Radio Guide

Radio's Technology Magazine

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May - 1991

PURE DIGITAL.

Use the 8200's Automatic Preset Switching to automatically change the processing on a programmed schedule. Ideal for dayparting or multi-format stations.

Bottom Line Orientation.

Creating a "sound" that attracts and holds the largest possible audience is the bottom line in the radio business. And the new OPTIMOD-FM Digital 8200 is a technological breakthrough with bottom line impact.

Digital Makes the Best Even Better.

The power of digital propels the 8200 to new levels of performance and functionality. OPTIMOD-FM 8200 is a *true* digital audio processor—the audio is digitized and all control functions are digital.

What is the value of digital processing and control? In addition to a better sound, digital makes the OPTIMOD-FM more user-friendly, more programmable, more flexible. Simply put, because the OPTIMOD-FM is easier to adapt to a station's programming needs, it will produce more benefit, more of the time.

The Processor with Multiple Personalities.

With most conventional processors, multiple processing configurations require multiple boxes. With the 8200's Multiple Variable Processing (MVP) architecture, processing configurations can be changed with the push of a button—select the protection MVP for total transparency, or the two-band MVP for an improved version of the traditional open, bright and natural OPTIMOD-FM sound which helped make thousands of stations successful. Choose the optional multi-band MVP and meet the challenge of competitive major-market processing with selectable speeds to match any format.

Power. Potential. Profitability.

Take advantage of the power, potential and profitability of the OPTIMOD-FM 8200. Call your dealer now for a personal, hands-on evaluation of the 8200.

The OPTIMOD-FM 8200 is a technological breakthrough with bottom line impact. The power of OPTIMOD— in pure digital.

OPTIMOD-FM DIGITAL

orban

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San Leandro, CA 94577 USA
Tel: (1) 415/351-3500
Fax: (1) 415/351-0500

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Volume 4 Issue 5

Cover Photo

Bob Orban

Courtesy of AKG/Orban

Watch For The New

Radio Guide-Net

Coming Soon

More After This!

Guest Editorial

By Ed Cole - Lakeland Florida

A Salvation For AM Radio

It seems that everyone who works in any phase of the broadcast industry, or anyone who regularly listens to AM, has an opinion as to what can be done to give the AM industry the needed infusion to recover health. Dozens and even hundreds of articles have appeared in the trade publications, regarding this issue. It would seem that almost everyone has an axe to grind on this subject, and I am no exception. Some of these persons have opinions on how programming should be changed so the stations can serve their communities better. Still others put forth a myriad of suggestions for improving the station technically. Regardless of the motives, all of these suggestions acknowledge the need for change.

The driving force behind an AM revitalization effort is that, in almost every market, FM has the lion's share of the listeners as well as the advertising dollars, and has provided the copper for shunting AM marketing efforts to ground. Without adequate income from sponsors, AM managers have found themselves on the hot seat with the station owners. Theirs is *not* an ulcer-free job. If you are the engineer for one of these operations (and believe me, I've been there and back), don't be surprised and don't go of in a tiff if your suggestions for buying that miracle black-box or that new transmitter fall on deaf ears.

This is an ironic situation, in that many AM broadcasters have brought about this grim state of affairs on themselves. Owners who are getting ready to sell don't usually buy new equipment. While the new owners have every intention of doing so, equipment purchasing is not one of their immediate priorities. There may be many improvements made at the station, but chances are the technical plant will suffer. It always does. And this scenario is repeated time and time again, throughout each succession of owners.

The new transmitter is never bought, and the antenna system is in dismal condition. These conditions exist year after year, becoming more abhorrent through the decades. It was always something that they were going to do - false hope and good intentions. I shriek in horror when I hear that these operations are considering stereo. What a joke; two channels of garbage instead of just one! Once again the proverbial cart has been put before the horse.

To conclude, I do not believe that AM stereo is going to provide any insulin to revive AM, even if receiver manufacturers get into high gear. Perhaps the emphasis should be on providing listeners with more public service. It takes time, planning and money to do this, but good public relations never hurt any business.

One station I read about, recently took their Marti to a business that had just opened in town and did a free remote from their place of business. This is an absolutely excellent approach that more stations should consider. You may wish to get paid for it on the spot, but you'll reap more benefits by doing it this way. You will have shown the interest in promoting their business for them, and they may just sign a one year spot contract with you! Why not? You're probably running trade-outs anyway.

AM is in a unique position to provide localized services, which you may never hear on the sterile FM jukebox operations who offer a lot of hype but very little personalized programming.

Ed Cole is currently freelancing after spending more than 25 years in all aspects of radio. You may fax him at (813) 682-2235, 24 hour a day, or write to him at P.O. Box 3509, Lakeland, FL 33802 ... editor

Comments?

Fax to: (507) 280-9143

Editor's Notes:

"Want-ads" Now in Equipment Guide

We have moved the "equipment-wanted" classified ads into the ***Equipment Guide*** *publication. From now on, all listings of equipment and parts wanted will be found in that publication. Special requests for technical assistance or schematics will continue to be printed in the Radio Guide Forum. Please take a few minutes to read both of these listings. These people need help and many of you may in a position to assist them ... Editor*

Radio Reply Card

Begining with this issue, you will find a Radio Reply Card in the pages of this magazine. On this card will be found the names of all advertisers in this issue. Fill out this card and then send or Fax it back to us at ***Radio Guide****. In a very short time, you will receive additional information from the manufacturers about the products you've indicated. See page 20 for more information on this new service for our readers ... Editor*

Radio Guide Forum

Letters, Questions, Help & Parts Wanted From Radio Guide Readers

SBE Offers Free Employment Service to Members.

Effective immediately, the SBE has installed a job-line listing potential new employment opportunities for SBE members. The new SBE member service provides a listing of employment opportunities throughout the country, basic details about the position, location and desired qualifications. This service is free to SBE members.

A job number is given with each listing. Using this number, SBE members can obtain detailed information about the openings from the SBE office.

Employers also can take advantage of the SBE job-line. Technical openings from broadcast and media related positions can currently be listed for a nominal fee. Contact the SBE office at 317-253-1640 for information regarding the job-line. The job-line number is 317-253-0474 ... *editor*

Help Needed - Gates M6095 Exciter

I have an old Gates M6095 FM exciter that I'm having problems with. I'm looking for someone who knows this exciter forwards and backwards.

The problem is in the first frequency multiplier circuit (consisting of a 6AU6 and three tank circuits). If anyone has any information regarding this unit, please call me at (309) 833-5561 or fax to (309) 833-3460.

Rick Fess
Sharp Broadcasting Co.
Macomb, Illinois

Get the info you need!
Fill out this month's
Radio Reply Card

ITC Schematic Wanted

I need a schematic for the record portion of an ITC series RP cart record/play cart machine. If anyone has this information they can call me at (417) 235-6041 or fax it to me at (417) 235-6388.

Jim Helmkamp
KRMO/KKBL
Monett, Missouri

Jerrold FSM Assistance

I am looking for someone who has the expertise and/or parts to repair a Jerrold 704B Field Strength Meter. The tuning mechanism on this unit is defective.

Curt Parrish
306 W. Amherst Ave.
Melbourne, FL 32901
(407) 723-8659

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State of the Art

By Chip Morgan - CMBE
Sacramento, California - (916) 983-9834

By The Sea By The Beautiful Sea

If you're in the ocean and think you hear foghorns underwater, you may not be going crazy! Researchers are sending underwater audio signals to receiving stations around the world in an effort to measure the greenhouse effect. Scientists measure the speed of sound transmissions looking for an increase in speed. If the sound (which travels as far as 18,000 kilometers) arrives earlier than previous measurements, that indicates the ocean is warming. The sounds take about 3.5 hours to travel to their most distant destinations.

More About Underwater Cables

Optical fibers, those hair-thin glass "wires," have some of the same problems as metallic wires; you put in a signal and the level decreases over distance. A new fiber-optic undersea cable from Tokyo to Seattle will test technology which uses specially shaped light pulses called solitons. These pulses can travel greater distances without spreading out and losing strength. Scientists hope to be able to use optical amplifier repeaters in this cable instead of converting light to electrical signals and back to light again. This new technology will greatly increase transmission speeds and capacity.

