener might seek. And the need for a signed, written statement before any ad is texted effectively rules out permission contained in a text message, although electronic or digital signatures, including certain email, web forms, telephone keypress or voice recordings, may suffice. But the prior rules that had allowed consent by any means and assuming consent from a prior business relationship no longer apply. And once consent has been given, it may be revoked by any reasonable method, including orally.

If you do obtain valid consent, there is one further mandatory step to follow – keep good records. Should a complaint be filed, the burden is on the licensee to document consent.

Although non-profits are exempt from certain parts of the federal law, that exemption does not apply when commercial content is included in a text. Your state may also have its own rules, some of which may be even more restrictive than the federal law. And, as always, the law is more complicated than we can present in this brief overview. So unless you steer a safe course by avoiding any commercial content in your texts with listeners, do check with your attorney about your specific plans and procedures.

Texting is a fine way to engage listeners and develop "brand loyalty" to your station. It's also tempting to sell ads in every possible ancillary medium. But in this context it could be prohibited. And potential fines are steep – up to $1,500 for each text to each individual, which can add up very quickly to a frightening sum.

Pay Up or Else

Until now, a failure to pay regulatory fees meant having all facilities under the same FCC Registration Number (FRN) flagged with a "red light." That, in turn, meant that the FCC would process only requests for emergency relief until the debt was fully paid. And that meant that once action was needed (including on license renewals) not only the delinquent fees themselves, but a late-payment penalty of 25% plus interest and administrative charges had to be paid. In the meantime, the FCC would send a demand letter and then assign seriously delinquent debts to the Treasury Department, which would send its own threatening letters but otherwise generally didn't do much at all. And there it would sit, often for years, as a costly but open-ended loan accumulating interest until the licensee needed the FCC to act on an application or request.

That may be changing. The FCC recently issued an "Order to Pay" giving a licensee 60 days to pay in full or have its authorizations revoked. The amounts, from two separate years, were rather modest – regulatory fees of about $2,000 plus penalties, charges and interest. So it's no longer a matter of just having the FCC decline to process an application, but licenses themselves are in jeopardy. So if you're thinking of letting regulatory fees slide for a while ... maybe think again.

Those Growing Regulatory Fees

Speaking of regulatory fees, several broadcasters filed comments protesting the huge increase in several categories for smaller stations this year. One commenter, Robert Bittner, went further to make a constructive proposal that fees no longer be based on class and predicted population but rather on income – either a straight percentage applicable to all stations or a sliding scale of percentages increasing with revenue (and presumably profitability). Sounds fair, doesn't it?

And while we're at it, what's the logic behind a one-size-fits-all set of forfeitures (translation: fines) for FCC rule infractions? Under current procedures, any station with an inadequate tower fence, EAS log, public file, etc., gets hit with the very same fine, regardless of whether it's a struggling AM standalone or a hugely successful major market blowtorch. True, the FCC does have some flexibility and occasionally doubles a fine into a double wrist-slap for a billion-dollar company or cuts a fine if it would exceed 7% of a station's annual gross billing. But aside from extreme cases, shouldn't the impact of an infraction be adjusted so that it is felt evenly by small and large, weak and strong, rather than devastate the former and barely be noticed by the latter?

After all, the whole purpose of FCC fines is to deter future misconduct (at least that's the theory). So shouldn't there be a distinction between a wrist slap and threatening a licensee's existence?

The Aliens are Coming!

... or at least they might be! Last October the FCC proposed a substantial relaxation of its rules limiting foreign ownership of broadcast licensees. The Communications Act permits foreigners to own or control up to one-fifth of a licensee or up to one-fourth of a parent corporation. While the FCC is authorized to approve situations of greater foreign ownership or control, it rarely has done so.

The rulemaking proceeding proposes to enable broadcasters to justify up to 100% foreign control of licensees and 50% control of parents. It also proposes to use a variety of techniques to estimate the percentage of ownership held by foreigners in publicly-traded companies. The way was paved by a declaratory ruling last year in which the Commission relieved the parent of Pandora Radio from the need to prove that only 25% of its stock was held by foreigners, since it was a publicly-traded company and could not verify the beneficial owners of shares held by nominees.

Although the rulemaking remains pending, two broadcasters already have asked for relief to exceed the statutory threshold.

Frontier Media seeks permission to be wholly owned by an Australian couple who live in the U.S. and who currently own the statutory limit of 20%. Its petition raises several factors to justify relief – Australia presents no security threat, relatively few stations are involved (16 plus translators) in remote areas of two states, the couple has managed Frontier stations for a decade, they have compiled strong records of civic participation, the current owner is retiring and other purchasers are unlikely.

The other petition is from Univision, which wants to hold an initial public offering. Following the Pandora precedent, it anticipates difficulty in determining the nationality of investors. Indeed, it cites securities regulations that prevent it from obtaining that information.

Rulings on either petition may provide a signpost for the ultimate outcome of the rulemaking. The injection of foreign investment (or, for that matter, any new sources of capital) may result in higher values and stronger demand for broadcast properties. And that could turn out to be quite good!

Peter Gutmann is a partner in the Washington, DC office of the law firm of Womble Carlyle Sandridge & Rice, LLP. He specializes in broadcast regulation and transactions. His email address is: pgutmann@wcsr.com

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Chief Engineer

Adding a Rear Rack Support

by Scott Schmeling

Greetings from hot and steamy Southern Minnesota! (You seldom hear that from the "frozen northland!") We, as well as much of the country, are feeling the affects of a "Heat Dome." I hope you're all able to keep cool!

Before we begin the article for this issue, I'd like to share a few e-mails I've received. The first is from Glen (didn't include his last name) who referenced an article from 2014, listing some helpful hints that, I've "learned by accident."

Hello Scott:

I read your "Chief Engineer Some of What I know Article." (Mar/Apr-14) I use my empty medication bottles for nuts and bolts and "stuff." Nice article – Glen

Great idea, Glen. It's always good when you find a way to re-use things. It seems no matter how careful we are to put all those small screws and other pieces somewhere where they won't be disturbed ... they always are! Keeping those pieces in a medication bottle guarantees they will stay together. And you can put the bottle inside the unit if it's something you're setting off to the side while you wait for parts. Thanks, Glen.

Regarding the last article about installing an RF transfer switch, I got this from Steve Brown, a fellow engineer from the Minneapolis/St. Paul area.

Scott:

I just finished reading your article about the transfer switch installation in Rochester, and have a comment.

If you're not doing something in software or hardware to make sure there's no RF in the switch before it moves, you run the risk of hot switching, which gets expensive. At minimum, Mike Hendrickson found that with some brands of RF switches, where there are several sets of auxiliary contacts, that ONE set of those switches will open sooner than the others. Maybe this is because of the way the cams are laid out on the shaft? Anyway, it's a good idea to put an Ohmmeter on the switch contacts and then manually, slowly rotate the switch to see how far the switch rotates before the contacts open. This certainly won't prevent ANY hot switching, but may minimize the damage!

Steve Brown - Radio Rangers

You're absolutely right, Steve! I was working on the assumption that the transfer switch would usually be activated by an engineer at the transmitter site with first hand knowledge that neither of the transmitters was outputting RF. That's a fairly dangerous assumption. Especially since the transfer command is wired to the remote control. It's entirely possible that someone back at the studio could (even accidentally) press the button and cause the switch to change positions while one of the transmitters is up and running. *My Bad!*

At a bare minimum, the transfer command should run through steering diodes to shut RF off on both transmitters and activate the switch. Maybe better to wire the command through relays that would only allow the switch to change if *both* transmitters have no RF output. Or even better ... design a logic circuit that would send an OFF command to both transmitters (just in case) and after a short delay of two to three seconds, activate the switch.

On that same subject, I heard from Robert Tarsio of Broadcast Devices.

Dear Scott:

I enjoyed your article in the May/June edition of Radio Guide. I appreciated your explanation of the importance of interlocks and just how they behave and that you have to be mindful of that.

I wanted to call your attention to a product that we manufacture that may have been of some help for your install. Take a look at these links:

www.broadcast-devices.com/images/SWP200_Motorized_RF_SwitchController.pdf

www.broadcast-devices.com/RFProducts.html

The above link is for our very popular SWP-200 series motorized switch controllers. These are designed to work standalone or with our RF power meters. They are compatible with all motorized switches on the market, including the Myat switch you used in your installation. They provide interlock and Tx On/Off management for both main and standby transmitters, and provide for external load interlock paths such as the dummy load path that you wrote about. Not only do we provide the controller, we also manufacture prewired and tested switch interface cables for just about every switch available today.

Thanks again for a great article and feel free to reach out if you ever have a requirement that we can assist you with.

Best regards – Bob

Thank you, Bob. It looks like the SWP-200 would satisfy all of the RF and interlock requirements. And it would certainly reduce installation time since all of that interlock wiring would already be done.

In the last few months I've been in a situation where I have a piece of rack-mount equipment that is both heavy and deeper than my racks. The pieces in question come with rack-mount glide or slide assemblies. The assemblies are designed for racks with both front and rear rails and have a certain amount of adjustability to compensate for various depths. *But*, in three cases so far, my racks do not have rear rails *and* they're too short for the glide assembly. I probably *could* just mount the equipment in the rack and not use the assembly, but I figured that would put severe stress on the rack rails and the front panel of the equipment. Not to mention how difficult it would be to pull it *out* of the rack for repair.

