

Radio Guide

Radio's Technology Magazine

October 1992



Station Stories

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A DA Gets Dunked

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AC Power Configurations

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The U.N. Enters the Digital Age

The United Nations has its own radio facilities, and a recently completed upgrade of two of its seven studios.

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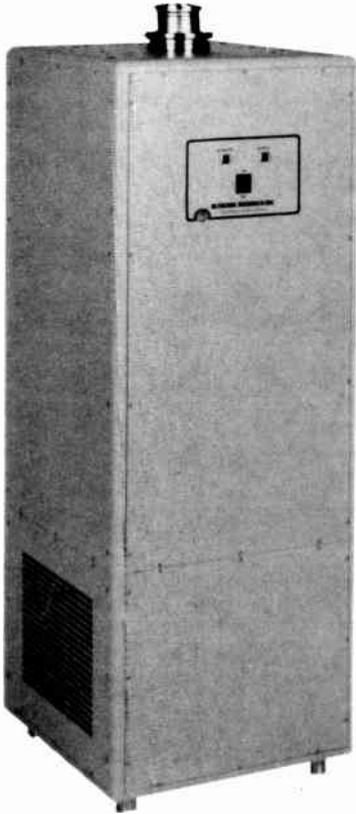
Next Month:

A Year-End Report: You Tell Us ...

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Publisher's Page

By Ray Topp

Radio Reply Card

If you look in the center of this issue of **Radio Guide**, you'll find that we've changed the format of the "bingo card." In fact it's not a bingo card at all.

We've developed a new postage-paid reader reply and information card that we call **Radio Reply**. We're asking you to do a couple of things for us and for yourself. First of all, we ask for your personal information such as name, address ... etc. This helps us to keep your **Radio Guide** subscription current. If there are any changes in your mailing address, or if you're tired of reading someone else's copy and want your own free subscription to **Radio Guide**, then let us know about it here.

At **Radio Guide**, we don't place you on a waiting list or make you "qualify." If you work in radio and choose to learn more about it's technology, then **Radio Guide** is required reading!

After entering your address information, the next thing we ask you to do is take the time to fill out the rest of the **Radio Reply Card**. It's easy and all you have to do is circle all the numbers that apply to you and your sta-

tion. Our advertisers require this information to help you with your equipment needs, and we use it to help tailor our editorial content to keep in step with industry trends.

And, as if working in this industry isn't exciting enough, we've added a bit more fun. When you send in your **Radio Reply Card** you'll automatically be entered in our **Radio Guide** giveaway. Every month we'll take all the **Radio Reply Cards** we receive, place them into an old Collins 300G transmitter skeleton and give it a kick.

Then we'll draw out 26 winning cards. This month we'll award one main "PA Prize" -- a new Radio Shack portable CD player. We'll also give out 25 "Exciter Prizes" -- Tech Tipster calculators. Even if you don't have any plans for construction or purchase in the future, fill out the top part of the card anyway. You'll still be eligible for the drawing.

Even better, we'll do this every month with different prizes. You'll have plenty of chances to win -- and to help the radio industry and **Radio Guide** do their jobs. It's our way of saying thanks. *R.T.*

Publisher's Notes:

Radio Guide Staff Changes

Art Constantine is no longer on staff at **Radio Guide**. Art has left **Radio Guide** to join Eric Small at Modulation Sciences. We thank Art for his help in the **Radio Guide** restart, and wish him well at his new position.

Bob Dennis, vice president of Radio Press Group will become sales and marketing director of **Radio Guide**.

A Pre-93 Survey

Next month **Radio Guide** will conduct a readership survey. What's right, what's wrong and what needs to be changed in **Radio Guide**? We'll ask

some questions and offer some suggestions. You'll be able to help us design the direction that **Radio Guide** will take in 1993.

Tech Tips to the Fore

We're always looking for unique and unusual tech tips. When you send your tips to George Whitaker, our tech tip editor, George will send you a Tech Tipster calculator in return. They're small, convenient and solar powered. Of course they don't work in the dark, but then you couldn't see to press the buttons anyway

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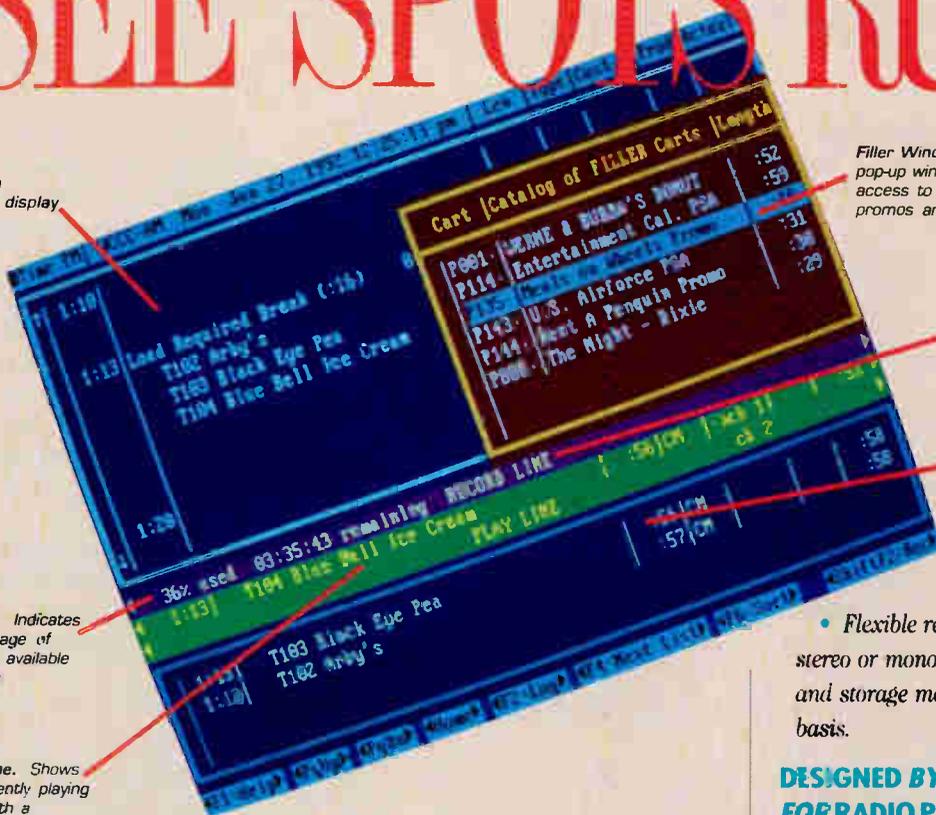
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Two On Filter Design

By Eric Small

Simplified Practical Filter Design Irving M. Gottlieb Tab Books.

Few topics in electronics evoke the foreboding that filter design does. At best it conjures up an image of thick books with page after page of tables and graphs. Then begins the search for an "ideal" op amp, without which the filter will never quite behave the way you want it to anyway.

This book breaks all the rules. First it advocates passive LC instead of active RC filters. Then goes on to suggest the image parameter approximate method of design as opposed to the modern "exact" techniques.

By avoiding active op-amp filters in favor of passive designs, the filters created are easy and non-critical to build. Sometimes even experts have difficulty preventing active filters from becoming active oscillators. Because the impedance of passive filters tends

to be low, stray capacitance in the construction of the filter has little impact on final performance.

LC filters are not the answer to all filter needs. They require inductor of specific value. Inductors are bulky, expensive components and usually have poor temperature stability. If you plan

"The discussion of the effects of source and load impedance mismatch is the best I've read."

to manufacture a product, you learn very quickly to avoid inductor whenever possible.

However, for a "one-off" piece of gear to solve a problem, then LC filters have a lot to recommend them and hand trimming a cup core inductor is not such a big deal. It's a lot less of a hassle than trying to stop a 5 kHz audio low pass filter from oscillating at 2 mHz.

Several Varieties

Many families of filters are covered in this book: low-pass, bandpass, crystal, high-pass, band-reject and crossover networks. Composite and m-derived filters are also discussed. None of the "obvious" aspects of filter design are taken for granted; the discussion of the effects of source and load impedance mismatch is the best I've read.

The book has one serious omission however. It provides no details on how to construct inductors of the odd values needed to build real filters, nor does it discuss many of the real-world limitations of inductors, such as temperature coefficient and core material effects on Q.