Produce Your Own Video Presentations

Personal computers and video cassette recorders are merging faster than most people can imagine! There are already several PC platforms designed to handle live and recorded video and mix it with spreadsheets, presentations and graphics. Now NEC's PC-VCR and Multimedia Toolkit can edit scenes from multiple tapes with audio, can produce interactive videos and mix live video with graphics. It's available today and costs about $2,300.

More About Radio and TV on the Telephone

A little-noticed article in the NAB Daily News (published at the spring NAB show) reported on a session that included the Chief Counsel for Mass Media on the House Telecommunications Subcommittee, Larry Irving. While the session centered on cable TV, future competition for broadcasters was foreshadowed again when Irving said he expects legislation allowing phone companies into video and audio programming to be introduced soon.

Speaking of Technical Legislation

If all goes as planned, legislation mandating a national high capacity digital fiber optic computer network will be enacted this year. When it is completed, more than 1000 installations and a million users are expected to be tied in. The network is being compared to the superhighway system as a national security issue. Another major goal is to maintain U.S. leadership in supercomputers. The National Research and Education Network (NREN) would be available to major users including hospitals, federal labs, universities, industries, schools and even small businesses.

Coming This Summer to a Telephone Near You

Another way to save on your long distance bills! If you have multiple phone system locations that spend between $50 and $2,000 each month on long distance, you can get one bill with a volume discount from AT&T. It's called Customnet, and gives you a 10% discount on the domestic area code with the highest billed usage, and another 10% discount on the total usage higher than $200 per month. Installation fees are reasonable and you can even use a few residential lines as part of the "Customnet."

Don't Drop the Memory in Your Iced Tea

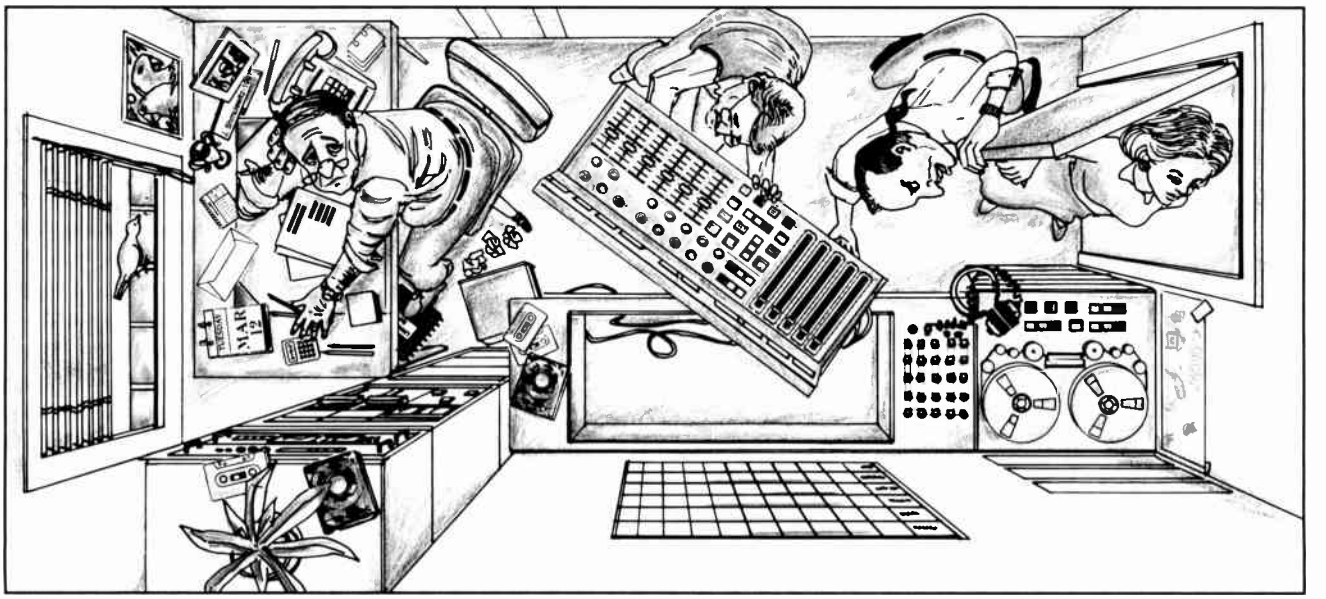
Digital video buffs will be happy to note that a scientist at the University of California has announced a chemical storage device that's the size of a sugar cube. It's said to be capable of storing and retrieving one trillion bytes of data. There's only one problem, and it's a big one. The device loses memory at room temperature!

The Perfect Security Guard for Your Station

It roams your facility randomly, looking for trouble and collecting video and data. When it spies an intruder, it sounds an alarm sound and records the suspect's activities on video tape. It monitors the environment in case of fire or flood and never falls asleep on the job. It's Cybermotion's Spinmaster Security Robot - - only $65,000.

Some Up-And-Coming Technology

Coinless pay telephones that use prepaid change cards purchased at convenience stores; discounted cash-free instant access parking by credit card; music and video downloaded to your library; a GPS map in your PC so you know exactly where you are; switched video on LANs including TV; video phone calls and live camera feeds; flat screen TV sets that hang on your wall; a heads-up copy screen for air talent; sound and video attached to your e-mail messages; PC access to telephone directory information; windows that change transparency at the flick of a switch.



How do you turn a multitrack production room into a *real* profit center? With fast, efficient operation and superb audio quality—a combination you won't get from "beefed up" recording studio boards or on-air boards with a few tacked-on features. Unfortunately, if your budget didn't have room for PR&E's ABX, you had to accept one of these compromises.

Well, not any more. Introducing Productionmixer™, a genuine broadcast production console that costs no more than the board you thought you had to settle for. We think everyone—including management—will agree it's a better choice.

Production Directors are going to fall in love with Productionmixer's full multitrack capabilities, versatile EQ with 3 sweepable bands, built-in dual telephone mix system, auto timer, two stereo effects sends and flexible monitoring/mixdown system. Chief Engineers will appreciate its high RF immunity, powerful CMOS logic control, top-quality components and complete, full-support documentation.

There's no room in your operation for an ordinary production console.

General Managers may well get the biggest thrill out of Productionmixer—when they realize that it delivers PR&E reliability, performance and functionality for no more than a "compromise" production console. As with our highly popular Radiomixer, we've made Productionmixer affordable without lowering our standards.

If you're trying to build an extraordinary production room on an ordinary budget, Productionmixer delivers the creative power you need in an efficient, easy to use format. For more information and your copy of the color Productionmixer brochure, call us direct at 619-438-3911.

Productionmixer

Pacific Recorders & Engineering Corporation
2070 Las Palmas Drive • Carlsbad, CA 92009
Tel 619-438-3911 • Fax 619-438-9277

By Gordon Carter - Pro Audio Services
Chicago, Illinois - (708) 482-4142

CD or Not CD?

With all due apologies to W. Shakespeare, CD or not CD is no longer the question at most radio stations. The only question at this time is, "How many?"

Do you remember the first time you heard a compact disc being played? The sound was probably crystal clear and noise free. No clicks, thumps, bumps, rumbles, or other sounds that didn't belong. Just music, beautiful music. Right?

At least that's the way it was the first time I heard one. My only complaints were that there was so little material available on compact disc, and it was very expensive. Of course, the player was well over a thousand dollars.

Along with the beautiful sound was all the media hype about this fantastic new invention. We no longer had to worry about the record sticking, the stylus jumping the groove and skipping, dirt and fingerprints on the surface of the disc, and all the picky rules about handling and cleaning of records. All you would have to do is insert the disc in the player and enjoy the music. These wonderful shiny discs would even have track numbers, index numbers (optional) for less important points in the music, and accurate timing encoded on the disc. Some of the players would even show you the time remaining until the end of the track and the end of the entire disc. Even more amazing, they could hold more music than two sides of a standard LP! This was the answer to all the music listeners' problems.

Then reality set in. It was about a year later. The second time I saw a CD player in person we were evaluating it for use on the air. Software (the discs themselves) were still hard to find, but the promise was there of a bountiful supply as soon as the new pressing plants were in full swing. The manufacturer of the player provided us with a sample disc. We connected the player to a console so we could listen to it. After fighting with a few grounding problems (this was a piece of hi-fi equipment after all) we got everything nice and quiet. In went the disc, the door was closed, and we waited. And we waited. And we waited. All we heard was silence. I looked at the machine, and the disc was not even spinning. After some further investigation, we came to the conclusion that the machine was defective.