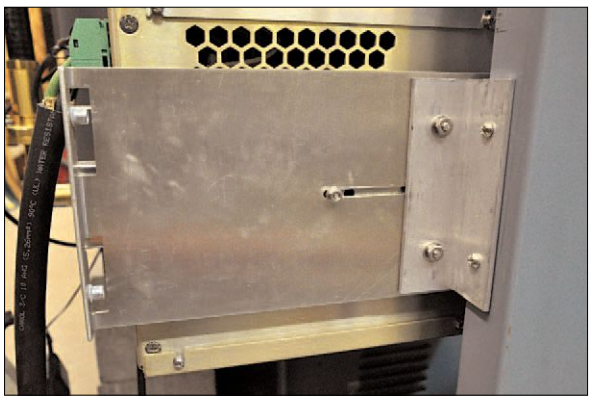
So it's unanimous (I agree with myself!) – the glide assembly must be used. But my rack is still too short and doesn't have the rear rail. How can I make this work? The solution is really pretty simple. In fact, I'll bet most of you have already solved the problem!

All it takes is a couple pieces of 1-1/2-inch or 2-inch angle aluminum and some mounting hardware. In a nutshell, you cut the aluminum to size so you can mount it to the glide assembly and to the back of the rack. But there's more to consider, of course.

My two watchwords are **center** and **level**. The distance between the two glide assemblies at the back of the rack *must* be the same as in the front. If they're closer together in the back, there may not be enough room for the equipment to actually glide (or slide) fully into position. Likewise, if they're farther apart it will likely pull on the glides and over time cause undue wear. Probably the most time-consuming part of the project is getting the space in back equal to the front - and *centered* in the space! It also all has to be level. If not, it won't "square up" with the front of the rack and might either slide closed on its own or slide out on it's own – neither of which are good.

The first thing I do is determine how long my pieces of angle must be and cut two pieces to that length. Then I drill holes in the two faces for the mounting hardware. I prefer to use 10-32 hardware, but that's just a personal preference. There are two things to consider before drilling any holes, though. First, be absolutely sure your mounting hardware will be above and below the equipment glides and second (again, this is more a personal preference) I like to have the holes slightly offset.

So far, I've only drilled holes in the angle. I really can't mount the angle to *anything* until its position is set. Again, those two words come into play – **center** and **level**. After determining how far in from the edge of the rack the side of the assembly must be, I use an adjustable clamp and a small level.



Once the angle is in place, I mark the position of the holes and drill. (I suppose if I bought one of those oval drill bits I wouldn't have to be quite as precise!) To mount the angle, I use the standard "flat washer/lock washer/nut" on the end of the screw. After double-checking the "center and level," the equipment goes in the glides and it's ready for installation.

I hope you find this handy and useful. Until next time ... have a great rest of your summer – and keep it between 90 and 105!

Scott Schmeling is the Chief Engineer for Minnesota Valley Broadcasting. You may email him at: scottschmeling@radiomankato.com

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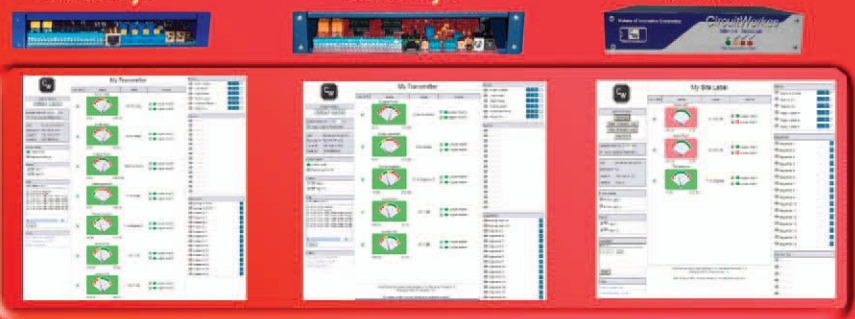
- Upgradable firmware. Keep your product current with downloadable updates!
- Streaming audio option encodes Ogg-Vorbis & decodes mp3 or Ogg-Vorbis.

SiteSentry4 SiteSentry2 WAM-2



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- DTMF-16 and DS-8 DTMF tone decoders.

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Small Market Guide

A No Nonsense Dummy Load For Your AM Station

by Roger Paskvan

As many projects in small market, this project started out as a typical routine operation that soon went bad. Our AM transmitter was having some troubles. To isolate the issue, I decided to connect a 1,200 Watt Bird dummy load to the beast, running it at 500 Watts for a test in order to see if our problem was at the antenna. Well, that was the easy part, since it all went down smooth, running a several hour test. I had just left the transmitter to get a bite to eat when the alarm company called saying, "you have nine smoke alarms going off at the station; fire department is on the way."

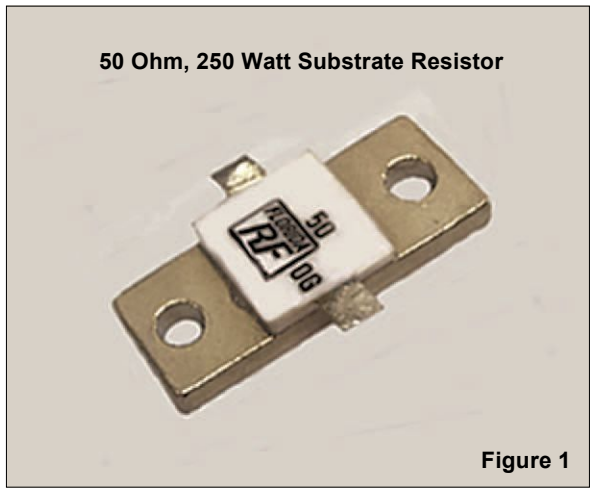

Figure 1

When they got there, there was smoke throughout the station and the distinct smell of oil everywhere. It seems, the Bird dummy load exploded and sent hot oil out of both ends, running through the transmitter over the nice hot tubes. Apparently there was some smoke picked up by the air intake of the nearby furnace and circulated throughout the station – this set off fire alarms in all rooms. The dummy load was toast; apparently it didn't like 500 continuous Watts for that long a time. A new broadcast load runs in excess of $4,500! That's a lot of cash outlay for something that usually just sits in the corner. Like everything else in smallmarketville, cost is a major thing to keep down – I needed a better solution.

So this story ends and a new one begins – let's build a 1,500 Watt dummy load, cheap. This new homemade dummy load was not to have oil and must run with air cooling. Utilizing some simple resistor theory, I came up with a schematic combination that would make 50 Ohms and handle several thousand Watts. Unfortunately, pricing on non-inductive 200 Watt resistors was out of sight so I resorted to E-bay, locating some two terminal 50 Ohm, 250 Watt substrate resistors from China at about $4.00 each in lots of 10. **www.ebay.com/bhp/rf-resistor (See Fig 1)**

DESIGN: The idea was to physically mount sixteen flat pack resistors on the smooth side of two aluminum heat sinks – eight on each. Mounting becomes tricky since you will have to drill and tap for each resistor flat pack – 16 holes on each heat sink for 6-32 screws. This is the only logical way to deal with mounting screws into the narrow slot spacing between the fins. A small pilot hole drilled from the fin side and taping the smooth side seems to work best. Buy several taps, since they don't like aluminum and you will break off at least one before you are done tapping 32 holes.

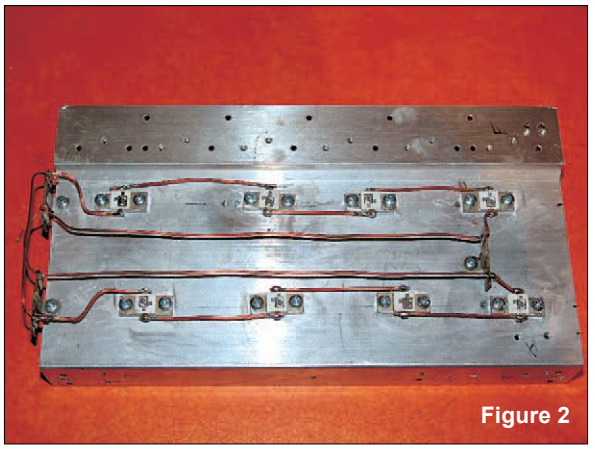
Figure 2

The resistor flat packs come with metric holes and you will have to ream with a 1/8-inch drill bit for each resistor. (Clamping them in a vise will make this job easier.) Once mounted, you will now have eight resistors equally spaced on the smooth side of each heat sink. Make sure you use a generous amount of heat sink grease under each flat pack. This is an important step since we want maximum heat transfer to the heat sink material. Make sure each resistor pack is tight against the heat sink surface. **(See Fig 2)**

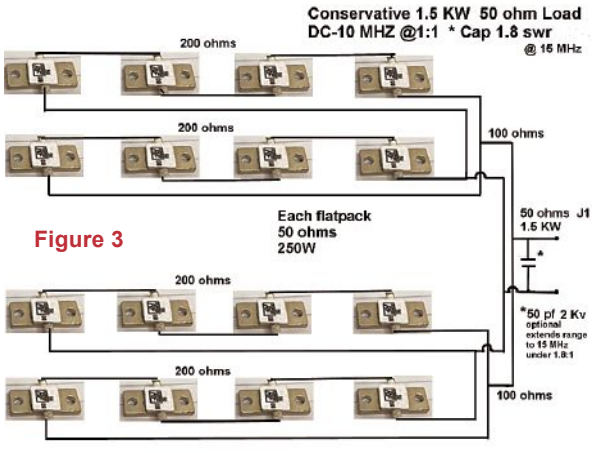

Figure 3

ASSEMBLY: These eight resistors on each heat sink were wired in series/parallel to end up combined to 100 Ohms, then both sides bridged in parallel to become 50 Ohms again. **(See Fig 3)**The resistors were soldered with #16 solid enamel wire using stand offs for dressing. The two sides are bridged across the front providing connection to the transmitter. Two RG58 cables with the center conductor removed provide flexible connections with battery clips on their ends. Both heat sinks are mounted on-end with sheet metal aluminum on the top and bottom making a long metal box, 5 inches on a side. A high volume, 116 CFM, 120 V fan is mounted on one end to transfer heat from the fins. Sheet metal was bent to hold the ends together and mount the fan. **(See Fig 4)**

Figure 4

The entire dummy load unit costs around $150 and will do 1,500 Watts all day. The theoretical power could be higher since the resistors are max rated at a total of 4,000 Watts. The problem is one of arcing since the resistor flat pack terminals are only spaced 1/8 inch above the aluminum heat sinks. Depending on the frequency, this power rating was de-rated to a conservative 1,500 Watts. If the input RF voltage exceeds 500 Volts (which it could at 4,000 Watts), one or more flat packs may arc, although I have not experienced this in my tests of higher than 1,500 Watts.