For the brave, the catalogs of the companies who make cup cores and toroidal cores provide enough information to enable winding inductors, however they can be tough going if you are not familiar with the technical units of electro-magnetics.

Inductor Primer

Fortunately, there is a book devoted entirely to the subject of real world inductors:

Ferromagnetic-Core Design and Applications Handbook
Doug DeMaw
Prentice-Hall.

This book is *everything* you ever wanted to know about designing and building inductors: the wire, the ferrite core material and the bobbins. Very practical nuts and bolts stuff. It is everything that you need to make sense of ferrite manufacturer catalogs plus a lot more.

Another consideration is how to obtain small quantities of ferrite parts. Ferrite is cheap and the manufacturers like to sell it by the pound, with minimum orders of hundreds of dollars. The catalog houses such as Mouser and Dow-Key can help here. Amateur radio suppliers, such as Amidon Associates (310-763-5770), welcome small orders for various ferrite products.

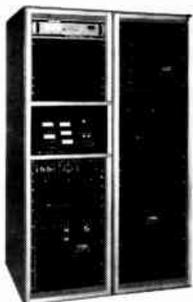
Passive LC filters solve many problems in filter design, especially for the engineer who only occasionally needs to use filters. With modern ferrites and the techniques provided by Simplified Practical Filter Design, designing a filter need not be more formidable than designing an attenuator.

Eric Small is president of Modulation Sciences. You may call him at 800-826-2603 for more information on these books.

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DAB On The Air

By Judith Gross

We wandered around the Louisiana swamp outside of New Orleans for what seemed like hours, past the Shoneys and Walmarts and Rib De-Lites.

There, in a sweltering field, standing in front of a transmitter shack that had definitely seen better days, was the future of DAB.

Oh, it didn't look like much. It was just a rented Ryder truck, a cheery yellow home for USA Digital's FM set-up. Yeah, that's where the CCS MUSICAM box was, and the special gizmo that made the FM signal "do the hoola," as CBS' Tony Masiello likes to call it. And oh yes, the special Harris transmitter rigged up by Ron Frillman and friends to transmit the DAB signal.

The FM was on WWNO's signal with the output of analog and the DAB

signal fed to its antenna, some 12 miles away from the convention center. The DAB was 40 dB down, power was at a 1000:1 ratio. Because of the way the FM signal is interleaved to the DAB signal, in a time relationship, you'll always need that analog signal to transmit DAB.

Pretty tricky way of making sure FM doesn't die a premature death, right?

The FM co-developer, EDI, Electronic Decisions Inc., got the whole thing together with this ACT chip I told you about before. The whole shebang came out of the defense industry. The system is still being tested out in Champagne-Urbana IL, where EDI is located.

As for the AM side, Z-Tron is USA Digital's co-developer, and they are a subsidiary of Westinghouse (surprise!)

based in Cincinnati, OH, where the AM system has been tested. Out in N'Awlins, WNOE-AM's signal, broadcast in analog on 1060, was fed into a digital transmitter and broadcast at 1660 kHz -- yes, the expanded AM band (are you listening, FCC?).

The signal was squeezed down into 96 kbs via MUSICAM encoding. And, to (literally) top things off, for the digital signal, a special Kintronics antenna used in Desert Storm was used for the AM DAB, proving once and for all, that DAB would be nowhere without the U.S. military (it's no wonder other countries had a hard time figuring out how it's done -- we aren't in the habit of revealing defense secrets).

Well, after all this hoopla, how'd it sound? Well, in a word, great. No interference that I could hear or see and a really hot sound.

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JG's Earwaves *continued*

OK, yeah, it needs to be tweaked some more. They still need to work on the multipath for FM and all. But, the skeptics notwithstanding (and there were still a few lurking around, like pesky skeeters on a midsummer camping trip) in just a little over a year, some real progress had been made despite those who said "it couldn't be done."

Meanwhile, at the management sessions, DAB again drew record crowds. And I guess poor Gary Shapiro of the EIA, (whom I'm not mad at even though he did throw me out of my last NRSC meeting) must have felt a wee bit out of place as he was surrounded by broadcasters bombarding him with complaints about the EIA's DAB standard-setting committee.

Radio managers and the NAB think that broadcasters should be given a bigger say in the voting, after the committee tests all DAB systems next spring. Gary was really in for a rough grilling. All that was missing was the tomatoes.

Randy Odeneal, one-time DAB trouble-monger and now spearhead-

ing the majority opinion that in-band is the way to go, and also, I might add, an NAB Radio Board member, got the biggest applause for his always pithy observations.

He warned that "Canada is determined to pressure the U.S. into L-band for DAB" despite the fact that in-band renders L-band moot and the U.S. military refuses to part with any L-band anyway.

Randy also said the EIA's involvement is "not a blessing" and of in-band development, he noted that it was "proceeding at a blistering pace" and observed that USA Digital, the system that many said "defied the laws of physics" was successfully defying them in the convention lobby all through the show.

So, after all this DAB excitement, I just have two teensy weensy questions. First, what was all this I heard about Canada and Mexico trying to put the kibosh on any and all in-band DAB research (even here in the good ole U.S. of A?) at the C-TEL meet in late August? it didn't get far, thank heavens.

And where, oh where was DAB's persistent pioneer, Ron Strother? We were right there in your backyard on the bayou, Ron, but you were nowhere to be seen. R.S., please phone home.

Back up north aways, after more than two years of patient waiting and wondering, the FCC finally gave the go-ahead to satellite DAB. Yeah, Satellite CD Radio is jumping for joy.

Well, heck, the esteemed five on M Street really couldn't do much else. Once we put our WARC cards on the table there was little or nothing much standing in the way of authorizing a satellite DAB system here. Yeah, nothing much, except the whole terrestrial-based broadcast industry. Go figure.

And as for me, I think I'll just go back to pulling the swamp moss out of my toes.

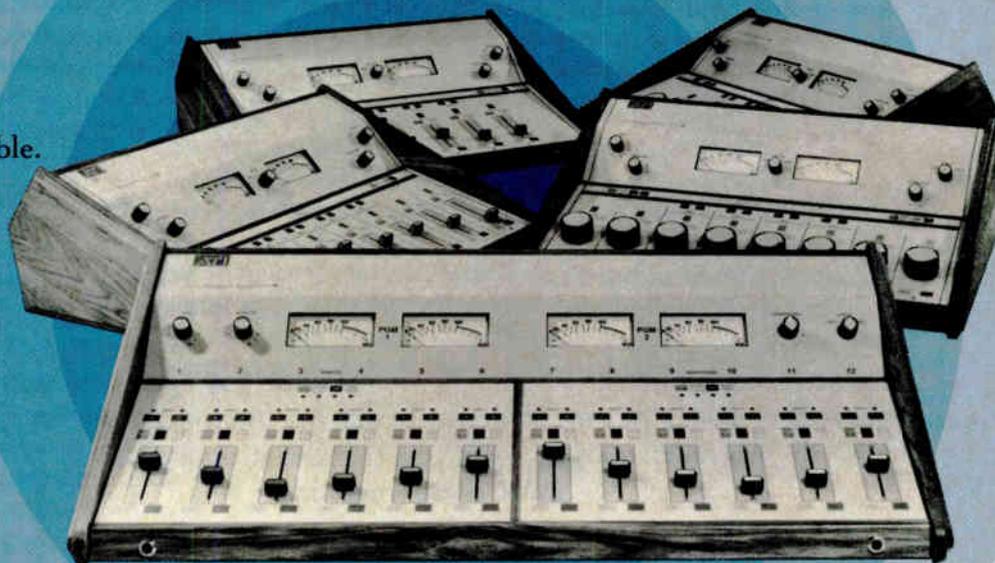
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Contract Engineer

The Business of Radio Contract Engineering

Parts Ain't Just Parts

By Mike Patton

Two months ago, I promised that we would look at dealing with manufacturers and vendors in our next visit. That got blown away along with my fences, trees and lots of other stuff in beautiful suburban Baton Rouge by Hurricane Andrew. Here we are now, debris cleared and the story of my experiences in the big blow told, to look at the erstwhile topic of last month.