A few days later another machine of the same type arrived from the manufacturer. We hooked this one up, inserted the disc, closed the door, and waited. HUM. That's right, HUM! This noise-free medium was full of hum. Stop the disc, and the hum goes away. Go to another track on the disc and there is no hum. Only track #1 hums. We listened to the LP version of the same recording. Sure enough, there is hum on the LP, too, but it is partially masked by the surface noise of the LP. So much for perfect reproduction.

We finally got some CD players on the air, and the sound was great. Then one day, in the middle of a piece of music, we hear this strange pinging sound. On closer inspection, we discover that the CD player is stuck, repeating the same bits over and over. Wait a minute! That's not supposed to happen, either. Another jolt of reality.

Perhaps your experiences with compact discs have not been as interesting, but I'll bet they were just as shocking. By now, most people realize that the compact disc is not a perfect medium, but one that is better than LP's in certain respects. Yes, the noise is lower, they may sound better (this is still being debated in some circles) and they sure are convenient. But they have their own set of problems that can be just as annoying, if not more so, than LP's. If you're not using CD's yet, check them out. In many places you can buy a player (maybe not a good one, but usable) for about $100.

With a little shopping you can find discs as cheap or cheaper than LP's, and the sound is little more than amazing on a well-produced recording. More important, whatever your taste in music, it is being released and re-released on CD. Old classical, rock, jazz, and other recordings are being reissued on CD. If you missed them first time around, or were just too young to buy them, you can have another chance. There are even some newly released CD's that contain historic, but never before available material. But that's not on our subject.

Most radio stations are using CD's for at least some of their programming. A few are exclusively CD. If you are in charge of maintaining the equipment, and have any CD's in your system, you have undoubtedly encountered the "What's wrong with this equipment? They aren't supposed to do this!" complaint from your PD or GM. If your players have misbehaved, you have probably looked at them in wonderment, thinking to yourself, "why don't they give you anything to adjust on these things?" Let's look at some of the things that might happen and maybe we can figure out what to do with them.

The basic concept behind the compact disc is simple. Data is recorded on the shiny metallized layer of the disc as a series of pits. A laser shines a beam of light (possibly infrared) onto the disc and reads the variations in the light reflected to a sensor. These variations are then translated into a digital bit stream, which is in turn converted to stereophonic audio. Sounds simple enough, doesn't it? The problems come in when you notice that there is nothing to guide the light beam except the reflected light. Unlike an LP, there are no grooves. Not only that, but this digital stuff wants a steady bit rate, much more stable than you can do with a simple turntable. All of this requires some sophisticated electronics and mechanics to make it happen.

(continued on page-10)

EXPERIENCE COUNTS . . .

Continental Electronics Installations At Master Antenna Facilities.

OLDSMAR TOWER PROJECT
Tampa, Florida
2 OF 2 STATIONS

WKRL 40 kW
WUSA 40 kW

TELETOWER PROJECT
Houston, Texas
2 OF 2 STATIONS

KLTR 27.5 kW / 21.5 kW (Aux)
KMJQ 50 kW

BRODIE LANE TOWER SITE
Austin, Texas
2 OF 2 STATIONS

KHFI 35 kW
KPEZ 21.5 kW

MILLER TOWER SITE
Dallas, Texas
6 OF 6 STATIONS

KKDA 40 kW
KLTY 40 kW
KLUV 40 kW
KOAI 45 kW
KZPS 40 kW
WRR 40 kW

LOXLEY TOWER SITE
Mobile, Alabama
3 OF 3 STATIONS

WBLX 27.5 kW
WGCX 27.5 kW
WJLQ 27.5 kW

LOADSTAR TOWER PROJECT
Ft. Lauderdale, Florida
2 OF 2 STATIONS

WJQY 40 kW
WKQS 50 kW

GANNETT TOWER PROJECT
Miami, Florida
8 OF 10 STATIONS

WEDR 50 kW
WHQT 25 kW
WLVE 25 kW (2)
WPOW 25 kW
WQBA 21.5 kW
WSHE 25 kW
WTMI 25 kW (2)
WZTA 25 kW (2)

BITLOW TOWER PROJECT
Orlando, Florida
3 OF 3 STATIONS

WHTQ 50 kW
WSSP 50 kW
WSTF 50 kW

LOADSTAR TOWER PROJECT
Orlando, Florida
3 OF 3 STATIONS

WJHM 25 kW
WJYO 55 kW
WOCL 55 kW

LOADSTAR TOWER PROJECT
Jacksonville, Florida
3 OF 4 STATIONS

WAIV 40 kW
WFYV 27.5 kW
WQIK 35 kW

SENIOR ROADS TOWER GROUP
Houston, Texas
7 OF 12 TRANSMITTERS

KFMK 27.5 kW (2)
KIKK 27.5 kW (2)
KKBQ 27.5 kW (2)
KLOL 27.5 kW

SUMMIT TOWER PROJECT
Atlanta, Georgia
2 OF 3 STATIONS /
4 OF 5 TRANSMITTERS

WSTR 35 kW (2)
WVEE 40 kW

LOADSTAR TOWER PROJECT
New Orleans, Louisiana
4 OF 4 STATIONS

WEZB 35 kW
WLNG 35 kW
WMXZ 35 kW
WQUE 35 kW

SHOREVIEW TOWER PROJECT
Minneapolis, Minnesota
6 OF 8 STATIONS

KDWB 25 kW
KEEY 25 kW
KLXK 25 kW
KQRS 25 kW
WLOL 25 kW
WLTE 25 kW (2)

MONTGOMERY TOWER PARTNERS
Montgomery, Alabama
4 OF 4 STATIONS

WBAM 35 kW
WHHY 35 kW
WLWI 35 kW
WSYA 35 kW

WEST TIGER MOUNTAIN TOWER SITE
Seattle, Washington
6 OF 9 TRANSMITTERS

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KMPS 50 kW
KRPM 50 kW

When experience counts you can count on Continental transmitters. This track record reflects the quality of Continental transmitters and our commitment to the broadcaster. May we assist you in planning your new facility around a new Continental transmitter?

Continental Electronics Corporation

P.O. BOX 270879 DALLAS, TEXAS 75227-0879 214-381-7161 TELEX: 73-398 FAX: 214-381-4949

Continued . . .

When playing a disc, any dirt on the surface of the disc or defect within the disc may cause the light beam to be reflected somewhere other than the sensor. If the error is large enough, causing a long enough interruption in the data, the machine will get lost and not know exactly where it is. To alleviate this problem, the manufacturers have devised all kinds of clever schemes to correct and conceal the errors. However, if the dirt is large enough, nothing will be able to correct it. Since different manufacturers use different schemes for error correction and concealment, and the same manufacturer may even use different schemes in different models, different machines may respond differently to the same dirt or defect. If you have more than one brand of machine you have probably noticed this phenomenon. Supposedly the newer machines will be more tolerant of defects than the older ones, but there are no guarantees. Only a comparison with a number of defective discs will show which are better in this regard.

While dirt is the most common cause of mistracking, scratches on the disc can have the same effect. A radial scratch (one going from the center directly to the edge of the disc) may not cause any audible problem, since it will only interrupt for a few bits of data on each revolution. On the other hand, a scratch going around the disc, like the groove on an LP, is almost guaranteed to cause trouble, since it will interrupt a longer portion of the data and exceed the capabilities of the error correction circuitry. You can usually see any scratches in the surface of a compact disc by holding it up to a light so that you see a rainbow effect on the non-label side of the disc. Any ripples in this rainbow indicate a flaw in the surface of the disc and scratches will stick out like a sore thumb.

It is also possible for the disc itself to warp, much like an LP, if it is not stored correctly. Compact discs should be stored in the plastic jewel boxes in which they come. Some discs only come in cardboard sleeves, and these should be replaced with a jewel box. If you need more boxes, they can be obtained from some of the broadcast equipment suppliers or from your local Radio Shack or record store. The discs in their boxes should be stored vertically on shelves, just like books or LP's. Do not pack them in so tight that you can't remove one, but make sure they are not leaning, either. Depending on your player, a warped CD may or may not play properly. Some players have very little clearance below the surface of the disc, and these will give you problems. Also, if the disc is very warped, the laser may not be able to track the variations in distance from the disc to the sensor.