OPERATION: Looking into this load with a network analyzer, the unit is flat all the way up to 10 MHz, 50 Ohms @ J zero. Above 10 MHz, the load exhibits some inductive reactance. A 50 pF capacitor rated at 2 kV across the input brought the match down and allows operation to 15 MHz, at an SWR of 1.85:1 – but this dummy load was for use on AM broadcast transmitters. At AM broadcast frequencies it is a pure resistive load in every form.

My initial tests with this air cooled dummy load were very successful. Although it will run continuously at 1,500 Watts, it does warm up a bit. It's a worthwhile project for a simple piece of test equipment that rarely gets used until you have antenna problems.

PARTS LIST:

2 – Aluminum heat sinks with large fins. (approximately 5 x 12 inches) – E-bay.

16 – Two terminal 50 Ohm, 250 Watt resistor flat packs – E-bay (www.ebay.com/bhp/rf-resistor).

1 - High volume, square AC fan. Tessco #4715TS-12T-B50.

Misc wire, 6-32 screws, tap, aluminum sheet metal.

Roger Paskvan is a Professor of Mass Communications at Bemidji State University, Bemidji, MN. You may contact him at: rpaskvan@bemidjistate.edu

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Safety Guide

Shocking News

by Jim Turvaville

There are times when the inspiration for writing comes from an unwelcomed source – this time it was almost a shocking experience that brings me to our subject of today. While checking the voltage of the primary power in a service panel recently, I had the meter in the wrong position (set for series current instead of voltage) and it blew the meter up in my hand. The only fatality is my little DMM – the soot washed off my hands and, except for several moments of ringing in my ears from the arc and being rather nervous, it all ended well. But let's talk today about electrical usage in our workplace.

Growing up the child of a power plant worker for the local electrical company, I was fascinated at an early age by the concept of electricity and how it's made and distributed. By the time I started school, I not only had seen power being made on the megawatt scale, but I had a pretty good understanding of how it was being made and how it got sent out from that little power plant on the banks of Lake Pauline. That little kick start in knowledge did not exactly give me any status with my playmates or the girls; however I was voted "most studious" in High School. In other words, I was a cool geek before the richest man in America was a cool geek.

Working as a Radio Engineer for the past 38 years I've had my share of opportunities to work with and around electricity. The guys and gals in our profession who work in the smaller markets tend to have those scenarios a bit more than some of the larger market stations, but all of us deal with it on a daily basis in some form. Let's review some of those situations and how to work around them in a safe manner.

Studios

Most of our studios tend to have a lot of things that require power, but all of it adds up to relatively small power use. The biggest issue is distribution of that power to the needed devices, and in a neat and safe manner. In general, you should keep your power working in a "star" configuration like your ground system, not daisy chained. Have a central source for power in your studio, like the UPS unit itself or a single breakout from it. Then have your multiple outlet distribution devices all come back to it, not from each other.

Not only does this provide the proper balance of the load for the various circuit protection devices that are involved (most plug strips have a breaker on them, so daisy-chaining them only causes undue stress on the first one in line) but it minimizes the potential to turn off most or all of the devices in the studio should one plug strip be turned off or fail.

In most cases, the entire electrical demand is small enough for affordable UPS units to be purchased to run them and protect all of that gear from outside bumps and trash. For any given typical single studio, a 2 KVA UPS unit generally can supply at least 10 or more minutes of backup power to a studio, which should be sufficient for that weather related brown out, or the occasional blink or short outage.

If you have locally licensed electricians who will share in your creativity, you can probably get them to hook you up some small transfer switch so that the circuit that feeds your studio (and hopefully that UPS unit) can be re-directed to a small generator for longer term power solution.

I've accomplished this with a pair of 20 Amp twist-lock style receptacles – one connected to the service panel breaker, and one to the wiring to my portable generator; with the male cable going to the conduit that feeds the UPS and studio.

In case of long term failure of the primary power, simply disconnect the twist-lock from the primary power receptacle and put it in the backup one; crank the generator and you're in business. As long as you choose a generator with the required stability, your UPS unit will charge from it and most likely keep your studio running without a blip.

Tower Site

The electrical needs at the typical tower are pretty much what you have at a studio but on steroids – particularly if you have a large AM or higher class FM plant. I've seen some amazingly huge transmitter installations, with as many as a dozen FM's in one building (most with a main and an auxiliary transmitter) and the power into those facilities is in the thousands of Amps and usually as higher than typical voltages.

(Continued on Page 22)

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Shocking News

– Continued from Page 20 –

Always be aware of how your power is provided to your site, and where the disconnect and distribution panels are located. Make your label maker your friend, and over-label things. You'll thank yourself when you make that middle-of-the-night run to the tower and have to find the correct breaker or disconnect switch. That's also *not* the time to make mistakes, so label things assuming someone who knows nothing about your plant is coming along behind you.

Larger transmitters use 3-phase power, which can be a mystery to most of us; but it is an extremely economical method of power distribution and utilization. If you see 4 wires on your service panel – usually White, Black, Red and Blue – then be assured you are dealing with 3-phase power. The standard white for Neutral is consistent across most wiring schemes, with Black being the first "hot" wire (and the "hot" in regular 120V power and the "L1" of standard single-phase 240V power), Red being the second "hot" wire (and the "L2" in single phase 240 V power) and Blue being the third "hot" wire of standard 3-phase power.

Depending on your transformer configuration, the voltage between each of the hot legs to neutral or ground may vary, so find out what it should be before you measure them, to know if you have a problem one day. Use your Volt meter carefully, and if you borrow someone else's like I did, check how it is set before you go touching electrical terminals.

General Thoughts

You should always have the services of a locally licensed electrician on short notice. In the ideal world your sales department would take care of that, but this need rises to the level of importance that if it has to be a paying situation it should be done. There is nothing like the helpless feeling of being off the air at 9:00 a.m. on a Saturday because of an electrical failure at the studio or tower with a problem your skilled and trained electrician can fix quickly ... *if* you can get them there.

You should also own a few basic items to make his or her job easier – specifically a nice volt meter and clamp-on ammeter. And please have one or more of the pocket voltage sensors. Learn how to use them all properly, especially that voltage sensor – it's designed to let you know if you are about to touch a live wire, without having to physically come in contact with the conductor. It's saved me from what might have been a serious shock on more than one occasion, by alerting me that the wire was really live – in spite of my own assertion otherwise.

A very serious and important point to make here – you should always know your own skill set, and level of knowledge and ability, when it comes to interactions with electricity – poor judgment in this area can be fatal. I grew up with electricity and have worked with it for much longer than I have been a licensed Engineer, and I still maintain a very healthy respect for it. I also recognize it has been nearly two decades since I was certified to work with it, and while little of the physics of electricity has changed, I am more than a bit rusty when it comes to working with it on a daily basis.

A few basic common-sense rules are easy to remember:

1. Always assume that a wire is hot – even the best will turn off the wrong breaker or fail to check before touching. That's where that pocket voltage sensor comes in handy. In a junction box, there may be more than one circuit involved, turning off one breaker may leave hot wires in your work space.

2. Know your colors for hot wires and keep them in sight at all times, when potentially around open electrical wire in a transmitter or service panel. Don't forget that you have other appendages which are capable of inadvertently touching electricity – specifically the back of your hand, your elbow and even the top of your head if you are in close quarters.

3. Always keep one hand out of your work. I often stick my left hand behind my back when probing with a Volt meter inside of gear, just to remind me not to become a path to ground in case the right hand makes a slip.

Let me close by reminding us all to never, ever lose your respect for electricity. We sadly read of accidents where people die, and many times it is because of a careless act. It only takes a fraction of a second to touch the wrong thing. May any incident you have result in only a burned meter, and nothing more.

Jim "Turbo" Turvaville is semi- retired from 38 years in full-time Radio Engineering and lives in Rural Wheeler County Texas in a "tiny house" where he maintains a small clientele of stations under his Turbo Technical Services (www.jimturbo.net) operation, providing FCC application preparation and field work.