“You spend the morning on hold ...”

On the surface, it seems simple to call up a manufacturer and order a part. “Ring, ring, hello, Acme widgets? Parts department please.” NOT! You may already be in trouble. Some companies don't have a “parts department” as such, and you get to explain to the secretary, who couldn't care less and has twelve other calls waiting, just exactly what you want so that she can pass you off to the first victim she can find.

Said victim gets regaled again with your problem, you spend the morning on hold, and then you get told that you must contact their east coast branch, which has already closed for the day.

Telephone Tips

Sometimes you don't have the part number, but just the description. This can be an excruciating way to spend your long-distance money. It usually helps a lot, though, if you can have the model number of the equipment the part is out of, and its assembly number and schematic designation. If all you have is a description, ask to speak to someone in technical ser-

vice first, so he or she can look it up, and don't forget to order a manual so you won't have to do this next time.

I find that middle-sized manufacturers are the easiest to deal with. These companies are big enough to have a parts department but small enough to where the parts people actually know the equipment and how to help you if all you have is a description. The largest companies are most likely to have just “order-takers” for parts people, whereas with the smallest firms there may be only one person who can help you, and there may be two other calls holding, or the person is not there right now.

As a contract engineer, I am doing well to take the time to call for parts once, much less several times. If I have to play phone tag with the parts guy, I'm already going to be in a bad mood before I ever start the conversation.

Patton's Principles of Parts

To help you with your adventures in parts procurement, I have devised my own set of rules.

Rule # 1: Speak softly and carry a big part number. Don't tell anyone any more than who you are and that you need a part (*not* what part) until they give you some sign of intelligence, or at least of familiarity with what you need. There's nothing more frustrating than explaining what part you need in four-part harmony with masacree to six different people who are all waiting for you to take a breath so that they can tell you (in diplomat-speak, of course) just how little they know/care.

Rule #2: Stand out from the crowd. Establish a personal relationship with someone at each manufacturer that you deal with. Make note of the person's name and ask for them. Tell them your name up front. You'll be pleasantly surprised how much further a parts or field service person (or for that matter, anyone) will be willing to go for some-

one they “know” even if they've never actually met you in person.

This is where going to conventions really helps. Many of the field service/parts people are there, and you can give them a face to go with your name, and have a mental picture of theirs. Two caveats: Don't act offended if the person doesn't recognize you (he/she talks to a whole lot of people like you, while you talk to only one at each company.) And by all means don't get on the person's bad side by arguing or whatever! (“Oh, no, not him again. Quick, tell him I'm in a meeting!”)

Get It In Writing

Rule #3: Get permission, not forgiveness. Don't order parts for stations without a manager's prior knowledge *and* approval. If you are buying and then reselling the parts to your clients at a markup, be sure to make

“Some clients go ballistic on this ...”

this clear to your clients before you have to eat the profit on an order. My feeling is that part of my education/experience is knowing where to get parts cheap, that this is a commodity that has real dollars-and-cents value and therefore I should be able to charge for it.

Some clients go ballistic on this, others seem to understand that it goes with the territory. Many contract engineers put their policy on this in their

(continued on page 12)

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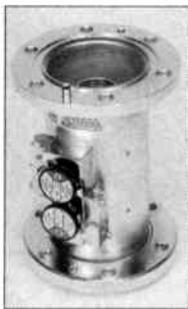
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Contract Engineer

. . . continued

contracts. Note to managers: any idiot can (hopefully, if he has the part number) order a part from the transmitter manufacturer, but a good contract engineer can often find the parts cheaper even after adding a percentage. But, I'm not going to make an issue of it if the client objects. I do it because it's a win-win situation, not to take advantage of anyone.

Rule #4: An IC in the hand is worth ten in Chicago, or don't buy one of anything, unless it costs \$1000. If one quit, so will another. Especially if the parts are cheap, get a handful. You'll use them. You may blow two or three more up just figuring the problem out. There are often quantity discounts from many mail-order parts houses on quantities of 25 or 100. If you can, buy them yourself and resell them to all your clients (see Rule #3). This may allow you a serious quantity discount (translate: profit).

I keep for resale a large assortment of resistors, electrolytic caps, and ICs. This allows me to keep on hand better quality, more exact replacements than are locally available and still make money on them while selling them for less than the local parts house, thus benefitting my clients and myself.

Rule #5: You can't be too organized. I have a good memory (I paid extra for it) and I cannot keep up with whosells what. I have two five-drawer file cabinets of literature and catalogs from manufacturers, vendors and distributors. I keep notes on parts sources with the manuals for the equipment. I have a long list of companies and contacts, which I hope to soon put into my computer.

These are by no means all the good ideas about parts that there are. I encourage you to share your good ideas with your friends and colleagues, and to learn from theirs.

Next month we'll talk about going the extra mile with quality contract engineering at stations where you have the time for it.

Mike Patton, who seems to have all of his parts in working order, owns and operates Mike Patton Associates and can be reached at 504-292-4189.



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Studio Site

Repair & Maintenance at the Studio

Designing Your Space

By Gordon S. Carter

Once you have finally picked out the space you are moving to, it is time to begin designing your facility. A good space planner (architect) and studio designer can be big time savers in this phase of the project. But first let's take a quick look at your new offices.

By this point you should have determined how much space each person needs to perform his or her job. When you get down to planning your offices you also need to look at how the various positions interrelate to one another.

For instance, you don't want your sales department at the opposite end of the building from your traffic department. They must be close so they can communicate quickly and easily.

Saving only a few steps from one person to another can result in hours of lost time saved and cut down on unplanned interruptions along the way.

Talk To The Staff

As you plan each office, be sure to work with the people who will be using the space. When you get some ideas on paper, talk to them and find out what they think. Remember that some people have a great deal of difficulty visualizing an office from a floor plan. A three dimensional drawing or model may be more helpful.

If you are working with a CAD system on a computer, consider a 3D module for the system. This can "walk" people through the proposed room so they can see how the various parts work together. It may be worth the extra expense to save a lot of changes later. Your space planner may already have such a system, so check with him before you buy.

Remember that your plans will go through a number of changes before they are complete. How you visualize someone else's work space may be totally impractical for them, so be sure to listen to what they tell you.

Individual Vs. Open

As you plan your space, there are two basic approaches you can take to office space--the individual office and the "open" office. Individual offices give everyone lots of privacy and a little extra security and can even be a great ego booster for some people. However, changes can be rather expensive if you have to remove or add a wall.

The "open" office is nothing but a large space with dividers between individual work spaces. The dividers are usually tall enough to provide some measure of privacy, but will not keep the spaces as quiet as individual offices. On the other hand, they are much easier to change and move.

Whichever approach you take, as the individual work spaces take shape, you will have to consider getting around in the space. Corridors or walk spaces can take up 1/3 to 1/2 of your total floor space if it is not carefully planned. This can get costly and even cause you

**"Good lighting
will pay for itself
in improved
performance."**

to shortchange some work spaces to allow for the extra corridors. Plan your traffic flow carefully.

Light And Power

As you determine floor plans, the electrical plans will begin to take shape. Make sure each work space has adequate light, both in the day and at night. Some people will end up working late and will need enough light to work. Also, make sure your lighting is not hard on the eyes. A good space planner can help with this. Remember that good lighting will pay for itself in improved performance and the morale of all who work under it.

One area that is commonly overlooked in office plans is adequate electricity. Make sure that each office has enough outlets for everything in it. A typical office may have a desk lamp, radio, tape player, clock, computer, printer, and a few other items to plug in. A simple duplex outlet is simply not enough for all of this. It is silly to move into a new space and have to buy an outlet strip or two for every office when enough outlets could have been installed from the beginning.

(continued on page 16)

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Studio Site

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By the same token, make sure the power is distributed well. Add up your power drains in each office, and you will find that it is best not to have more than two or three offices on a 15 amp circuit breaker. Otherwise you are just spreading the load too far.

Another area where you should allow room for growth is in your telephone wiring. Remember that many offices will have a multi-line phone, a fax machine and a computer with either a modem or a network connection. Be sure to specify enough wiring to each location to handle all of these needs plus some that you don't know about yet.