Dust can also be a problem with the player itself. The lens of the laser and sensor (many times the same unit) should be kept free of dust. This can be cleaned with a lens tissue or a slight burst of air from a squeeze bulb such as are used on camera lenses. CAUTION: When cleaning the lens or working around the laser, be sure that power is off and the plug removed. These units are equipped with interlocks to prevent operation of the laser when open, but they may fail. Looking into an operating laser may cause permanent eye damage. You may have to remove the cover of the player or other parts to clean the lens. Consult your service manual, if you have one, as to the proper way to get to the lens.

Another area where dirt can be a problem with a CD player is in the mechanism. The laser tracks the disc from the center out, just the opposite of an LP. As the disc spins, a servo circuit maintains the speed of the disc at a constant linear velocity. This means that the rotational speed of the disc (RPM) will change as the relative position of the laser to the disc changes. The closer the laser is to the center of the disc, the slower the disc will rotate. The speed of the disc varies from about 500 to 800 RPM. Another servo circuit controls the position of the laser relative to the disc. This may be accomplished either by moving the disc or the laser assembly. Any dirt in any of these mechanisms may cause binding, which will result in skipping or hanging up of the disc as it is being played.

Some player manufacturers have an unfortunate habit of using some sort of grease on the gears of their mechanisms. With time, the grease becomes gummy and may cause the gears to bind. To reduce the amount of slop or backlash in the mechanism many players use split gears. If you look closely at these gears, you will find that they actually are made of two pieces with a small spring causing the teeth to mesh more fully than they would in a normal gear. I have found that the two sections of these gears will gum up and bind, causing the player to skip and mistrack. When you encounter binding in the mechanism, the only cure is to carefully clean all the old lubricant from the system and re-lubricate all the gears.

Complete cleaning may require partial disassembly of the unit. If so, be sure to do it carefully and in accordance with the service manual's instructions. There are some very delicate wires and parts in this area of most CD players. When lubricating the unit, be sure to use the proper oil or grease as suggested by the manufacturer. If you do not have access to this, a good hobby shop can suggest an appropriate lubricant that will not attack the plastics used in the player. A service person for one player manufacturer even suggested not lubricating the player, since the plastics used were slippery enough. I can't guarantee that this will work forever, but there would certainly be no grease or oil to collect more dirt.

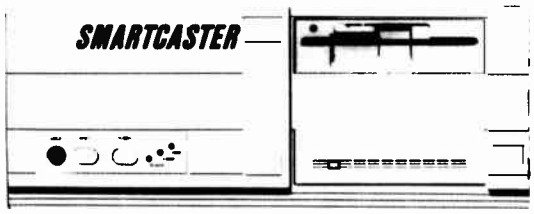
The lasers used in CD players have been known to age and to fail. If you have a consistent problem with errors and cannot find a mechanical reason for it, you should check the laser output. This is usually done by measuring the current on the output of the optical sensor, which should be a good indicator of the light output of the laser. Some machines have adjustments for this,

(continued on page-12)

SMARTCASTER

DIGITAL AUDIO

IN JANUARY OF 1990 OUR LITTLE COMPANY TOOK ON A BIG JOB...



CHANGING THE WORLD OF RADIO with digital audio automation for satellite, tape, or CD

Today our growing company is the biggest in the business, with over 150 radio stations using SMARTCASTER. SMARTCASTER'S modular design allows you to get on the air with digital audio now, at a minimal investment, but enhance your system as technology advances. There's no obsolescence, and you won't be left behind

HOW'S IT WORKING? HERE'S A FEW COMMENTS:

GREAT COUNTRY 102.9 WKCM FM

Dear Staff,

I felt compelled to write you a note expressing my gratitude.....I still receive calls from people all over the country asking about Smartcaster. I'll continue to talk favorably.....Jeff Morgan, Program Director

THE CROMWELL GROUP, INC.

Dear John,

We are pleased with the three Smartcasters we have and it is our intention to order three or four more.....Bayard H. Walters, President

WRVI

Dear John and Jan,

If you're a small market broadcaster, even if you're not, the Smartcaster and SMARTS Broadcast Software are the way to go to keep your station running seven days a week.....Randall J. Miller, President and General Manager

SMARTS Broadcast Systems (800) 747-6278
(712) 852-4047

Continued . . .

and if yours does, it should be adjusted. If you are out of adjustment range, the laser may need to be replaced. This can be an expensive proposition, so try to make certain that is the problem before you order a new one.

As I have already mentioned, there are a number of servo circuits in CD players. Typically there are at least three: one for disc speed control, one for laser position control, and one for laser focus. Some players may have more, but I don't know of any that have fewer. Servicing servo circuits is difficult, since whatever you do affects the entire circuit. It is very difficult to determine what is the cause of the problem and what is the effect. Do not attempt to service the servo circuits in a CD player without a service manual and the necessary instructions and equipment. You will probably need a special test circuit, a precise signal generator, an oscilloscope, and a special test CD to make the necessary adjustments, so be sure you have everything you need before you begin.

The digital bit stream from the optical detector is fed to the inputs of the various servo circuits through appropriate filters and wave-shaping circuits. Adjustments for these circuits include local oscillator frequency, detector sensitivity, gain, and other phase-locked-loop parameters. The error output from the phase-locked-loop is amplified and filtered to drive the motor (or laser positioning circuits) to make the necessary correction. Proper adjustment of these circuits will go a long way toward minimizing audible problems with your discs.

Most compact disc players have some other adjustments that should be checked if there are problems. These may include power supply voltages, laser current, and others. Again, check the service manual for the proper procedures.

Compact discs are pretty amazing. They can hold a lot of information in a small area. Unfortunately, the system is far from perfect. The digital bit stream coming from a typical compact disc is amazingly poor, with missing chunks of data and many other problems. The bit replacement, error correction, and error concealment systems in a typical player do such a good job that it sounds nearly perfect. It is a credit to the designers of the compact disc system that it works as well as it does. However, the time will come when it will not work. If so, the first thing you should check is for a defect in the disc or dirt on the disc. I have seen some that look like they were used as pizza plates, and these have lots of trouble working. If you have consistent problems with a number of discs in the same machine, look for dirt in the machine or a sticky mechanism. Then check the laser for proper output, if possible. Usually the last thing to fail is the electronics.

If you have eliminated all the mechanical possibilities, and do not have access to a service manual, you may want to send it out for factory service. If it is not an expensive machine, you may want to consider replacing it. Remember that the machine you can buy now for a given price is probably better than the one you could buy three years ago for the same price. If you don't have expensive machines, replacement may not only solve your operational problem, but it may sound better as well.

Finally, a few comments on the sound of compact discs. The compact disc system was never intended to be a super fidelity medium. The original intent was for it to be a low cost better fidelity medium than the LP. This would help get better sound to more people, and the compact disc has been very successful at this. However, many people will argue that the compact disc sounds harsh, bright, edgy, or any other number of complaints. I even heard one person present a paper at the Audio Engineering Society suggesting that digital sound caused undue stress on the human body. Needless to say, the discussions emptied the meeting hall. Unfortunately, I was presenting the next paper and had almost no audience. While some of these complaints may be valid, many other claims are not.

There have been any number of "fixes" for compact disc defects suggested. Some of these may have some validity, but many do not and are simply a waste of money. If you understand how the compact disc system works, you will be able to determine which devices are valid and which are simply "snake oil." There are a number of books available which explain how the compact disc system works, and I would suggest that you buy one and study it. The best one I have seen was written by some people from Sony, but someone has walked off with my copy of this book and I do not know the title, author, or where to get it. However, the explanations of the theory, mechanics, and electronics are thorough yet simple, with good diagrams to help you understand the text.

You may not feel bold enough to venture into the world of compact disc player repair, but perhaps this will help you realize that it isn't all black magic.