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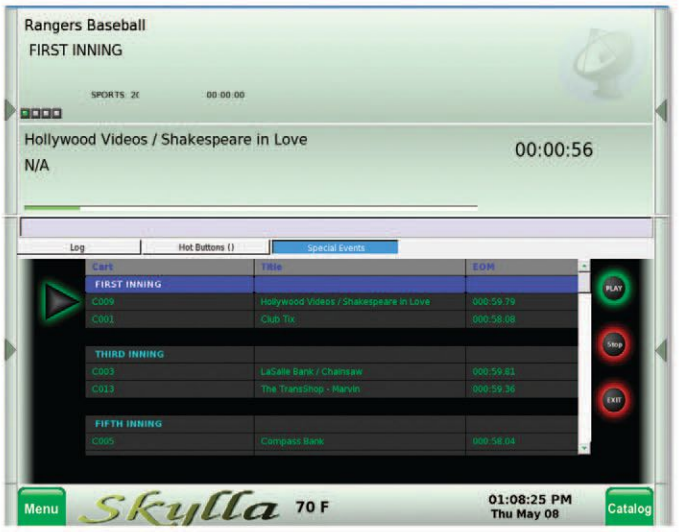

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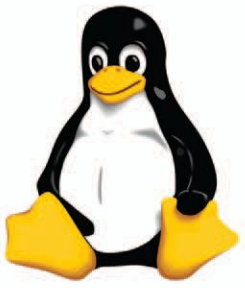

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- Roger Utnehmer, Nicolet Broadcasting, Sturgeon Bay, WI

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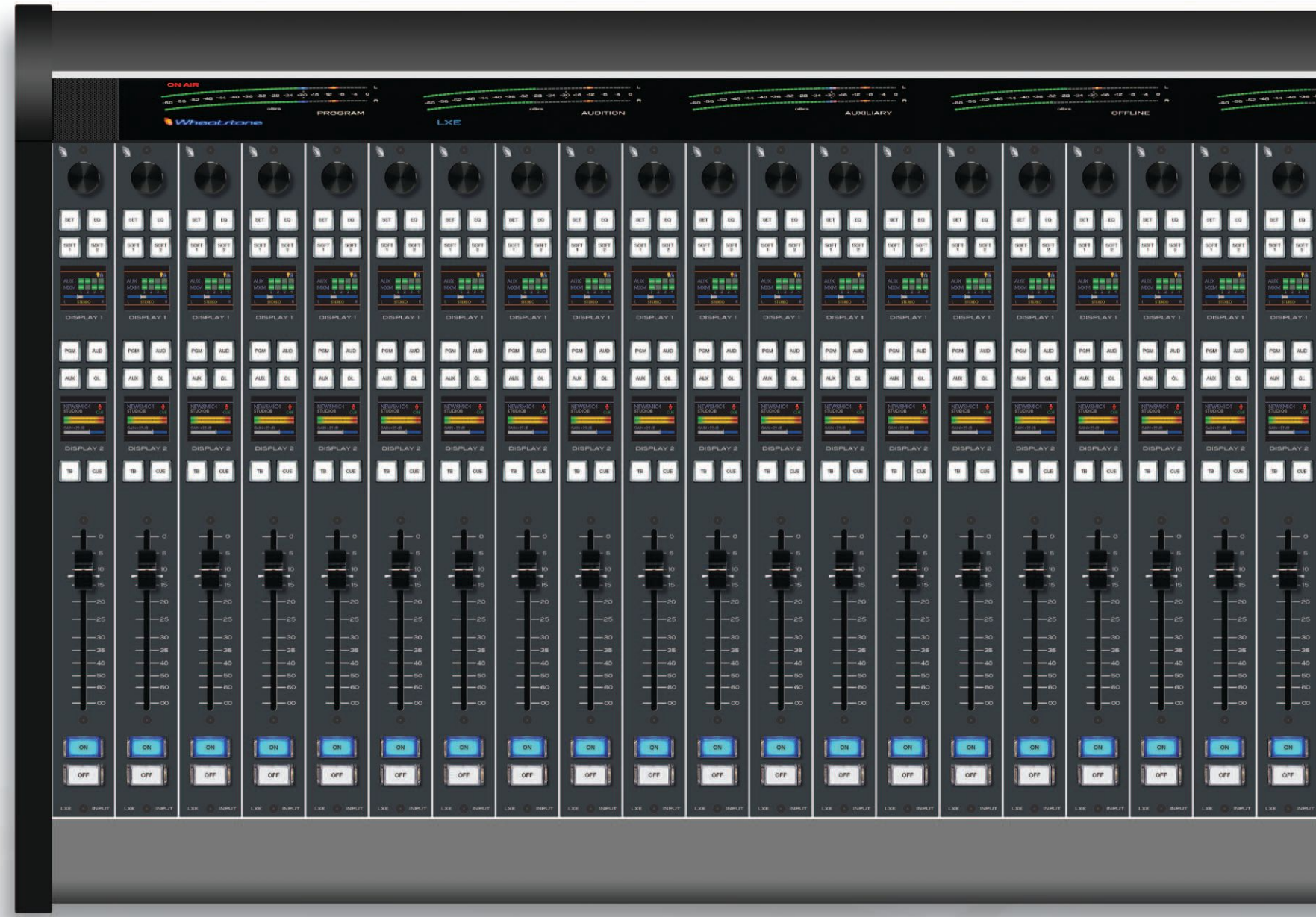

The Evolution of LX Radio Control Console

Wheatstone's new LXE console brings control surface configuration to a new level. Going far beyond the usual "any source to any fader" network concept, the LXE is a fully flexible control interface, where every switch and rotary control is programmable to perform any desired function. This means console architecture is completely customizable to client requirements, and limitations to functionality are no longer a factor. Physically compact, the LXE is available in several different form factors including countertop, countertop sunken, and split frames (split sections are not confined to one room, they can actually be in different studios).

Any Way You Want It

ConsoleBuilder software allows every switch on the surface to be programmed for function, mode, and even color (switches are RGB led illuminated). In fact, built-in software allows every button to be scriptable, letting you create powerful macros for as many controls as you want. Multiple full color OLED displays on each panel keep pace with ongoing operations, and event recall allows painless one touch console reconfiguration at the press of a button. With its inherent control flexibility and ability to access thousands of signals (sources and destinations are limited only by the size of the network) the LXE takes facility work flows and audio control to a new level.

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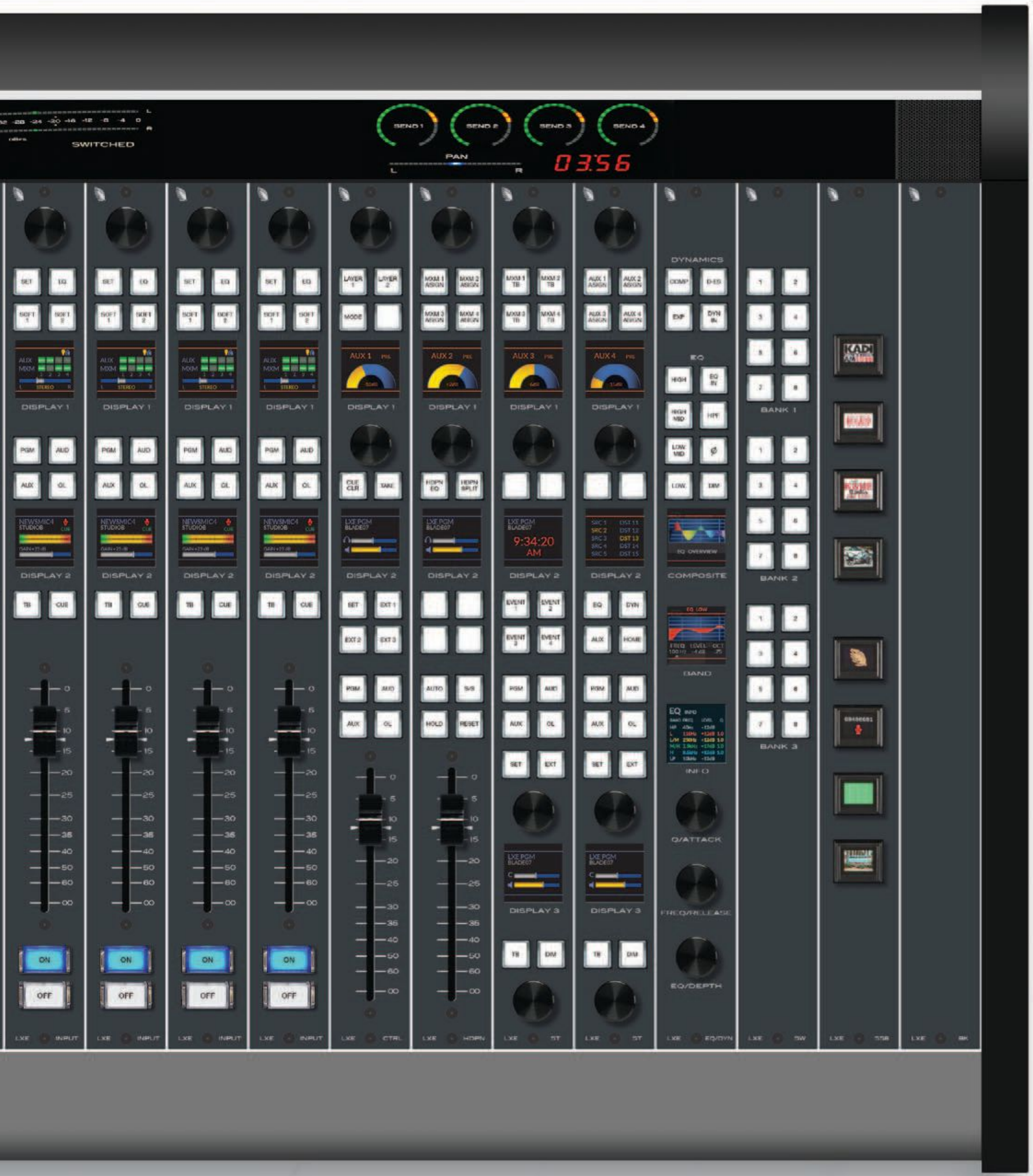

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The LXE can have up to 32 physical motorized faders, with full DSP processing available on all 32 channels. Surface(s) interface seamlessly into the WheatNet-IP Intelligent Network, and utilize BLADE-3s for audio, control and associated logic data flowing on single CAT6 interconnecting cables. The system can ingest and convert virtually all audio formats: analog, microphone, AES/EBU, SPDIF, AoIP, MADI, SDI and even AES67. Loudness metering, phase control, and full EQ/Dynamics are included.