Anticipate Mistakes

As you finalize your office plans, check the furniture layout and the details of the furniture. A common mistake is to have outlets and phone jacks on the wall under the desk, only to find out that the desk has a modesty skirt that prevents access to the wall.

There are a lot of details to look at, and no one can catch all the possible errors. However, if your design team is experienced in the field, you should be able to catch most of the major mistakes before they are built into your space forever.

A final word about designing your offices. Someone will need to plan for decoration of your office space, in particular paint or wallpaper, carpeting and wall decorations. Some designers seem to think that white walls are the best, judging from all the white walls I have seen at radio stations.

But in the real world people have coffee cups, food and dirty hands. White walls do not stay white for long. Be sure that whoever picks your paint, wallpaper and carpet is aware that a radio station is not generally a clean environment.

A good designer will find something that looks good and will stay looking good for a long time. Wash-

able wall coverings and stain resistant carpeting, along with careful choice of color, will help keep your station looking good.

Next time we'll begin designing the studio space for our new station.

Gordon Carter is studio facilities manager at WFMT-FM in Chicago. He can be reached at his company, Professional Audio Services, by calling 708-482-4142.

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Tech Tips From the Field

Practical Solutions to Practical Problems

Fingerstock and DA Dunking

By George Whitaker

As I get older, I seem to be losing my memory. I thought of that as the opening line to this column the other day and had a good tie-in to go with it. However, I seem to have forgotten the rest of it.

So, our first Tech Tip this month is from the Lone Star state and J. P. White of KWDX-KKAS in Silsbee who found that careful preparation can make:

Changing Fingerstock Almost A Fingersnap

I discovered some deteriorating fingerstock inside the PA socket of our FM transmitter and knew that I must replace the it. I was forewarned of the difficulties when I read the article in RADIO GUIDE by Paul Black, CE, KMEL, San Francisco. He wrote "Repairing Fingerstock In Socket: It's No Thrill."

After thinking through the needed procedure, searching for a schematic (which was not to be had) and after many trips to Eddie's Hardware across town, I was chided for "Spending more time in preparation than it would take to correct the problem." As it turned out, they sure got that right. But for *Radio Guide's* article I would have tackled the job without all that preparation and I would probably still be trying to get the pieces back together.

With the help of my friend and trusty DJ, Mitch Day, and professional advice from my buddy, Doug Buffington, who knows all about carburetors, we proceeded to replace the fingerstock.

The fingerstock is the second piece down from the top of the socket. The six 4/40x2 bolts are heads up, taps on bottom of socket. Consequently, all six bolts must be removed first in order to replace the fingerstock. The 50 or more small parts go wild on you, and trying to put them back in exact

order within a space the size of a coffee cup is the obvious problem.

First we took one bolt out of the socket at a time and turned it upside down (head at bottom and nut at top). Then we reversed the use of a small turnbuckle, making a small "extender"

and put it under the bottom plate of the socket to keep a small amount of pressure on the socket, then put a piece of tape on the heads of the six bolts (to keep them from falling out of the socket).

(continued on page 18)

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Tech Tips

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Next, we took all six taps off, removed the top plate, removed the fingerstock, replaced the new fingers, replaced the top plate and put all six taps back on. Finally, we took one bolt out of socket at a time and returned it to its original state, head at top, nut at bottom.

Complete overhaul was finished in one hour, thanks to being forewarned by Black, *Radio Guide*, Doug Buffington and Mr. Eddie. I also appreciated the encouragement from our tube rebuilders at Econco.

DA Dunking

Shortly after constructing our new 4-tower array in east Dallas we had the biggest flood in 84 years. Three of my tower bases went under, as well as their tuning boxes. I switched to the auxiliary site and ten minutes later it went under. But, that day and the next several are a story unto themselves. This item has to do with the aftermath.

As soon as the water receded I took everything apart, cleaned it, reassembled it, and spoke kindly to it about ignoring the effects of the dunking. Not having total faith in the efficacy of these actions, I turned my attention to "what if."

Being a DA-2, we have plenty of relay switching going on out in the

ATUs. "What if" one of them began to hang up? Well, our Harris phasor came with an alarm that would begin to issue an earsplitting tone should the towers fail to tally. Although this is helpful in knowing why you are off the air, it has a couple of problems associated with it.

First, it doesn't tell you which of the four towers is hung. Therefore, you must go to each one. Murphy's law tells us that you will try all of the good ones first, whether you have a 2-tower or a 12-tower array.

Secondly, there was no provision made for turning the alarm off and it would sit there screaming until you finally solved the problem. This happened to me once during the construction phase and was definitely an impetus in making the following alterations.

I decided that, having had a river water bath, the RF relays would be the most likely thing to give trouble. And, if this was true, then I wanted a tally light system that would show me where the trouble had originated. The photograph shows the upper left hand corner of one of our phasor cabinets where I mounted the tally lights.

The LED's are mounted on a protoboard to match up with the LED holders I mounted in the front of the cabinet. Some rub-off letters completed the aesthetics.

Some years ago, Harris went to a standard phasor design where everyone gets the same book and control-

ler. Therefore, what fits our phasor will fit almost anyone's Harris unit. So, if you have a Harris phasor, your schematic should look very similar to the portion of our schematic shown in **Figure #1** (on page 19). I limited the portion to only two towers since the wiring sequence is simply repeated out to however many towers you happen to have.

The actual connections are made to the terminal blocks on the floor of the phasor where the incoming control cables from each tower are connected. The multi-pair cable going to the LEDs only has to be about 8-feet long to make a neat "90 degree turn" type installation.

Take notice of the fact that the same terminal blocks that have the 24 V tally circuit also carry the 220 V switching circuits. Turn **off** the breaker to the phasor before starting this project.

I didn't show them on the schematic for this article, but, you may have to add some small RF chokes in series with each LED in order to keep RF from causing a glow in them. I found that my night power of 1000 W was no problem. However, at 5 kW in the day, the day set would glow slightly. This does not prevent them from doing their job since you can easily tell the difference if they light up completely. But, I went ahead and put some little Radio Shack chokes in series with the day set to get them to stay completely dark.

The installation does not require any alteration to existing wiring. All you have to do is add the dropping resistor and LED in front of each microswitch. If the switch is open, the current flow will be to the LED. If the relay locks up correctly, and the switch closes, the path of least resistance is on to the next tower and the LED stays dark.

Therefore, if one or more of the LED's are lighted, the last lighted LED in the sequence is the tower that has failed to latch. IE: if LEDs One, Two and Three are lighted, then tower three is guilty.

As it turned out, the Harris relays withstood the dunking. In the four years since, I have only had one in-

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Tech Tips

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stance of failure to latch and it was not caused by the relay. A wire corroded inside a crimp-on terminal and the resistance became too high to pass the necessary current.

Tommy Messerli of KMJC in Dav-
enport, Iowa gave me a "slapper" this
month with a "Big Brother" arrange-
ment that allowed a:

Camcorder To Catch An Arc

Our 816 R-4 had begun to arc
occasionally and would trip the plate
breaker. Sometimes it would be days,
sometimes hours between arcs. I had
been at the transmitter when it hap-
pened so I knew that it was actually
arcing. But, examination did not re-
veal the spot. It never sustained an
arc, just one quick pop and the breaker
was tripped.