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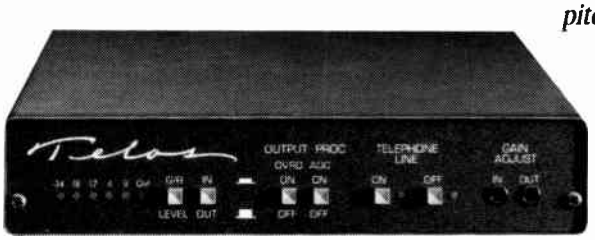

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Maximizing Your FM Antenna

There are almost as many philosophies for FM transmission system design as there are engineers. All the various choices in antenna gain, transmitter power, and transmission line type provide a wide range of variables that can be used to either benefit or work against a station.

Most station owner/operators want to provide the maximum coverage with their transmitter/antenna systems. This can be done, but it may well be that by designing a system for maximum range, the city or cities that the station primarily serves will be left with multipath, shadowing, or a combination of signal problems.

FM antenna systems can be chosen that will overcome these problems to a large degree, and reach a compromise between distance to a contour and service to a particular area. In this article, we will examine the factors that must be considered when planning such a system and the technology that is available to help us achieve our goals.

Terrain Considerations

Terrain plays perhaps the most important role in the performance of an FM antenna system. A number of questions must be answered before an antenna system can be properly designed:

What is the elevation of the transmitter site? What is the elevation of the areas to be served? What is the terrain like between the transmitter site and the target area? What is the terrain surrounding the target area? Are there mountains behind the target area?

All these answers play a part in the selection of an antenna system. If the transmitter location is not a variable, then the effort must be directed toward designing the right antenna system for the job. Terrain factors will enter into almost every part of antenna planning, and a good working knowledge of the terrain and any significant features is a must.

Brewster Angle

When a circularly polarized VHF signal strikes the ground, the vertically polarized component will not be reflected to the degree that the horizontally polarized component will. How much difference depends on the angle of incidence. Angles of incidence greater than about 2 degrees result in very little reflection of the vertically polarized component as compared to the horizontally polarized component.

This phenomenon, discovered by an Englishman by the name of Brewster, produces reflections that tend to be more elliptical than circular in polarization. For that reason, it is important that an antenna height above the target service area is chosen that will result in grazing angles that are less than 2 degrees. Of course, distance from the transmitter site to the target area plays a large part in this.

Conductivity & Vegetation

As with medium-wave frequencies, soil conductivity (and permitivity) greatly affect the attenuation of VHF signals. Vegetation is also a factor.

As a rule, raising the receiving antenna above the ground counteracts the immediate effects of soil on the signal. It is important to remember that most coverage predictions are based on a receiving antenna located at least ten meters above the ground for this reason. The trouble is, not many cars are on the road with their FM receive antennas elevated 30 feet or more into the air!

Fresnel Zone

Many times, what engineers consider vital when planning their STL/ICR and microwave paths, they totally neglect when planning an FM antenna installation. A 60% first Fresnel zone clearance is very important to FM reception. When selecting a tower height or an antenna site location, the engineer should ask if obstacles or terrain between the transmitter site and the target service area will allow this clearance.

(continued on page-16)

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The 6367 series comprises 6 separate tunable notch filters, each of which covers an approximately 2:1 frequency range with adjustable 3 dB bandwidth.

In CATV, LAN or other Broadband Data Systems, adjacent channel or FM carriers often interfere with reception of a desired channel or data frequency. The notches offer a convenient means of suppression.

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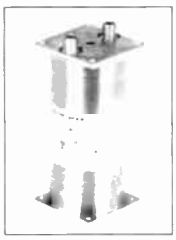
Tunable Notch Filter Type 6367

Standard Models 6367



Model #	Tunable (MHz)
6367-0	22 - 35
6367-1	30 - 50
6367-2	50 - 108
6367-3	108 - 216
6367-4	216 - 450
6367-5	450 - 900

Bandwidth Adjustment
1-5 MHz min.
Notch 20 dB approx. for Bandwidth=3 MHz
Standard:
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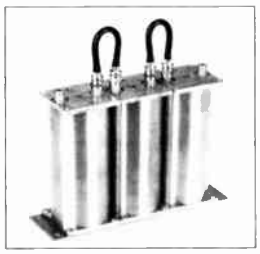
50 ohm BNC



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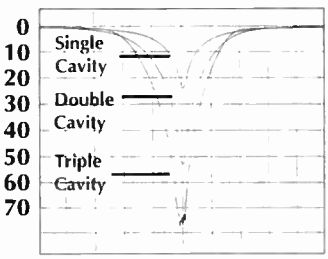

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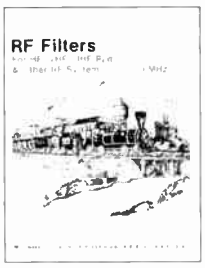
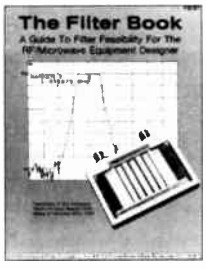


RF/88: RF Filters 0 - 1000 MHz

Also, ask for FREE catalog The Filter Book - FB/87, a guide to specifying microwave filters.



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Toll Free(USA/Can.): 1-800-448-1666•Collect(NY/AK/HI): 315-437-3953•FAX: 315-463-1467•Telex: 246-613

Transmitter Site

Continued . . .

The formula for finding the midpath first Fresnel zone radius was found by French scientist Auguste Jean Fresnel, who discovered the effect on radio waves of clearance above ground or obstacles while working with optics. The formula is:

$$R = 1140\sqrt{\frac{d}{f}}$$

where:
d = path length in miles
f = frequency in mHz, and
R = 1st Fresnel zone radius in feet

While there are other, more exact formulas for calculating the first Fresnel zone radius for microwave and other applications, this formula gives good results over the 4/3 curvature of the earth for VHF applications.

Once the radius of the first Fresnel zone is known, then the engineer must insure that all obstacles and terrain between the transmitting antenna and the target service area are cleared by at least 60% of this value. If there is any less clearance, signal strength will be lost. Clearance is most critical around the middle of the path from transmitting antenna to receiving antenna.

It is important to note that for coverage predictions based on the FCC's 73.333 F(50,50) graphs to be anywhere close to accurate, 60% first Fresnel zone clearance must exist.

Beam Tilt

An FM antenna, mounted on the vertical face or leg of a tower, will radiate more than half its energy above the horizontal and into space. This is wasted energy. Beam tilt, or the tilting of the main vertical plane lobe of the antenna by mechanical or electrical means can be used to put the main vertical plane lobe either at or somewhat below the radio horizon.

The distance to the radio horizon is roughly the square root of twice the height of the antenna in feet. You can use simple trigonometry to approximate the depression angle to the radio horizon.

In some cases you may need to tilt the beam down even more to place the main vertical lobe directly on the target service area. Typical tilt values are in the order of 0.5 - 0.75 degrees down.

In the days of old, beam tilt was accomplished by mechanically tilting the antenna downward using shims or wedges. Present day technology accomplishes beam tilting by delaying the currents to the lower antenna bays and advancing the currents to the upper bays. All this is normally accommodated in the design of the power divider, and therefore, beam-tilted antennas must be center fed. It should be noted that electrical beam tilting uses some energy and thus lowers the gain of the antenna somewhat.

Antenna Gain versus TPO

Different engineers will have different opinions of what combination of transmitter power and antenna gain is appropriate for a given ERP. Until recently, little choice was available for the higher ERP levels, since the highest power FM transmitters on the market were 40 kW. With line losses considered, a power gain of 3 or more was required to produce a 100 kW ERP. This required an antenna with at least six bays.

Fortunately, transmitter manufacturers have made great strides in the development of FM transmitters with power outputs on the order of 70 kW, allowing a much wider range of antennas that can be used for a given ERP. This is particularly important in areas where FAA restrictions limit the height of towers and a shorter antenna must be used to put the center of radiation at or above a certain level.

As a rule, the more bays an antenna has, the narrower its vertical plane main lobe will be. This is an important consideration when it comes to planning for signal penetration in areas where shadowing and multipath are likely to occur (which includes just about all urbanized areas).

Generally speaking, the lower the antenna gain and higher the TPO for a given ERP, the greater energy that is actually radiated. Consequently, lower gain antennas seem to fill better and produce less multipath than those with higher gains and the same ERP.

(continued on page-18)

NEW!