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LXE's new GUI has pre-built screens for everything you normally use – metering, clocks, timers, dynamics, EQ, assigns, and more. All are touch-screen accessible with gestures you're used to using on your smart devices. And, the GUI is just as customizable as the LXE surface. Using our ScreenBuilder-LXE software, you simply drag and drop objects and define their functions via a simple wizard interface. You can store multiple custom screens, if you like, to go with your custom LXE setups.

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Telemetry & Control

SNMP and the New Class of Remote Controls

by Tom Bosscher

Quite a few decades ago, the Gentner company changed how we remote controlled our transmitter sites with the amazing VRC-1000 – with a microprocessor in control, you could dial in from any phone. A big step forward from the studio-only control, stepper style remote controls.

And now, as technology moves forward, we have even more advanced styles of remote controls. Made by Davicom, Burk, Audemat and others, these remote controls maintain the POTS line dial-up and control, and also have built-in Web and Internet interfacing. But there is a new wrinkle, in that these units can talk to many devices in your plant using SNMP and Modbus communication. Hang in there, we get to learn a lot more acronyms.

These remote controls have the typical analog and status inputs and contact closures, but a key element is that these units can now talk directly to SNMP enabled equipment right on your existing Ethernet network at your site. The key word for sharing information is SNMP, or **S**imple **N**etwork **M**anagement **P**rotocol. If you look at any modern transmitter, like a Nautel, a Broadcast Electronics, a Gates Air and others, these transmitters have an SNMP server built in. And with that, you get to have access to a whole lot of data, without having to solder one single cable.

But I have to warn you, there is a learning curve. Just like we all had to learn how to subnet and DHCP broadcast equipment, there are a lot of terms to learn and understand.

MIB and Other Acronyms

No, not Men in Black the movie, but try **M**anagement **I**nformation **B**ase. This a list of information about a specific piece of equipment.And that leads us to OIDs, or **O**bject **ID**entifiers. OIDs uniquely identify managed objects within the MIB hierarchy. There is not enough room in this or ten articles to explain how this all works, but that wonderful Internet supplies us with so many learning aids.

Start with Wikipedia. https://en.wikipedia.org/wiki/Simple_Network_Management_Protocol

Then the others:

http://www.snmplink.org/articles/abeginnersguide/
http://net-snmp.sourceforge.net/
http://www.simpleweb.org/
http://www.lammertbies.nl/comm/info/modbus.html

What you then need to graduate to is an SNMP management and snooping tool. One very good one is the free version of Ireasoning, a MIB browser.

Also, take a look at Worldcastsystems website. They have a limited time offer on their "WorldCast Manager," an SNMP monitoring tool.

The newer remote controls, notably the Davicoms, the Audemats and the Burks, will talk to your equipment using SNMP and also by Modbus, which is another management protocol. Be fair to yourself, and give yourself some time to be educated about this new method of inter-machine information transfer. It will take a while, but the difficulty in learning will be replaced by the easiness of expansion without wires.

At WCSG, we have a Davicom remote control located at the studio. This bothers quite a few broadcast engineers. "Remote Controls are meant to control transmitters!" Well, yes, they do that also, but today's studio complex has a tremendous amount of equipment that can be monitored by the remote control directly (think silence sensors), and also by SNMP – again, using your existing Ethernet network.

We have two 7 KVA Liebert UPS's in the studio. In looking at the MIB for those, there are over 25 items that we can monitor via SNMP. For fun, look at the MIB for your Nautel, BE or Gates Air. The Nautel NV-20 has over 100 items that you can look at using SNMP. At the WCSG transmitter site, which uses a Nautel NV-20, we grab all of the normal remote control readings you desire, which is Ep, IP, Fwd Pwr, Reflected Pwr, and we add items like cabinet temperature – again, with no additional wires or calibration.

Now here is a critical point that has to be made. In the case of our Davicom MA-216, we are limited to 16 analog and 16 status inputs supplied. You can order expansion kits, and that is good. But the SNMP parameters that you monitor, do not detract from that 16 item count. In the case of the Davicom, you can monitor and display 96 additional items using SNMP and/or Modbus. Other manufacturers have other numbers of SNMP displays. Please take a look at **Figure 1**. That is a screen shot of the WCSG studio remote control, looking at the page that is monitoring our two UPS's. Please note that all the status and analog information is supplied via the Ethernet connection between the Davicom and the UPS's. No additional wiring needed, and again, no calibration.

And now we get to the cool part. Just like any analog or status input, you can now have the remote control work for you. At the studio, we have the studio emergency generator wired into the remote control status inputs to let us know that we are on the generator.

(Continued on Page 28)

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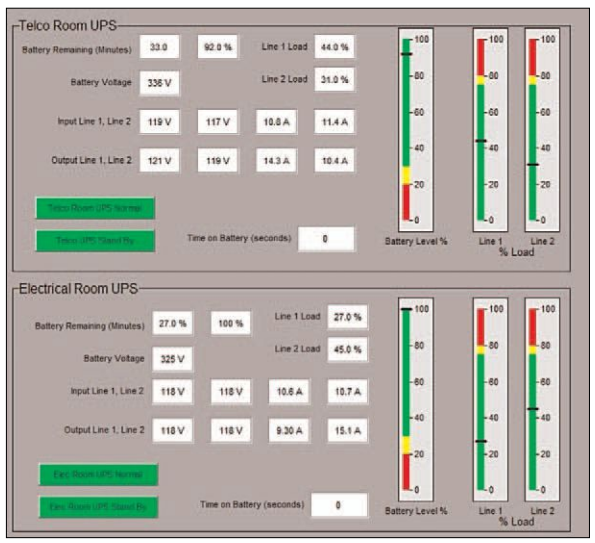

Figure 1 – Davicom Screenshot

One very nice feature about the Davicom is that this triggers a minor alarm. And why a minor alarm? So that I can tell the remote control that any minor alarms that occur between 11:00 p.m. and 7:00 a.m. get logged and queued, but I don't get called – I get to sleep on. The thought is that if there is a power failure, and the generator transfers and all is well, I don't need to know about it. However, at 7:00 a.m., I will get a series of text messages that will inform me as to what happened while I slumbered. But remember, I said to let the remote control work for you? We monitor, via the SNMP connection, the UPS input voltage status. If, after 60 seconds, the UPS's don't see any AC voltage, the remote control issues a major alarm, and for a major alarm, the remote control will call me, even at 3:00 a.m. The reasoning is that after 60 seconds of no AC, the generator did not start, and something is really wrong at the studio, hence the major alarm.

But Wait, There's More

Remember that 16 analog input limit? I like to monitor temperature, in a lot of areas. At most of my transmitter sites, I have two air conditioners, plus I wish to monitor transmitter exhaust, room and outside temperature. That takes five inputs.

Figure 2 – X-300 Web-Enabled Temp Monitor

But with a device called the X-300, made by Control By Web, which costs $215 and can handle eight digital temperature sensors, you can seamlessly integrate this cute little box into your remote control. (www.controlbyweb.com) The interface is using ModBus, which works a lot like SNMP. Again, the five sensors at my sites do not take away from the 16 analog inputs. And wait until you play with the $20 digital sensors. The days of soldering up and calibrating LM-34's are gone. Take a look at **Figure 2**, that shows the X-300 with one of the digital sensors.

We have a 190 foot tower located across our campus that holds a tenant FM station. We also have other equipment located there. We would like to be able to monitor building parameters, including temperature, emergency generator status, utility and generator voltage, and a few other choice telemetry points. We could buy another remote control, but we have our broadcast internal Ethernet network available inside that cross-campus building. Again, SNMP, Modbus and ControlByWeb come to the rescue. Take a look at **Figure 3** and introduce yourself to a ControlByWeb Model X-332. This device goes for around $550, and gives you four analog samples, 16 relays for control, and can interface with four digital temperature sensors. One simply wires this up, and then looks at it from the studio remote control. We now are looking at all of those telemetry items across campus, with a simple Ethernet interface. Once the information is inside the remote control, we can start auto-logging and alarming different situations. We also get to choose whether a minor alarm (engineer gets to sleep in) or if a major alarm is warranted.

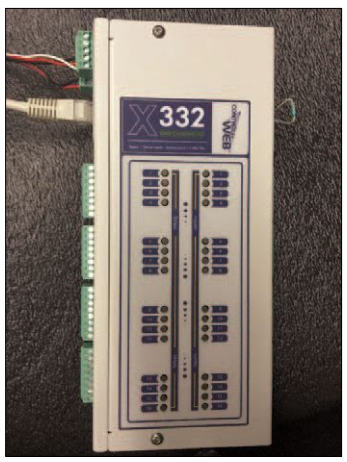

Fig. 3 – Advanced I/O Controller

Keep SNMP in mind when you are looking at replacing your remote controls. This technology allows you to do more with less, and lets you see more of what is going on inside your plant.

Tom Bosscher is the Chief Engineer at Cornerstone University Radio. Email him at: tom@bosscher.org

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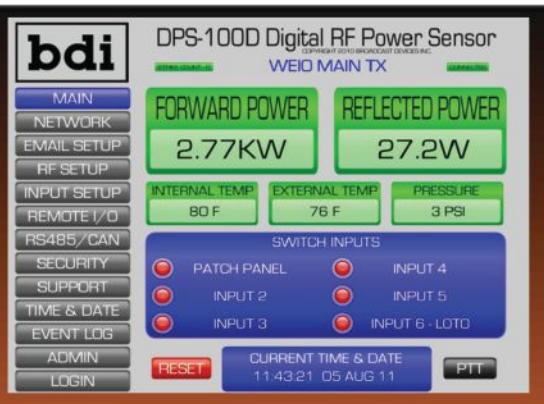

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Maintenance Guide

Corrective, Preventive and Predictive

by Rolin Lintag

You have heard these terms before as they relate to maintenance.