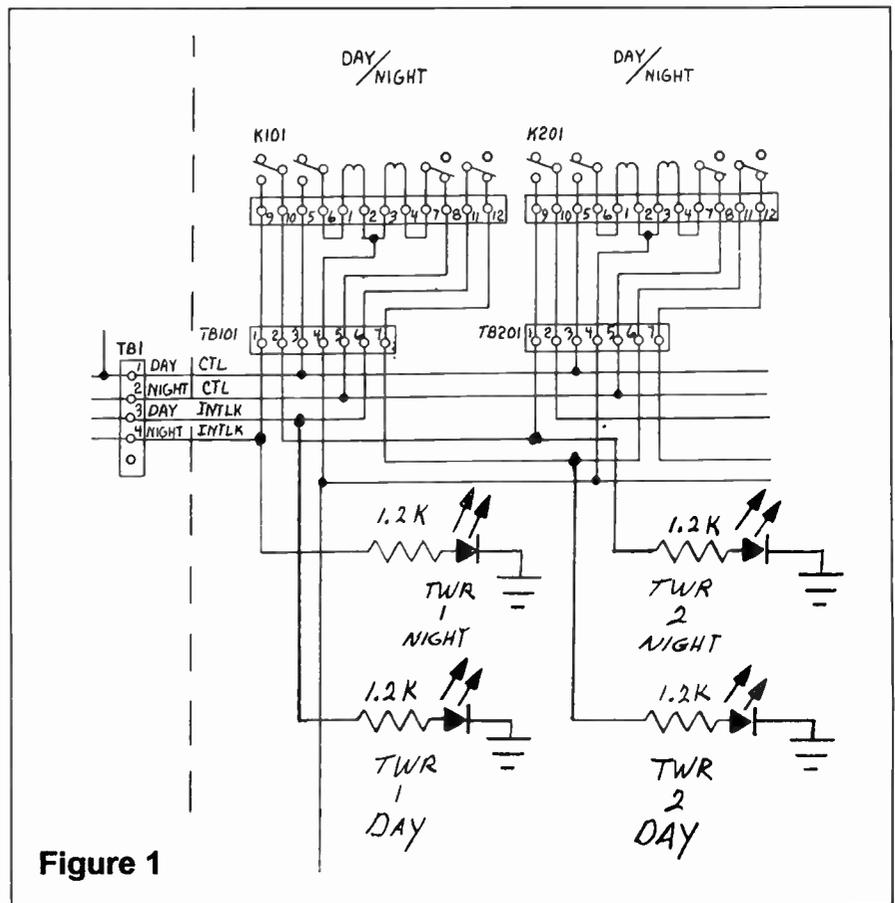


Figure 1

I couldn't stay there all the time,
so, I took a camcorder to do the watching
for me. It was set on it's slowest speed
and aimed into the back of the trans-
mitter.

It took a couple of trips out there
to rewind the tape since I could only
get eight hours at a time. However,
the trick paid off. The transmitter arced
and went down. I rewound the tape
and looked for the location of the
flash. It showed me right where there
was a pinhole break in the insulation
of the high voltage line to the final.
The damage was hardly visible, but
the camera doesn't lie. I repaired the
wire and no more arc.

In my years of running around to
transmitters and studios I have devel-
oped some axioms of my own to add
to Mr. Murphy's observation.

1. By the time I learn how it is,
that's how it was. 2. Whatever I need
is wherever I'm not. 3. Drill bits and
allen wrenches only come in two sizes:
too large and too small.

In order to attempt to overcome
item #2 most of us have developed

some goodie boxes that we carry along
with the other stuff. Paul Salois, GM
and CE of KPCR in Bowling Green,
MO has what I think is a very good list
in his:

Odds And Ends Kit

My kit contains a six-foot length of
regular zip cord, about 20 feet of 3-
conductor shielded audio wire and a
10-foot piece of 20 gauge hookup
wire. Just wind each length around
your hand and secure with a stout
rubber band. Probably the most used
item is a bundle of clip leads (Radio
Shack # 278-1156 or 278-1157).

My kit also includes one or two
each of 1/8" and 1/4" phone plugs,
male and female mic connectors (with-
out the shell), and a three prong adap-
tor for AC plugs. There's a package of
adhesive labels for identifying wires, a
pencil, a cheap pocket knife, a magni-
fying glass, a small disposable flash-
light, a disposable cigarette lighter and
a roll of electrical tape.

(continued on page 20)

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Tech Tips

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I have assembled this by recalling some of the items I really needed in the past. You may have similar experiences. Feel free to add or subtract as you see fit. Remember, this is not meant to replace your regular toolbox, but to supplement it and to keep it from getting too cluttered. Actually I have two nearly identical kits. I keep one in the trunk of the company sedan and one under the seat of my family station wagon. I don't use them often but when I do I feel real smart for having thought of my kit.

Hank Landsberg, President of Henry Engineering in Sierra Madre, CA informs me that the company has come out with a field modification to the "DigiStor" units that were shipped prior to Aug. 24, 1992. Henry makes some really neat things in little boxes. But, even good things can sometimes be made better as we see in this:

DigiStor Update

There is a simple modification to the DigiStor unit that will improve its audio clarity and reduce background noise. Follow these directions carefully:

1. Remove the unit from the case by unscrewing the four corner screws.
2. Refer to the users manual and locate the "Play Level Adjust" on the Digital Audio Storage Board. (This board is the smaller PC board.)
3. Turn this control fully counter-clockwise, then turn about 1/6 turn clockwise. The slot in the small blue "knob" should line up with the "1" in "VR1" that is printed on the board.
4. Refer to the manual and locate R-10 on the main (large) circuit board. Replace this (100 K) resistor with a 39 K resistor.
5. Reassemble the unit. This modification will reduce background noise by about 10 dB. For additional information contact the Henry Engineering office.

I think that just about any engineer would agree that Marti equipment is about as reliable as it is possible to construct. However, even the Titanic was sinkable and a Marti can malfunction as our next item shows.

C. J. Jackson of WSPA AM-FM in Spartanburg, SC found a fix for:

Motorboating In A Marti R-10

On the AM side of our stations, we had been having a low level, low frequency motorboating noise appearing in the on-air audio about once every two weeks or so. It could only be heard on cold voice—just enough to keep the air staff mentioning it to me every so often. After a couple of months of trying to trace this intermittent noise, it finally appeared and stayed. The problem turned out to be in our AM STL receiver, which is a Marti R-10.

On the 890-960 MHz converter module board, the local oscillator crystal is socketed next to a temperature control module, and on our units, a small piece of styrofoam covers this part of



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the board. Marti secures the crystal against the temperature control module with a small band. This band had lost tension. At our AM site, the STL receivers are mounted in a rack next to the main transmitter, and the vibration from the blowers was enough to cause the crystal to vibrate in its socket and produce noise in the audio output. A small rubber band around the crystal and temperature control module solved the problem.

Marti uses the same arrangement to temperature-stabilize many of their oscillators. I have never experienced this phenomenon with any Marti RPU's, but if you have a microphonic problem like the one I've just described, this may be a solution.

I have decided that what I really want to do is retire and become a permanent fixture at Jelly Roll'S on Bourbon Street in New Orleans. During the NAB Radio Show I fell in love with the music. Plus, the staff there is exceptionally nice. Susan, our waitress, was even willing to accept, (not necessarily believe), my story that Paul Strickland of KKDA was my father and therefore "Daddy" should pick up the tab for his son. By the way, I finally remembered what old memories have to do with Tech Tips.

I find myself many times thinking back to station problems I never solved. "If only I had known..." There are a number of cases where, I realize now, I just flat blew it. These cases become the inspiration for many of the tips that I try to pass on to other engineers. As I read and learn, and have more successes and disasters, I realize that someone else might not have run into that problem yet. Therefore, my experiences might help.

Next time you catch yourself thinking about one of those times, write up what you have learned and send it in. As a token of our appreciation you will receive a Tech Tipster pocket calculator and, at least some kind of a personal response from the editor.

You can write to: George Whitaker, 3505 Daniel Drive, Arlington, TX 76014.

My office phone is (214) 528-1600, fax line is 528-4667, and my home phone is (817) 468-5981.

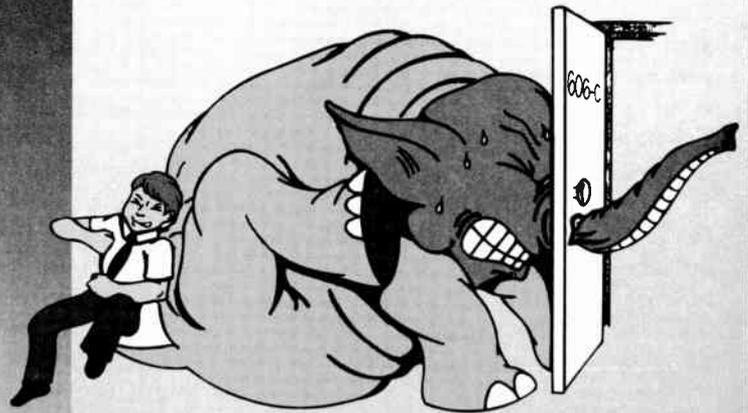
One more personal item before quitting for the month. Someone called my home a couple of months ago needing help with a Gentner VRC 2000 and my wife gave them my pager number. However, it is a digital pager where you have to enter the number you want me to call. I could not return

the page because I did not know who to call.