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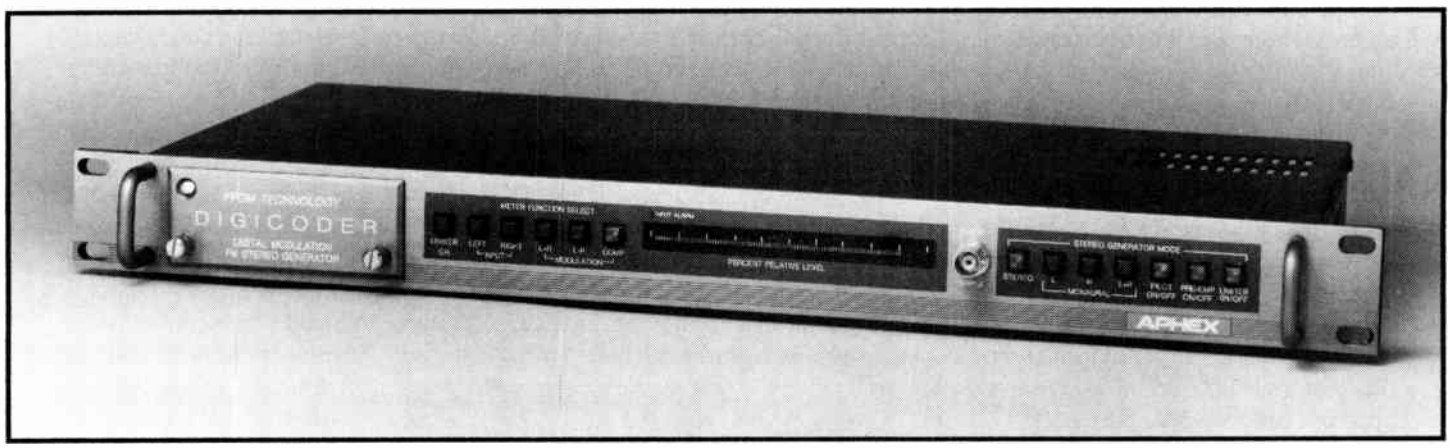

Under development for over six years, it's finally here. The Aphex Digicoder™ Stereo Generator ... the next link in the Aphex Audiophile Air Chain. The Digicoder provides unequaled sonic transparency of Class A analog with the separation and stability of digital ... and sustains maximum loudness. Plus it interfaces to your existing equipment with no A to D convertor.

This lab standard generator uses a proprietary PPDM™ (Parallel Path Digital Modulation*) circuit to provide a dynamic range better than 110dB. To achieve the same specs, a digital system would need 18 bit resolution sampled at 2.4 MHz.

Because of its sophisticated design, the Digicoder is easy to use and requires no maintenance. It is fully remote controllable and provides remote status output.

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* Patent Pending

Continued . . .

One other factor that must be considered in some cases is the RF power density produced by an antenna at various points on the ground. In some cases, the radiation from an antenna on one tower combines with the radiation from another antenna on an adjacent tower to produce a high-level RF radiation area on the ground. In such cases, the number of bays and/or element spacing can be altered to change the vertical plane pattern and either eliminate the "hot spot" or move it to an area where access can be restricted.

Null Fill

In its vertical plane radiation pattern, every FM antenna with more than one element will exhibit a main lobe and a series of minor lobes. The dips between these lobes are the nulls because, in theory, the radiation drops to zero in these very sharp areas.

Typically, for a ten-bay antenna, the first null will occur at approximately 5-1/2 deg. below the horizon, and the second null at 10-1/2 deg. Using simple trigonometry, you will find that the first null will fall at a distance of about two miles from the tower base, and the second at one mile, assuming an antenna height of 1,000 feet over uniform terrain. The radiated field falls to near zero in these areas, and therefore it is important to consider what lies in these null areas. If it is a major thoroughfare or a populated area, you will have to do something to deliver some signal there.

Electrical null fill can be employed to give some fill of these nulls, typically 1 to 2 percent. In most circumstances, only the first null is filled, because the second null is so close to the transmitter site that it is not a factor.

Perhaps more important than providing close-in coverage is the effect that null fill has on the overall vertical plane radiation pattern of the antenna. Filling the first null tends to broaden the main lobe, and therefore, more energy is concentrated in that main lobe, where you want it. This has a very desirable effect on multipath.

Adding null fill to an antenna is accomplished by feeding more power to the upper half of a center-fed antenna. As with beam tilting, null filling consumes power, and the gain of the antenna will be reduced somewhat if null fill is employed.

Shadow Effects & Multipath

Any time a signal from two different directions or paths reaches a receiving antenna, multipath occurs. The two signals may arrive in phase and thus add together in the antenna, or they can arrive with varying phase shifts and cause cancellations.

Shadowing, which occurs when an obstruction blocks the signal to the receiver, can work with multipath to make a signal un-listenable.

The worst case scenario might be a station outside of town with its tower on a mountain, another ridge halfway to town, and another mountain on the far side of the city. Shadowing is going to occur in the part of town hidden from the transmitting antenna by the lower ridge, and multipath is going to occur over most of the city because of the direct signal from the transmitting antenna mixing with the reflected signal from the mountain behind town. Situations like this require special consideration in the design, using uncommon amounts of beam tilt and careful selection of the transmitter site.

Multipath effects can be either source induced or obstruction induced. Obstruction induced multipath is difficult to get around, but careful site selection and attention to antenna gain and first null fill will help. Source induced multipath comes from IM products and sideband distortions, usually generated in the antenna itself, but sometimes from other sources such as another nearby FM antenna with selective filters in the transmission line. Careful antenna tuning and matching along with vertical separation from other antennas can eliminate all or most source induced multipath effects.

Antenna Types

There are numerous antenna designs available on the market with various characteristics that are good and bad. Some designs are

(continued on page-19)

Continued . . .

well suited to one application, while other, radically different designs may work out better in others.

Some common antenna types are: panel with crossed dipoles; shunt and series fed slanting dipole; ring stub; twisted ring; and multi-arm short helix. There are several variations on these basic designs, some of which have become very refined over the years.

Gain

Antenna gain is accomplished by stacking a number of bays about one wavelength apart on a common feed. A single bay by itself usually exhibits a negative gain, while two bays provides for unity gain. More than two bays will exhibit a positive gain, and gains of seven or more are possible with multi-element arrays.

Matching

Different manufacturers take different approaches to matching the antenna itself to the transmission line.

Perhaps the simplest and most common way is with the three-stub matching transformer. This matching section is inserted between the transmission line and the antenna interbay line, and is adjusted for minimum reflected power at the transmitter output. The net effect of this scheme is to place an impedance in parallel with the antenna impedance to produce a 50-j0 impedance at the transmission line termination. The disadvantage of this method is that it is bandwidth limited and it produces standing waves inside the interbay feed harness, behind the transmitter.

The best way to match an antenna to its feedline is to design the antenna in such a way that the bay impedances are a value that, when combined with all the other bays on that side of the power divider, equals 50 ohms. This is accomplished by performing an impedance transformation in the horizontal part (stem) of each bay. For example, a six-bay end-fed array would have six, 300 ohm bays which, in parallel, would present an impedance of 50 ohms to the feedline.

This approach is technically superior to the single transformer approach for several reasons. First, it eliminates standing waves in the interbay feedline. Second, since there are no standing waves present, the transformerless antenna can withstand higher input power levels. Thirdly, it results in a matched system, where the feedline is matched from the point of connection to the transmitter all the way to each individual antenna bay.

Shunt inductances are easily tuned out using a ceramic stud on the inner conductor near the bottom of the antenna or power divider, but this type of

(continued on page-22)

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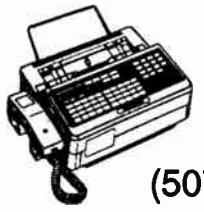

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The Orban Optimod-FM 8200

New Digital Processing For Radio

Radio Guide Product Information

In 1975 the aim of most engineers and program directors regarding the sound of their radio stations could be encapsulated in the single phrase: Louder, Cleaner and Brighter. A simple concept, yet difficult to achieve in the very practical world of radio transmission. In that year, Orban introduced the Optimod-FM model 8000A and altered the future of radio broadcasting by combining a compressor, limiter, high frequency limiter and stereo generator into one high quality system. Having re-thought the "multiple box" mentality which existed prior to that, Bob Orban not only combined several parts of the transmission chain into one system, but also upgraded the technologies used to do it.