One saying we hear from old timers is "Don't fix it if it ain't broke." It sure sounds reactive, taking action only as a reaction to an equipment failure. Sometime in the past, more failures were experienced when "tweaking" was done while the equipment was still in operation, so it sort of became a painful experience learned. I don't dispute this paradigm since there are equipment or pieces of equipment that are best left alone. Sometimes it is cheaper to just run them to failure than to expend effort and resources to ensure they are in A1 condition at all times.

However, as a precautionary measure, I'll add the word "yet" to the end of the saying, to make it more responsive to a stimulus. "Don't fix it if it ain't broke ... yet." It is not as reactive as before but takes action if you start noticing something is not going right. One example is those circuit breakers used on the AC power supplies of transmitters. Some say they need to be exercised once in a while to help the trip mechanism from becoming stuck. Somehow, that is true for the old clunky circuit breakers used in legacy equipment.

I remember some transmitters even specify how many AC cycles of overcurrent can be sensed before tripping. Just how do you test that the circuit breaker will trip in time (in microseconds) to prevent current flowing beyond a certain joules of energy? That is not a practical task to do in the field for a 10 kW AM transmitter. I wonder if transmitter manufacturers even test that? The most practical solution is just to run these circuit breakers to failure where they just trip and won't reset anymore. Recent circuit breakers have become so reliable that you don't even notice they are in the circuit – we tend to treat them like ordinary ON/OFF switches. On a similar note, you don't fix a fuse if it is still in operation. Unless it is loose in its holder, you just leave it alone until it is blown.

Corrective and Preventive

Not because an equipment is brand new, you won't experience problems. Some problems may be brewing from the start without you knowing until the inevitable happens.

Look at **Figure 1**. It is a power supply module that takes in 3-phase 440 VAC and puts out 32 VDC for a 600 Watt solid state power amplifier. You'll notice on the picture that the lower terminal of the right most rectifier is burned, apparently due to overheating.

The rectifiers were numbered 1, 2, and 3 so the third rectifier failed on the 440 VAC side. Post-mortem observation reveals that heating started from the connection spreading outwards. The size of the wire (and amplifier rating) suggests the amount of current that normally flows though this connection, so a less than tight connection presents a resistive path, dissipating power at that loose connection. It should not run hot but there was no way to know (with an infrared thermometer) since the cabinet operates with metal panels closed. Since a new power supply costs $13k, I just replaced the rectifier and the wire.

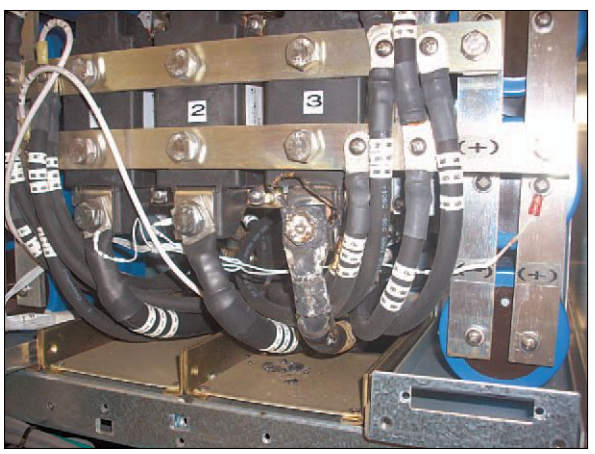

Figure 1 – Power Supply Modules

After the corrective measure, the question was, "How do I prevent this from happening to the other five power supplies?" The tech support of the transmitter manufacturer said that it may have come loose during shipping. Granted, however I didn't see any lock washers on any of the connections on *all* the power supplies. So I asked for these lock washers, opened up all the panels, and installed them on each of the connections. I didn't feel like stopping

(Continued on Page 32)

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Corrective Preventive and Predictive

– Continued from Page 30 –

there, so I checked the connections of the electrolytic filter capacitors (those big blue cylinders hanging on the metal rods). Just looking at those big capacitors gave me a feeling that they can come loose as well, if the only bolt holding it in horizontal position is not tight.

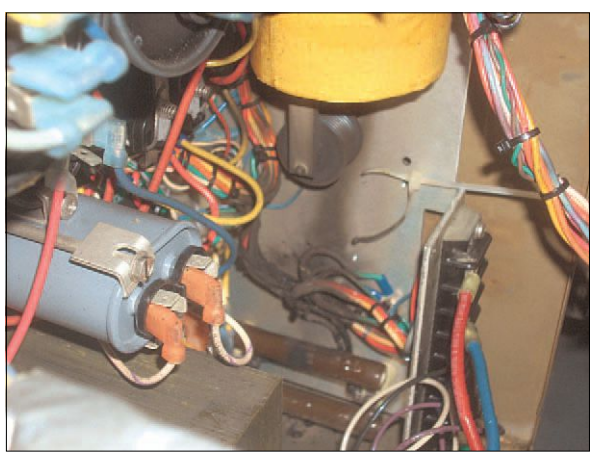

Figure 2 – Inside a tower light power controller.

Figure 2 shows the inside of a power controller (PC) for a tower light system. This is just one of the 12 PCs used for a High Intensity system of a 1,200-ft tower. We chose this tower light system because most of the electronics are located inside the building. I can do some of the repairs myself without having to spend $2k for every climb. Well, not for all the PCs – three of the PCs are located up at the 300-ft level for the top most tier of the tower. I leave those three topmost PCs to the climber for regular inspections.

The PC in **Figure 2** shows some burnt residue and signs of overheating. I was puzzled since the PC cabinet is inside an air-conditioned building and that there were no signs of overheating during the last monthly inspection. It was caused by a current limiting pair of parallel resistors that became overheated. I checked the other eight power controllers and another one seem to be heading in the same direction. So I called tech support and asked what was going on. I was told that they are now replacing those resistors with ceramic types, apparently with higher wattage rating.

"OK, so am I getting those retrofits for my 12 power controllers?" Sad to say, we have to pay for them. I cleaned up this power controller and installed its new ceramic resistor in place. I did the same for the other eight PCs I can access and scheduled work for the topmost three PCs on the next tower climb.

So the important questions to ask after every repair are:

1. How can we prevent this failure from recurring?

2. What are those tasks that need to be done (or symptoms observed) in order to arrest the situation before it becomes a problem?"

3. Do we have needed parts on hand to minimize time-to-repair."

There are failures that can be prevented from happening. It is just a matter of identifying them early enough and take mitigating measures.

Predictive

It pays to interview tower crews that you work with.

I have worked with different tower crews and interviewed most of them with regards to practical experience on similar towers and light systems. Some of them say that it is best to replace electrolytic capacitors after five years in operation, and flash tubes every three years – to save on tower climb costs. It is difficult to save on tower climb expenses if same parts fail one after the other at different intervals within the same year. The cost is parts *plus* the same $2k per climb. Add them up in a year, and the parts don't seem much compared to the tower climb expense.

But how can we make a sensible and reasonable prediction of what will fail or not?

Clue: Predictive maintenance relies heavily on data.

It is a good thing that the tower light system allows me to monitor the energy for each mode of operation – Day, Night and Twilight. It also shows how many missed flashes were there for each flash tube. Taking readings every month, I can tell if capacitors and flash tubes are getting weak. so I have data to back up my replacement decisions. It turned out what the climbers told me is not too far from what the data tells me. Just not exactly, as most predictions on equipment failure can be.

The important thing is to log relevant parameters and analyze the trend. Then make the best effort decision to prevent failures.

Rolin Lintag is Asst. Chief Engineer for KRON4 in San Francisco, California.

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How Secure is Your Network – *Part 2*

by Tommy Gray – CPBE CBNE

Well another month has passed and with each passing day, new threats to security are popping up that could not only hinder or interfere with the way we do business, but could altogether cause us a ton of grief. These days, there are new and innovative ways that hackers and thieves are using to try to steal our private information, with the common intent of getting into our pocketbook or bank accounts.

Don't Give Away Your Money or Identity!

I mentioned last month about all the hacks to audio codecs that we use to feed programming to different sites. Most of these are not the fault of the equipment, but the fault of the user and his or her lax security practices. This month, the topic of interest on the Internet has been the hacks to Teamviewer™ that have allowed cyber thieves to clean out the bank accounts of various users. The stories range from stolen passwords and personal information, to entire savings and bank accounts being drained of every last cent! How did this happen you might ask? Well, it is simple. People did not change their passwords frequently or used simple, easy to guess passwords – the thieves got into their computers during the night or while they were at work, and harvested their personal information.

Numerous stories surfaced about people happening to get up during the night and seeing activity on their computers where people were copying files, or logging into their bank accounts and transferring funds, etc. More than one unwitting remote access software user lost everything in this manner. The problem was not with the software they were using, but with the password they had not changed in many moons, or with a password so simple to guess that the robots got into the machine easily, and the rest is history!

I personally don't want to allow *anyone* to see or access my personal information. I refuse to give out my social security number or bank account numbers, etc., over the Internet or over the phone. It makes sometimes simple transactions more difficult, but "so far" I have survived without incident. I change passwords frequently, and use strong passwords, and you should too. Now I realize that this is difficult and lends itself to having you write down passwords, etc., that could be obtained by others, so what do you do? You say, "I need to have something I can remember."

The password robots and hackers use algorithms that look for entire words. If your passwords contain whole words or frequently used combinations of words, then you are at risk. All it takes is a few minutes of trying and the robot has them figured out – voila, they are in. The best way I have found to avoid this, and the way suggested by many security companies, is to use very difficult passwords. To me, it is hard to remember something generated by the password generators you find out there (which all probably contain the same algorithms and could be cracked, IMHO). They will come up with passwords like Cfk5%#*(Pa$$!. Now that is probably a good password, but let's be real. How many of you can remember something like that without having to write it down, which has already opened you up to problems. If you keep it in your wallet and it gets lost or stolen, guess what. Someone else has it!