And now there is someone out there that thinks I didn't care. If that someone was you, I want you to know that I *do* care and I did not ignore you. My advice is still free, (and that may be what it is worth), so ask my wife for my mobilephone and office numbers too. The secretary at the station also has instructions to give them, and my home number, to anyone requesting them. Keep them cards and letters comin' folks. ■

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Power Principles

AC Power Installation and Protection

Protecting Transmitter Sites

By Dick Townsend

Ten years ago, you wouldn't have found it necessary to be too concerned with the transient/surge phenomenon simply because older technology could handle most of this activity with no adverse effects. Relays, tubes, contactors, etc. were rugged enough to withstand all but the most severe of problems.

Now that the broadcast industry has graduated to faster, small mass solid devices which are generally more susceptible to power problems, we must spend more time, effort and money to provide the required electrical operating environment that this type of equipment demands if we are to get the maximum out of our investment. Sometimes this important consideration is overlooked until considerable damage has been done.

Transient Voltage Surge Suppressors (TVSS)

In general, these devices clamp, restrict or divert transient surges by operating on overvoltage, high frequency or both. There are versions that conduct from line to neutral, line to ground, neutral to ground or combinations of all three.

TVSS devices typically suppress spikes having a frequency greater than 10 kHz and peak greater than 250 V, depending upon the device. Low quality units might be improperly triggered on normal line voltage/frequency and might self-destruct on transients of relatively low magnitude. High quality units effectively cope with virtually any transient problem and will remove surges, spikes, transients, RF and harmonic activity found in the overvoltage band, both positive and negative.

Originally, surge suppression technology consisted of a single device, normally a single gas tube, carbon block, metal oxide varistor or similar type of device. However, the effort of

dissipating transient energy resulted in deterioration of the device itself. The surge suppressor was designed to fail by sacrificing itself to incoming surges.

Next Generation

The second generation of surge suppression technology is commonly referred to as a "hybrid network." These networks consist of a combination of the surge suppression devices mentioned above, arranged in stages so as to allow the various strengths of each device to interact. These are more effective than their predecessors, combining a much faster response time with higher energy dissipation capability.

However, like the earlier models, these networks still undergo a deterioration process while protecting against surges. The heat build-up in the electronics causes deterioration of the performance characteristics of the components. As specific components deteriorate, the entire design loses its effectiveness and ultimately fails. Specifications in the performance of this type of device can be misleading, due to the deterioration as a result of transient activity.

Today we realize that if an efficient process could be found for dissipating the heat from the electronics within the TVSS, the electronics could be protected and thus provide an extended life for a surge suppression device. All of this, along with the drawbacks and benefits from each type of protection device, must be considered when selecting surge suppression and voltage protection for your operation.

Selecting a TVSS

Basically, you should consider seven basic areas when choosing a TVSS. The response time should be less than one nanosecond. Then you should choose a device with optimum

performance in the following areas: Let-through voltage (voltage the equipment sees after the device has been clamped); energy handling ability (normally rated in Joules); peak surge current (in amps); price; warranty and degradation potential.

Once you've selected the appropriate device or devices, the main issue to address is what do you want to protect: the transmitter or the transmitter site? Sometimes, but not always, you can do both with just one unit.

In general, the larger your facility, the more complex your electrical distribution system will be. This means more equipment to protect and more "open doors" for transient-related problems.

Although most concern for protection is from lightning, over 80% of all transient surge related problems occur within the facility as a result of inductive load switching (sometimes referred to as "switching transients").

Inductive load switching transients are generated by the removal of electrical power from any inductive load (such as motors). This interruption in voltage and the consequent regenerated voltage caused by the separating contactor creates a voltage spike. Some causes of this problem are air conditioners, generators and even turning off the lights.

Specific Applications

According to the CE of one Dallas station, the ideal feed for a transmitter is a "fused disconnect" rather than a breaker panel. This way you'll never be concerned about tripping the breaker feeding the transmitter. A fused disconnect is basically a standalone box with fuses of different amp ratings and on-off switch normally downstream from a distribution panel dedicated to one piece of equipment such as the transmitter.

(continued on page 34)

Transmitter Site

Repair & Maintenance at the Transmitter Site

Electrical Power From The Source

By John Bredesen, P.E.

Most Americans take electrical power reliability for granted. Reliability expectations and realizations continue to grow. However, because we, as broadcast professionals, depend so heavily on a constant, reliable supply of commercial power to do our jobs well, it's helpful to understand where our commercial power comes from and how it gets to your facility.

Commercial power is derived from three basic sources of stored energy: by burning oil, gas or coal; nuclear fission and hydroelectric. The first process uses energy released in a conventional boiler. The steam generated is used to turn turbines attached to the generators.

Nuclear power generation also uses steam to turn turbines similar to those of a conventional fossil fuel power plant. The difference is the way the steam is generated. It's produced when a fluid circulates around the radioactive core of a reactor. This hot fluid, giving up energy in a heat exchanger, boils water to steam which turns the turbine. Hydroelectric generation uses the energy in falling water to directly turn a water turbine.

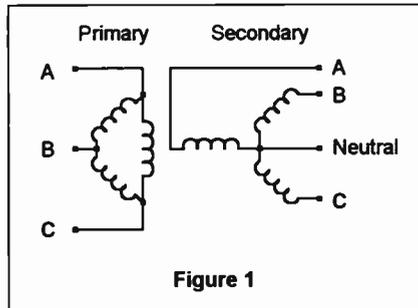
Transmission Voltage

Electricity generated in large commercial facilities is always three-phase and the voltage directly from the generators is relatively high--15 kV or more. Even at that it's stepped up to 115 or 230 kV or even higher for transmission to the final destination. Because of the great distances involved, transmission voltages in the western states will routinely be as high as 500 kV in order to minimize I^2R losses.

When the very high voltage transmission lines reach a substation serving a community, the voltage is transformed to 60 or 115 kV for distribution purposes. Switching of sources occurs at this level to patch around problems and assure continuity. Voltage will be further lowered to about

12 kV for distribution within a city.

Utilities place voltage-controlling step regulators in these lines and further distribution switching will occur at this level. From there it's transformed to the voltage needed by the end user using the very familiar transformers, either pole-mounted (pole pigs) or pad-mounted on the ground.



All of this is three phase, with the exception of distribution to areas such as residential neighborhoods where only single phase power is usually needed. (With all this transformation and switching, is it any wonder that voltage transients are a problem?)

Two Possible Setups

You, the end user, will generally be confronted with one of two configurations of three-phase power coming into the transmitter building. One is referred to as a Delta and the other a Wye ("Y") connection. Both are widely used, with new construction favoring the Delta-Wye system with the high voltage primary connected in Delta and the secondary a "Wye" configuration as shown in Figure #1.

(continued on page 24)

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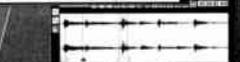
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Transmitter Site

Continued from page 23

The "Y" connection (Figure #2) is the configuration which provides 208 V, three phase (along with 120 V, single phase), while the Delta (Figure #3) provides 240 V, three phase and 120 V, single phase. Note also with the Delta that 120 V connections can only be made on one phase, and that there is a so-called "wild" leg or phase with an elevated voltage.

A derivation of these voltages is used in cases of very high power installations, such as 50 kW AM or UHF television transmitters. In this case the secondary of the "Y" transformer will supply 480 V phase to phase and 277 V from phase to neutral. A Delta transformer will supply just 480 V. These voltages are also commonly used in large commercial and industrial applications.

Note that neither of these configurations supply 120 V. In installations of this type, there will usually be

a separate station owned step-down transformer inside the building to derive the lower voltage.

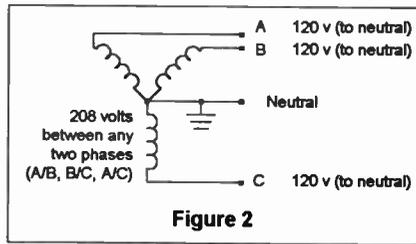


Figure 2

Open Delta

Utilities will often provide three-phase power using an Open-Delta arrangement as shown in Figure #4. The reasons are almost always for economic reasons. Notice that this configuration only requires two transformers instead of three. Either the cost of extending an additional primary conductor to the site and/or the cost of the additional utility transformer necessary to close the Delta connection contributed to the decision.