The Optimod 8000A was the first processor with overshoot compensated low-pass filters, permitting a higher average modulation level without overmodulation. This permitted the station to be louder because it could raise its average modulation without overshoot; cleaner because less peak limiting and clipping were required to control modulation; and brighter because the design of the high frequency limiter complemented the rest of the design. Since that time other companies have introduced quality products based on similar principles.

With the recent introduction of the **Optimod-FM 8200**, Orban has once again altered the concept of audio processing. There are still the criteria of Louder, Cleaner, and Brighter, but Control has become important. The issue of control has now been addressed through the use of fully digital signal processing, both in the audio portion of the system and in the control functions of the unit.

The research on the digital signal processing (DSP) algorithms and circuitry took Orban engineers more than four years, and built upon the many years of development invested to achieve the reliability and performance of the 8200's ubiquitous predecessor, the 8100. The most noticeable results of this effort were the presence of Modular Variable Processing (MVP) structures, programmability and expandability of the unit, and a PC interface.

Modular Variable Processing

Each MVP structure is the software equivalent of a dedicated processor. In a typical **8200**, two MVPs act as two-band processors (one a "phase linear purist" limiter and one an "improved 8100 emulation"). In addition, another MVP acts as a multi-band processor, and yet another as a transparent protection limiter.

Programmability

Programmability is achieved via the fully digital design of the **8200** that allows radio stations to start with one of the many built-in presets and then access a wide range of factory optimized settings by using the LESS< >MORE control to simultaneously adjust all of the MVP's adjustable processing parameters.

The chosen settings can then be saved as a new Preset. Up to 32 Presets can be saved and recalled at any time via the front panel, or by the internal day-and-time based automation, by a remote contact closure or by computer interface port. A large LCD panel shows all metering functions of the MVP structure in use. Clearly labeled "soft" keys allow recalling of a Preset, modification of processing, programming of the automatic preset switching or the ability to access system setup parameters. A dedicated Help button provides step-by-step instructions at any time.

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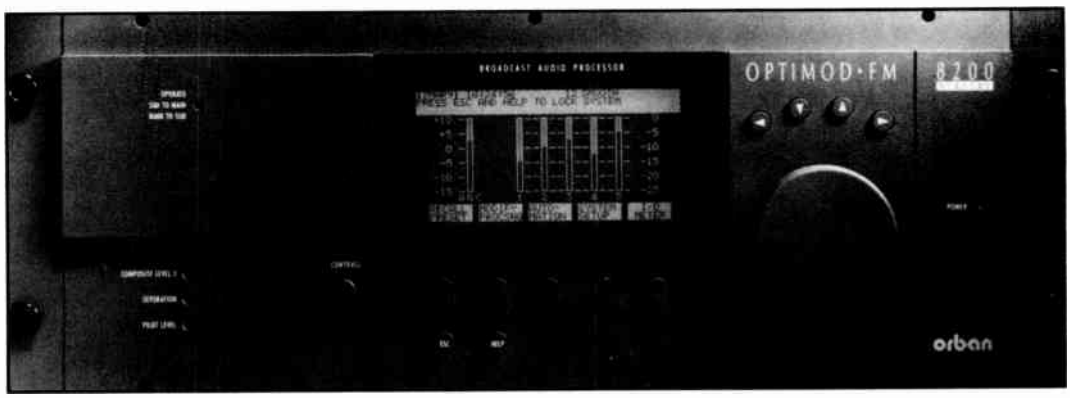


Expandability

The MVP structures are stored on a plug-in module, making upgrades easy, and the DSP cards can be added as needed when future software upgrades and additional processing structures require more processing power. Since processing is accomplished through software, the station's sound can be changed by replacing the software, not the entire audio processor.

Control

Optional software increases the 8200's power by allowing full remote operation of all front panel features from a PC. With a modem, the **8200** can be controlled from the studio, home or even a car.

High technology chips and sophisticated computer control are great, but what does it really offer a station trying to compete in today's fast-paced industry? It means a station can adjust its sound how and when it wants, and with much finer control than was available before. For the smaller stations, the help screens and simple control of multiple adjustments will mean they get the processing they need to remain competitive, while larger stations can take advantage of the additional control capabilities of the **8200.**

Continued . . .

tuning is so fine that it must be done using sensitive bridges and Smith charts.

VSWR Bandwidth

One of the more critical specifications that an antenna has is its VSWR bandwidth. Having a VSWR bandwidth of at least 260 kHz (with less than a 1.08:1 standing wave ratio across that band) is imperative for good system performance.

Everyone knows how a narrow bandwidth antenna can cause synchronous AM noise, but IM products are also generated by narrow bandwidth systems. This can cause more signal problems than almost anything else.

Consider a narrowband antenna system over which a station transmits a 67 kHz subcarrier. The 67 kHz sideband energy (along with other sidebands generated by high frequency components of the baseband) leave the transmitter and travel up the transmission line to the antenna. If there is a mismatch at the sideband frequency, some of the sideband energy will be reflected back down the line to the transmitter power amplifier, where it will be reflected back up again. The reflected sideband energy that will be radiated after it has made three trips through the length of the transmission line will be considerably out of phase with the other power being radiated and will interfere.

This is one prime cause of source induced multipath effects. Some stations have observed that their multipath problems go away when they turn off their subcarriers. If this is the case, then a narrow VSWR bandwidth or other mismatch should be suspected.

Some antenna designs are inherently broadband, with up to 20 mHz of bandwidth for some community panel antennas, and 4 mHz for single-user antennas. These types of antennas have a tremendous advantage over other, more narrowband antennas. They are much less likely to produce IM products, synchronous AM noise, and source induced multipath effects than narrower antenna designs.

Coping with Ice

Some antennas, particularly those with narrow bandwidths, require deicing equipment. This can be in the form of heating elements built into the radiating elements, or radomes. Heating elements, wiring, and tower-mounted transformers are heavy and high-maintenance items. Radomes add tremendously to wind loading. If you can afford the wind loading, use radomes.

For other antennas, the bandwidth is so broad that no de-icing apparatus is required. Elimination of de-icing equipment simplifies antenna assembly, maintenance, and lowers the cost of operation, not to mention the weight advantages. Antennas with no deicers are routinely tuned so that the resonant frequency is somewhat higher than the operating frequency, so that as ice builds up, the detuning effect is less detrimental to the operation of the antenna. If tuned properly, some broadband antennas can continue to operate with up to one inch of accumulated ice.

Transmission Lines

There is a wide choice of line types available, from relatively low cost foam-dielectric flexible lines to expensive, air dielectric, rigid lines. The decision of which line to use is usually made based on budgetary constraints. Foam lines are lossy and have lower power ratings than air dielectric lines. Money saved by using foam line may be required many times over to run the transmitter at a higher power level to overcome line loss.

Rigid line is more expensive, harder and more expensive to install, and requires more maintenance than flexible lines. The loss is much lower, though, and power ratings are much higher. In addition, rigid lines are more easily repaired. Choose the best line that you can afford.

Designing a System

Now that you have the facts, you can make educated decisions. Choose your site (if you have any choice in the matter) considering obstacles, terrain,

(continued on page-24)

Cutting Edge UNITY 2000

Complete Digital FM Processing Chain in a Single Chassis

Radio Guide Product Information

The UNITY 2000 audio processor is a complete system that was developed around a concept we refer to as Unified Processing (tm). This arrangement allows us to assemble or "unify" all functions of of a broadcast audio chain into one package. Within one seven-inch chassis is enough processing flexibility and power that would normally require at the least three, and at the most, six different pieces of equipment to comprise an audio chain. Through the use of advanced Digital Signal Processing, a qualitative, yet competitive sound can be created.

In addition to combining many functions together, total operation of this system is accomplished through microprocessor control. All processing settings, adjustments, and changes are made via a keypad and LCD screen. Remote operation can be performed through an RS232 port which allows operation through a PC and a modem.

Each unit is equipped with multiple format presets for different programming requirements. The UNITY 2000 comes with processing presets for six formats: AOR, AC, Country, CHR, Classical, and Urban. These are used as a starting point for processing adjustment. Format flexibility gives stations the option of fine tuning to find their own custom sound. Once satisfactory settings are realized, four "custom setting" memories provide storage of custom settings. A password code prevents unauthorized user operation.