The hackers and robots look for regular patterns of words or symbols that are frequently used together. It is amazing to me how many people can come up with the exact same thing to use for passwords. I was looking at a video on TED.com recently about passwords, and they gave the statistics of how often certain passwords are used. There were lists of frequently used passwords that were to the point of being ridiculous. If I recall correctly, the two most commonly used passwords mentioned were the word "password" and the numbers "1234." Now those are really great passwords aren't they! Okay confess up. Some of you have actually used those at one time or another, haven't you?

I was talking to a friend who keeps everything he has on his computer. He stores his passwords in his web browser and uses auto-complete, so he doesn't have to type them in. Not only is this a very dangerous thing to do, but he was using the same password for everything! And to top that all off, the password was his street address! He had been "living" on the Internet every day since he retired, and how he had not been hacked before is beyond me. The reason I found out was that he got a browser plug-in from some major company that was acting suspicious, and when I checked it out, I discovered that, even though he had not updated his virus definitions for a while, it was still trying to stop the attack.

(Continued on Page 36)

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MY RADIO ROCKS!

How Secure is Your Network

– Continued from Page 34 –

I had installed AV software for him and had instructed him to let it auto-update, but he had gotten tired of the thing slowing him down every day while it updated and scanned, and he had disabled the auto-updates. His computer was a hack waiting to happen as he had gotten some bad software from a major company and it was trying to access his computer – but the malware and AV software were trying to do their job (thankfully).

When I got there, I did the first thing I usually do and pulled the network cable out of the back of the machine so that the bug could not "phone home." I then used my secure computer to download the latest AV definitions and updates, as well as updates for the anti-malware software, and loaded it all onto a flash drive to put into his machine. After they had cleaned out everything and had the machine working like normal again, I forced him to go in and, not only put a password on the computer, but to sit down and come up with some good passwords for all his on-line accounts. Unfortunately, not all recoveries are this easy!

Now there are apps out there that we call "Password Managers" but I can tell you I do not trust anything that I have to put my passwords in to help me remember my passwords! Now they tell you that they are secure and that no one can figure out how to decrypt your passwords, but friends, if a programmer wrote the software and came up with the algorithm, someone else can figure out how to hack it. Call me overly cautious if you will, but I am not going to give *anyone* a possible door into my computer if I can help it.

So What Do You Do?

Well there are ways to help you that do not involve putting your passwords on paper or in a file on your computer desktop. Yeah, I found someone doing that as well, and it was not password protected – and it was a simple text file. Oh, and I also found someone putting all their passwords in a note file on their smartphone, and it was an open text file, and their phone was connected to the cloud, *and* did cloud backups! Now that was very secure! (Right!).

The best passwords contain several things that help them to be secure. They will contain a combination of upper and lowercase letters, numbers, special symbols, etc. They are also long (minimum 9-11 characters at least). I have some passwords that are 20 or more characters – I want to make it as hard as possible for a hacker to discover them. You might ask, "How in the world do you create a long and difficult password and still make it memorable?"

One way suggested by a major security company is to use illogical combinations of words that make no sense and that are never used together, and that have no significance to anyone but yourself. One other addition to that scenario is to add things that are also untrue. For instance, here is a password that contains all these elements but can be remembered: "StanleyAndRileyWereOur$540Dogs!!" Notice the upper and lower case letters, the use of special symbols and numbers, and things that are not true (unless someone out there actually had two dogs named Stanley and Riley who cost $540!). You can remember that one if you try, and not have to write it down. If they *were* privy to your personal information from your public data on Facebook, etc., they still could not guess these if they were not true! And yes, thieves are all the time looking at people's Facebook™ accounts to harvest personal info.

Is Nothing Safe!

There are numerous other ways that hackers and thieves use to get into your "Stuff," and even the most normal activities can expose you. Recently, a friend went to a local home improvement store to check on a problem with his store credit card. The lady behind the desk asked him all kinds of questions about his personal finances, and personal information. He unwittingly shared it all with her. It turns out that she was new to the job and not only got all his card info, but got all his personal info and sold it on the black market.

Within 24 hours, thieves had opened up accounts with fake driver's licenses (she photographed his license and Social Security cards!) to the tune of almost $100,000 in store accounts. They went to furniture stores, electronics stores, food stores and opened up thousands of dollars in new accounts and immediately maxed out all the accounts. By the time he started getting the bills they were long gone, as they never had anything they purchased delivered, but had picked it all up in the store!

He is still trying to clean up that mess! The kicker is that, in the store where he took the card to check it out, they actually opened up a "second account" and charged out $10,000 in appliances even though he already had an existing account there! He never figured out how that one got by them.

Bottom Line?

Be cautious, use good passwords, change them frequently, and never put your personal info where others can access it.

Tommy Gray is President and CEO of "Broadcast Engineering & Technology," a consulting and contract engineering firm in the Houston, TX area. www.BEandT.com

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Power Principles

National Electric Code

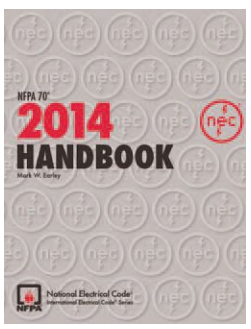
by Mike Hendrickson

At some point in our career we are going to encounter the "National Electric Code" (NEC). It is important that we understand the purpose of the code as well as have a basic understanding of the details of the Code. This Code affects almost all electrical installations in the United States whether they are high voltage, low voltage, power limited systems, communications systems, or fiber optic systems.

The NEC dates from 1881. In 1881 the New York Board of Fire Underwriters issued a document called *A Standard for Electric Light Wires, Lamps, etc.* This was the immediate predecessor of the National Electric Code. In 1897, the Code was issued under its present name.

The NEC is developed by a group of panels and a technical correlating committee. The panels and the committee have been sponsored by the National Fire Protection Association since 1911. The NEC is a national standard as approved by the American National Standards Institute (ANSI) as ANSI/NFPA 70. While the NEC is a "standard" and is not a federal law, it is typically adopted by state and local governments as part of their building codes. The state and local governments may also modify or change the code to meet local needs.

The Code is updated and published every three years. The most recent publication occurred in 2014. It generally takes a couple of years before various agencies adopt the most recent standard. There is also no requirement that the most recent standard be adopted by these agencies. The primary purpose of the Code is safety – both for personnel and property. As a reminder, in 2014, according to the U.S. Department of Labor, there were 74 deaths in Industry due to electrocution. According to Electrical Safety Foundation International there are 500 deaths and 51,000 fires that occur in the United States annually caused by electrical problems. One very important thing to remember about the Code is in section 90.1 (B) of the introduction. This states: *"This Code contains provisions that are necessary for safety. Compliance therewith and proper maintenance results in an installation that is essentially free from hazard but not necessarily efficient, convenient, or adequate for good service or future expansion of electrical use."*



The NEC book is divided into nine chapters plus the introduction, various notices, and annexes. The introduction explains the purpose of the code, what is covered, how the code is arranged, enforcement, and other general items.

Section 90.2 explains what the Code covers and what it does not cover. Generally the code states that all installations that use electrical equipment, conductors, signaling and communications conductors, and fiber optic conductors are covered. Some of the installations that are not covered are mines, ships, railroads, motor vehicles (vehicle mounted generators supplying power external to the vehicle are covered), and power and communications utilities up to the service drop at the customer's facility.

The introduction continues with information on the Code arrangement, enforcement, and other information necessary for a complete understanding of the Code.

The actual code begins with a general chapter. This chapter, chapter 1, includes definitions and electrical installation requirements. The definitions included in article 100 define the terms used in the code and are necessary for a complete understanding of the Code. Article 110 details the requirements for an electrical installation. These include the examination, approval, installation, use, and access to electrical conductors and equipment.

Wiring and protection is covered in Chapter 2. This topic encompasses The Use and Identification of Grounded Conductors, Branch Circuits, Overcurrent Protection, Grounding and Bonding, and more. The chapter details the proper identification of both the grounded conductor (neutral in 120/240 VAC systems) and the grounding or earth conductor. There is a difference between the "grounded conductor' and the "grounding conductor."

Chapter 3 is about wiring methods and materials. The chapter covers wire, equipment such as electrical boxes, conduit, and wire current carry capacity or ampacity. The code details the ampacity of various conductors with various types of insulation in this chapter. The ampacity

(Continued on Page 40)

Power Principles

– Continued from Page 38 –

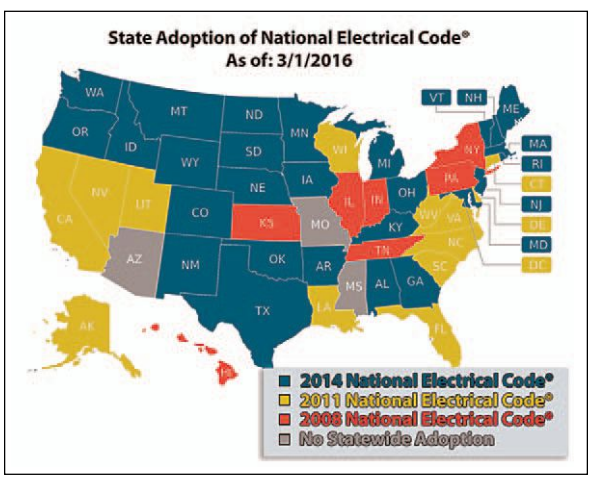
of the conductors is also dependent upon the ambient temperature of the installation environment.

Chapter 4 details the installation of equipment for general use. This topic covers everything from flexible cords, light switches, panel boards, air conditioners, appliances, and numerous other items. Chapter 4, along with Chapter 7, also address the use of generators and standby power systems.