Although there are many transmitter installations operating with the Open-Delta connection, it should be avoided if possible for a number of reasons.

First, voltage regulation under a varying load is poorer than with either a Closed-Delta or a Wye configuration. Second, the configuration is more susceptible to transient pass-through from the primary.

In addition, there can be a significant third harmonic content as well as voltage and phase unbalance resulting in the generation of ripple frequencies in three phase supplies which the filter section wasn't designed to handle.

Beware Of Overheating

A small voltage unbalance in a three phase motor or transformer will result in potentially disastrous overheating. One source indicates that a phase unbalance of 3.5% (7 or 8 V in a 208/240 system) can result in a 25% increase in heat generated by a motor. Transformers will also overheat when subjected to these unbalanced conditions.

Also, some manufacturers will not honor their warranty if their transmitter is operated on an Open-Delta system. If for reasons beyond your control you must use this configuration, be sure to check with the transmitter manufacturer.

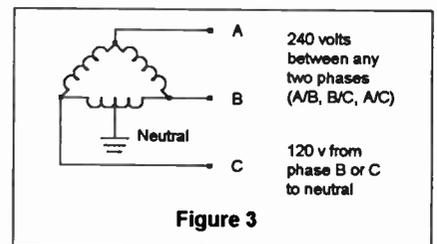


Figure 3

It may be possible to use a Delta-Delta or a Delta-Wye transformer between the utility's Open-Delta transformers and your transmitter to approximate a closed delta configuration. I've not had any first hand experience with this approach, but I have seen it used with apparent success.

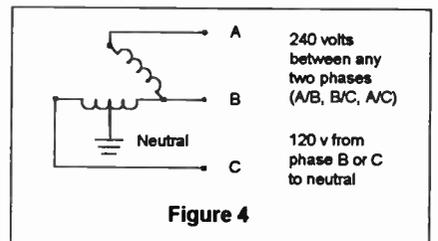


Figure 4

Regardless of the supply configuration, it's important to work with the power utility to obtain phase voltages as closely matched as possible. The problems associated with unbalanced voltages and phases aren't limited to the Open-Delta connection.

Next month we'll take a look at electric power bills and how they're arrived at. "Demand charges" and "power factor" are confusing to many and I'll try to clarify these.

John Bredesen, PE, is currently CE of KLCC n Eugene, OR. He can be reached at 503-747-4501, Ext. 2478.

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Stations Stories

Radio Station Installation Reports

The U.N. Enters The Digital Age

By Judith Gross

Next year, the "Year of Indigenous People" in international diplomatic circles, will also herald an vast International Conference For Human Rights.

Fine. But what's that got to do with radio technology? Well, for the radio programs sent to countries outside the U.S. in 19 different languages it will definitely mean: the start of digital production.

Few, if any knowledgeable observers either in or out of radio are aware that the United Nations has its own radio and TV studios, in the heart of the architecturally striking complex overlooking New York City's East River.

The esteemed organization even has its own radio frequency: 89.1 on the FM dial. That frequency is now used by New York University radio, however, and you can't dial up a "radio U.N."

From the Start

Radio began at the U.N. in 1947, shortly after its predecessor, The League of Nations, was formed in the wake of World War II. Originally, the Voice of America was part of U.N. radio but the two went their separate ways in 1985.

Now, seven studios, five supporting busy schedules all the time and the remaining two employed during hectic times of General Assembly meetings, produce daily news programs, documentaries and news magazines heard all over the world, except in the U.S.

"We are not broadcasters," notes Ayman El-Amir, who heads up the U.N.'s radio department. "We are packaging programs for other broadcasters."

El-Amir adds that as radio production in the rest of the world, "particularly in the United Kingdom and Europe" has improved quality through digital production techniques, U.N. radio has had to plan for its own

upgrades to keep up. And with programs that have to be duplicated, digital methods are almost a must.

Started This Year

The improvement program has already begun. Recently, two of the seven radio studios were refurbished and El-Amir says two more will be finished through next year. Then, in the 1994-95 U.N. session, the remaining three will be done.

"At least we have two now that can produce quality equivalent to the U.S. radio market," El-Amir notes.

Why use the increasingly digital U.S. market as the ideal when the programs are seldom aired within its borders? Consider again the all-im-

portant topics that will emerge at the International Conference For Human Rights.

The Rebuild

Studios 7 and 8 were the lucky ones this year. Studio 8 is "extremely busy" according to Martin Bunnel, who, as Chief of Television News and Production Services, oversees all of the U.N.'s broadcast operations.

"Studio 8 produces most of the anti-apartheid shows," a big part of the U.N.'s production, according to Bunnel. Studio 7, meanwhile, is closest to the TV operations and can be used for some audio-for-video production.

(continued on page 26)

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Station Stories

Continued from page 25

Pacific Recorders & Engineering got the contract to refurbish the studios. But with the company's west coast location, and a schedule that proved to be more sporadic than not, primarily because the U.N.'s in-house technical team was to do most of the work, a more local company was needed to oversee the process.

PR&E wanted somebody experienced in all phases of studio rebuild it could trust with its high-quality reputation. They selected Spectrum Broadcast, Inc. a full-service company experienced in design, prefabrication and installation of broadcast systems across a broad range of market sizes. The company is based near Philadelphia.

"New York is a short commute for us," notes Spectrum president Dick Schumeyer. "Plus we're a known quantity. We worked with Pacific on the WABC and WQXR renovations in New York. So they asked us to manage the installation and training at the U.N."

For Spectrum, that meant being on-site and instructing the U.N. personnel in furniture assembly and installing the cable harnesses, then installing the consoles and all the rest of studio equipment.

"Assembling Pacific furniture was not difficult because we are experienced with their equipment. But interfacing with some of the existing U.N. systems was a bit trickier. It was figured out by U.N. technicians and we had to train them," adds Schumeyer.

Added Creativity

In addition to PR&E AMX-18 consoles in each of the two studios, equipment included Tascam 122 Mk II cassettes and Tascam CD players; JBL 4412 studio monitors and Fostex 6301B pro monitors; Gentner Digital Hybrid IIs; and Eventide Ultraharmonizers.

The digital telephone hybrids and Ultraharmonizers give a hint of the quality upgrade the U.N. hopes to implement with the refurbishing of the studios. Audio technician Howard Silberberg and Helen Shaskan, assistant producer of a program called

**"Gentner hybrids
make phone
interviews easier"**

"World in Review," seemed delighted to be working in brand new surroundings.

Silberberg noted that the Gentner hybrids make phone interviews easier but added that he and the other audio engineers haven't even begun to take advantage of the Ultraharmonizer's potential.

"We use it for time squeezing and add some echo, but we could do a lot more." He said that effects on the programs might get even more interesting when Roland digital editing is added soon.

And El-Amir also expresses excitement at the possibility that digital effects might be added to underscore

the message of programs dealing with apartheid or other human rights issues for next year's conference.

"We will be producing eight special programs on various aspects of human rights in anticipation of the conference. We will definitely put more effort into the production of these programs with our new studio capability," says El-Amir.

World Changes

El-Amir is looking ahead, not only to the prospect of digital production, but also speculating on a changed world of broadcasting with the addition of direct satellite and DAB. It will be interesting to see if changes in technology will help bring about changes in the world social order through programs like the special ones slated to cover human rights.

For someone like Schumeyer, who grew up in New York but for whom the management of the studio refurbishing sparked his very first visit inside the U.N., playing a small role in fostering such changes was "satisfying."