Chapter 5 is titled "Special Occupancies." This includes hazardous locations, aircraft hangers, health care facilities, and other locations. Of special note to the broadcast engineer is that a Special Occupancy does include motion picture and television studios. This is in Article 530. Also covered in Article 545 of this chapter are the manufactured buildings that are used for transmitter sites by many radio stations.

Chapter 6 covers "Special Equipment." Section 640 of this chapter is for "Audio Signal Processing, Amplification, and Reproduction Equipment." Besides Section 640, Section 645 and 646 will be of interest to the Information Technology specialist. These two chapters address the proper installation of data centers. One note of interest is that there is a requirement that all "interconnecting cables" be listed or labeled. This means that the cables that are used must be listed or labeled by an organization such as Underwriters Laboratories. The electrical inspector may include Ethernet Cables as interconnecting cables. Section 647 deals with sensitive electronic equipment. This section permits the use of a transformer to isolate the power to such equipment. It also permits the use of a "balanced" power supply. Articles 690, 692, and 694 address the use of solar systems, fuel cell systems and wind turbines.

Chapter 7 covers Special Systems. This includes emergency systems, standby systems, systems operating at less than 50 Volts, power limited systems, and fiber optic cables. If you are required by a regulating agency to have an emergency system of some type, Article 700 will be of interest to you. Article 702 addresses the requirements of "Optional Standby Systems."



Chapter 8 is for communications systems including radio and television equipment. This chapter covers the installation of cabling such as communications cables. 800.21 requires that communications cable not block access to electrical equipment, such as circuit breaker panels. 800.24 specifies that communications cabling shall be installed in such a way to avoid being damaged. 800.25 states that abandoned cables must be removed. Finally 800.26 address the spread of fire and smoke from communications cables. The Code also specifies that any penetrations of a fire wall must be properly fire stopped using approved materials.

Chapter 9 is the "Tables" chapter. The first part of chapter 9 is related to the percentage of conduit fill that is permitted under the code. The percentage of fill is related to the total wire size, including the insulation as well as the number of wires. There are additional tables that provide the wire diameter size with insulation, the resistance of different size wire, and the resistance and reactance of wire at 60 Hz in a conduit. The last tables in the chapter relate to Class 2 and Class 3 wiring.

One mistake many broadcast engineers make is that they assume the code only applies to "line voltage" installations. However, the code applies to any installation involving electricity communications. There are several reasons why the code applies to communication systems, including audio. While low voltage cables may not start a fire they can provide a path for a fire to follow. They can also contribute to the hazardous gases a fire produces. Finally, communications installations can be a physical hazard and block access to electrical equipment.

Another assumption that is easy to make is that the Code only applies when an installation is connected to a power utility. This is not the case. Generally, the Code will always apply when there are wires and cables installed, whether they are electrical or fiber optic cables. The specific application of the code will depend upon the local jurisdiction.

Remember, the NEC is a safety standard. It is up to the engineer to determine the most efficient and convenient electrical system required. In my next article I'm going to give some real world examples of the use of the code. There will also be some examples showing that this is a *minimum* standard designed primarily for safety.

Hendrickson, CPBE, CBNT is the retired Chief Engineer of American Public Media Group. He has been involved in Broadcast Engineering since 1969. Over this time period he has been involved with all aspects of broadcast engineering from the technical to the budgeting. He may be reached at: mikehlakeville@gmail.com

In the Field

Shut That Door

by Bob Henry

These days, for whatever reason, it seems the practice of regular maintenance of radio station facilities often has become a thing of the past.

I saw this problem recently, while doing work for a local radio station that was in need of a lot of attention. Regular maintenance had not been done in a long time. The former engineer had passed away and the owner was not able to do the needed maintenance. I no doubt had my work cut out for me.

Wind Power

During one windy night, I noticed an unusual phenomenon was occurring at the AM transmitter site – the antenna ammeter readings were, mysteriously, gradually changing.

I briefly cut the modulation to observe the symptom more carefully. As the wind blew harder, the ammeter reading would vary up and down with the wind variations. Obviously, wind is not supposed to have any effect on RF – that is, unless the wind is causing something to move to produce the effect.

This is exactly what was happening, albeit, I did not know how it was happening at the time.

An Open And Shut Case

The next day, I decided to completely examine the transmitter facility to find the probable cause of this phenomenon. After walking out to the tower (located some 100-feet away from the transmitter), there it was, the source of the problem – the door of the ATU was wide open!

Evidently, this door had been blowing back and forth in the wind, thus causing the tuning to vary with the blowing of the wind. I wondered how it opened as it did. After some more investigation, I noticed that the lock hasp had been cut by someone to open the ATU door for access, but it was never repaired.

This ATU opened the door to problems.

It was obvious that it had been this way for a long time, allowing the elements of the weather and the environment to enter the ATU housing.

Fixing the Collateral Damage

After closer investigation of the inside of the tuning unit, I noticed heat emanating from one of the tuning coils. Looking closer, I noticed visual signs of charring caused from excessive heat at the coil tap. This was an obvious indication of a bad connection, causing some power to be lost in heat.

The coil was obviously charred at the tap point.

With buying a new coil not an option at the time, I was able to fix the problem, rotating the damaged coil 180 degrees horizontally so that the other end of it could be used, as it was not charred. After burnishing it with an emery board, the tap was then placed back on the coil at the proper tap point.

I then powered up the transmitter and checked tuning and operating parameters. Now, meter readings were very close to those originally logged and posted on the transmitter. No more fluctuations were noticed with the antenna current readings.

No matter how new and modern (or old) they are, transmitter sites still require some routine maintenance to avoid such problems. *– Radio Guide –*

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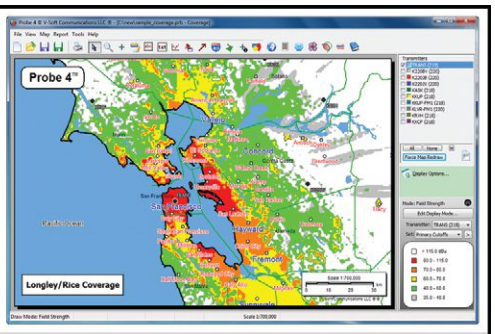

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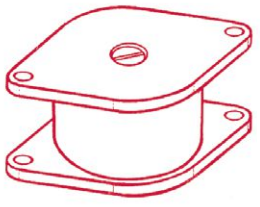

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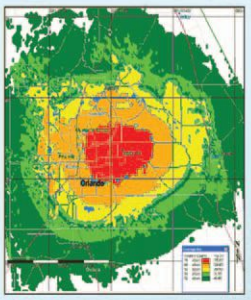

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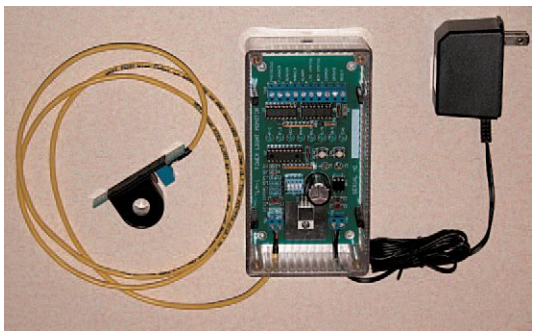

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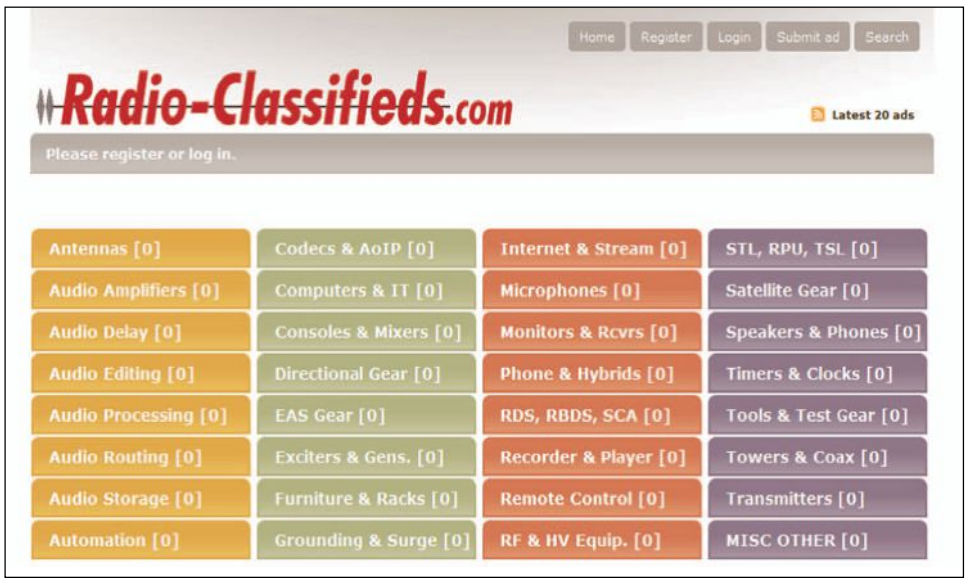

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This gives site operators better situational awareness as to the reasons why their site could have stopped transmitting. If the site sustained a hit and is still transmitting, the operator could nevertheless use the information to carefully check if everything is still operating at 100% capacity.

If the site sustained a hit, is still transmitting, and everything is still in tip-top shape, it will be a great reassurance to know that the site's lightning protection and grounding plan are working as designed.

The DVLC-1 consists of a tower-leg mounted module that is connected through a fiber-optic cable to an internal signal conversion module attached to the back of any DV Intelligent Remote Control Unit.

For more information: www.davicom.com

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http://ne-ba.org/news_and_events-convention.asp

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