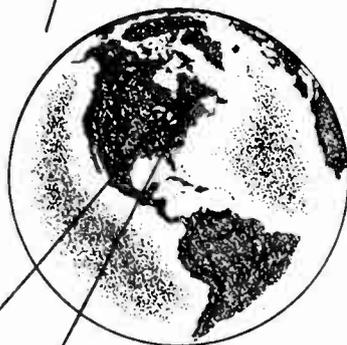
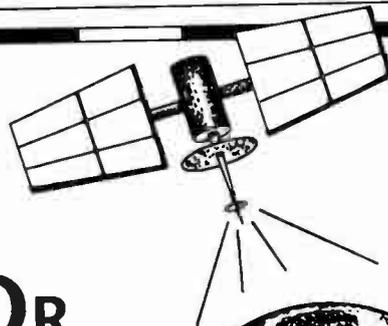
"We helped them make a technical transition from the mid part of this century that will carry them through to the end of it and beyond," Schumeyer says. "Finding out about U.N. radio and what their mission is was fascinating," he adds. "It's nice to think that if profound programs on human rights change the world for the better we played a small part of that. It's quite a bit different than what we're used to dealing with in typical U.S. radio." ■



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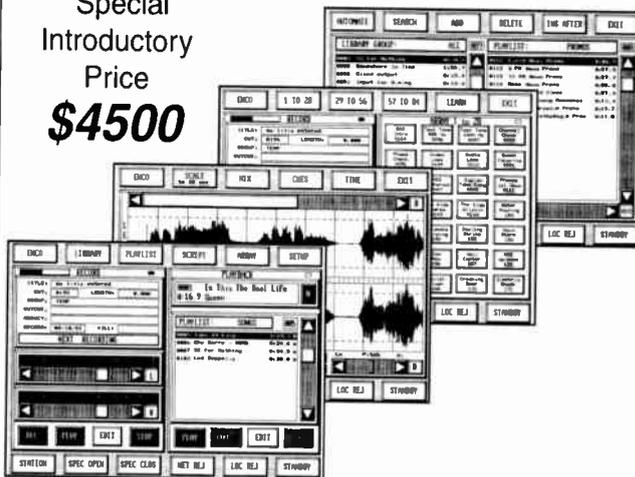
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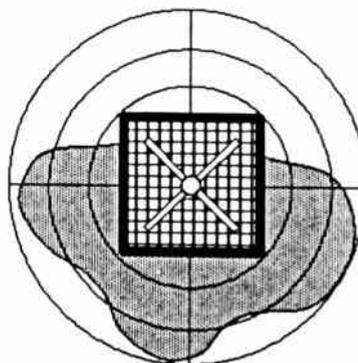


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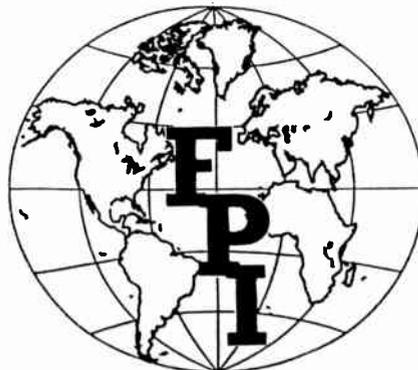
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After four years, WireReady is now used by hundreds of AM and FM stations. Several of the largest state radio networks, and some of the biggest radio newsrooms and names in the business have computerized their newsrooms with WireReady. Toss in a few government agencies and a nuclear-powered aircraft carrier and we think we can handle your needs too. We'll be happy to send you references, information, or a demo, so give us a call today.

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WireReady Newswire Systems Inc.

Equipment Guide



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From Your Fax-Phone

Radio's Most Effective Classified Ad Listings

Classified Ads: On-Line — On Your Fax

Here's How to Get the Latest Equipment Listings:

1. Call the Equipment Guide at (507) 280-4045, from your Fax Phone.
2. Follow the operator's voice instructions, and you will be asked to press one or more of the following buttons on the phone:

- #1 — Used Equipment for Sale
- #2 — Equipment Wanted
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3. Remember, just follow the voice instructions, and you'll get a complete fax printout of all the information you want — right on your fax machine.

Send Your Equipment Listing to Us — We'll Place it on the Equipment-Guide

1. Copy this ad form.
2. Use one form for each category.
3. Fill it out & fax or mail it to us at:

Equipment Guide

Box 7001, Rochester, MN 55903
Fax # (507) 280-9143

Name: _____ Station: _____

Address: _____

City: _____ State: _____ Zip: _____

Phone: _____ Fax: _____

Ad Copy Below: (Use a New Form for Each Category)

Equipment Categories:

For Sale Wanted

- AM Transmitters
- Antennas, Towers, Coax
- Automation Equipment
- Computer Equipment
- Consoles and Mixers
- Exciters: AM, FM, SCA & Stereo
- FM Transmitters
- Misc. Audio & Telephone Equipment
- Misc. Equipment & Parts
- Misc. RF Equipment
- Processing & Equalization
- Satellite Equipment
- Schematics, Tech-manuals & Books
- Speakers, Headphones & PA Equip.
- Source Equip: TTs, CDs, Mikes
- STL, RPU, TSL & Remote Control
- Tape Equip: Reel, Cart, DAT, Cassette
- Test, Monitor & EBS Equipment
- Tubes, Sockets & Misc. Parts
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NEW Discrete Digital STL CD Quality Audio



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The INTRAPLEX 4800 DDAT LINK Discrete Digital Audio Transmission LINK with 16-bit linear coding and **no compression** gives you far better audio performance than a good analog system.

With the 4800 DDAT LINK and the T1 line available from all telephone companies, there is enough bandwidth to handle your 15 kHz stereo (or dual monaural) signal. Further, there is sufficient bandwidth left over for SCA's, SAP channels, telemetry and control channels, and telephone circuits with no compromise in quality.

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Call us at INTRAPLEX for full details and a quotation.



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TEL: (508) 486-3722 / FAX: (508) 486-0709

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How to Submit Articles

Radio Guide welcomes your comments, letters, articles and Tech-Tips. We prefer electronic submissions.

1. MCI Mail to Judith Gross, at #507-3038.
2. Modem: Call 703-370-7943 and request an XMODEM transfer.
3. Mail a 3.5" or 5-1/4" double or high density floppy disk (Wordperfect 5.0 or ASCII) to: Judith Gross at 101 S. Reynolds St., Suite H-405, Alexandria, VA 22304.

We also accept clean, typewritten or printed manuscripts mailed to Judith Gross at the above address. Photos and clean, camera-ready art with articles and Tech-Tips appreciated. Articles should be 750-1000 words in length and Tech-Tips should be 200-500 words. Radio Guide pays for all articles accepted for publication and Tech Tipsters will receive a Radio Guide pocket calculator.

Power Principles

Continued from page 22

There are a number of variations on the type of setups that need to be considered when adding protection. There could be one main service entrance (main disconnect or breaker panel) feeding everything. This is the simplest to protect because it requires only a single unit.

Or you could have a main service entrance which feeds a generator transfer panel, which feeds a transmitter or transmitters and a building power panel. In this case you need to determine if anything else is fed off the main, such as other panels or disconnects. If not, you should protect the GTP (load side). If there is other equipment being fed from the main, you should protect both the main and the load side of the GTP panel.

Other possible situations might include equipment being fed directly from buss ducts, which suggests that you put in individual fused disconnects feeding equipment; primary and stand-by transmitters being fed from two panels, which becomes a budgetary concern; or 480 to 120/208 WYE (Y) step-down transmitter.

In the last case, if you protect the primary (line) side you also provide protection for the transformer. If you protect the secondary (load) side, you leave any equipment being fed off the primary side unprotected.

Finally, remember that a spike/transient will always follow the path of least resistance and seek the shortest

path to ground. This is the role of the TVSS, to become that path of least resistance. But if you only protect the main service, the protector will "sleep" through any internally generated spike downstream. For optimum results, isolate and protect at the source or as far downstream as possible.

Dick Townsend manages the broadcast division of Energy Control Systems in Fort Worth, TX. He can be reached at 817-483-8497.

Roll The Dice On Credit ?



Sound's silly, doesn't it? But in reality, you may be doing just that. Equipment manufacturers, contract engineers and other services are at the mercy of their clients' ability or willingness to pay.

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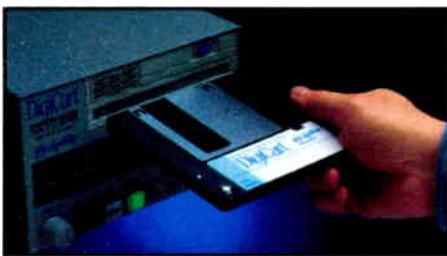
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