The UNITY 2000 provides nine complete processing functions. For a moment, picture in your mind a broadcast studio processing chain that would comprise itself of the following:

1. A selectable Broadband AGC

2. Selectable Phase Rotator Circuits

3. An adjustable low frequency Bass Enhancer circuit

4. Phase-linear 4-way Adjustable Cross-over Networks

5. Four band Preprocessor/Leveler

6. A four band multiple constant Limiter

7. An integrated Clipper/Low Pass Filter system

8. A high quality Stereo Generator

9. A selectable and adjustable Composite Clipper

There is also a selectable Interface Port that will allow reverb, stereo enhancement, or whatever else that may be required, to be inserted between the four band leveler and limiter.

A key and important feature is the use of Feed Forward control circuitry. In doing this, the UNITY 2000 will always operate at the same processing ratio, providing a larger "sweet spot" of operation. This yields improved sonic consistency for whatever amount of processing that is employed. Five dB of gain control will sound the same at 15 dB of control. This is unlike feedback systems where the "sweet spot" window narrows due to the changing of ratios as the amount of processing varies. This is why most, if not all, feedback processors develop that thick, dense, mushy, and unnatural quality to their sound as they are driven deeper and deeper into gain reduction.

We discovered that radio stations with successful audio chains were the ones that had all the separate components working in concert. Each part of the system was tuned for maximum benefit, and the sum of all the parts produced a good sounding signal.

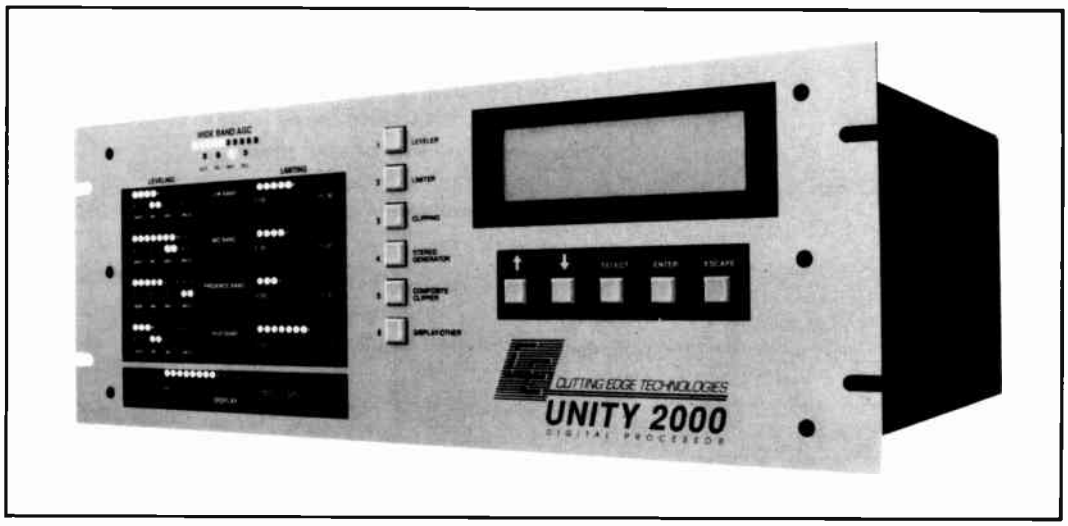
After much research, we decided to build the whole package ourselves. This way we could work to maximize the ability of each function, and make certain that, as a system, optimum benefits could be obtained.

With the UNITY 2000, you will notice that we replaced mechanical switches and pots. In their place are a keypad, LCD screen, and digital pots. Through user menus, you can achieve the same results as before, with better repeatability and flexibility.

The UINITY 2000 is a system that will maximize the audio quality of your signal, yet at the same time maintain your competitive requirements. We feel that good quality competitive audio can be realized without the expense of listener fatigue due to "heavy processing" and distortion!

Cutting Edge
2501 West 3rd Street
Cleveland, OH 44113
Phone (216) 241-3343
Fax (216) 621-2801

For more info on the UNITY 2000 Fill out the ***Radio Reply Card*** *in this issue*



Transmitter Site

Continued . . .

the approximate desired antenna height, and allocations scheme. If you plan to use a very tall tower, using a site further from the target service area will result in lower angles of incidence with the ground and less Brewster angle effects.

Now, select the right tower height for class of station, distance to target areas, terrain, and Fresnel zone clearance. FAA considerations may play a part in height selection, and a change in site location may be necessary to achieve the desired height. A compromise is probably required.

Once the site location and antenna height are known, you can decide other factors. How far is it to the radio horizon? What amount of beam tilt, if any, is required to put the main vertical plane lobe at this depression angle? Is there a primary target service area close-in to the site that would indicate a greater amount of beam tilt?

Choose an antenna with the fewest bays you can afford to use. Initial cost of a higher powered transmitter, as well as regular operating costs and maintenance, must be factored in here. If there is a big jump in transmitter power/cost near a point where you would like to operate, use the number of bays on the high side of this point. In other words, if you have the choice of using a single, 35 kW transmitter and an eight-bay antenna or a combined, 40 kW transmitter and a six-bay antenna, go with the eight-bay antenna and the 35 kW transmitter. The difference between six- and eight-bay antenna performance for a given ERP is probably not worth the much greater initial cost of a combined transmitter.

Once the number of bays is known, select the type of antenna. Talk to antenna manufacturers and users, and list the advantages and disadvantages of the various models. Select an antenna model with the greatest bandwidth and power rating you can afford. Be sure to factor the cost of de-icers into antennas that require them.

With the make and model chosen, ask the manufacturer for the first and second null angles. Look at the areas where the nulls will fall, and decide whether null fill is needed, and if so, how much. Give the manufacturer the desired beam tilt and null fill values and let him provide you with the exact gain, length, and weight of the antenna.

Ask about pattern optimization. Most manufacturers offer this service for a reasonable fee; the end result is the most circular pattern that can be achieved with your antenna.

Select your transmission line, keeping in mind the output connection of the transmitter and the input connection to the antenna (adapters may be required).

Once the CP (if required) is in hand, put the system together, turn it on, and evaluate its performance.

Keep in mind that transmission system design is a series of compromises; there is no free lunch. No matter what the gains, there will be losses in some areas. Don't be discouraged; consider the total improvements in your coverage compared to the total losses in coverage area and you will see the big picture. If you planned the system correctly and wisely, you will see that your antenna is delivering the goods on target.

Audio Animation's Paragon
Digital Audio Transmission Processor

Radio Guide Product Information

Getting Started

Audio Animation created the **Paragon** digital audio transmission processor with the help of many broadcast engineers and program directors. They told us that a transmission processor should be powerful, clean, extremely flexible, and easy to use. They wanted on-air A/B comparison, plus storage of all settings. The **Paragon** is all of these and more, with a unique user interface.

The controls of the **Paragon** are designed for professionals with different levels of technical knowledge. The user does not have to understand complex engineering issues to increase the amount of compression or limiting, or to change the tonal balance of the station. No small screwdrivers are needed to adjust the sound of the station, and there are on-line help screens available at all times for quick reference.

Digital Processing

Digital processing with the **Paragon** offers complete control over every element of the sound. There are two critical elements of transmission processing: control of fast peaks and control of of the RMS level (perceived loudness). In both cases, audible distortion should be kept to a minimum.

Peak Control

In some analog systems, clipping is used to control instantaneous peaks and to raise the loudness. Distortion from this clipping can make the mids and highs sound harsh. Some analog boxes remove this distortion with rather elaborate methods.

Ideally, waveforms that are above a given threshold should be scaled down to an appropriate size, instead of being clipped, and the harshness would never be generated. Digital processing in the **Paragon** achieves this waveform scaling.

The smooth waveform resulting from digital processing of the **Paragon** yields a cleaner and more transparent sound. The control of the waveform amplitude is very elegant and precise.

RMS Control

Each station has different needs for perceived loudness, based on the competitiveness of the market. To produce a "louder" station sound, the RMS (average) level of the music must be increased. Multi-band compression is the usual way to achieve this. Digital processing can make every parameter of the multi-band compressor controllable by the user. Attack and release times, crossover frequencies, and compression ratios for each band of the compressor and limiter are separately adjustable on the **Paragon**.

Digital is Different

Because it's so fast, digital can control the shape and amplitude of the waveforms precisely; analog systems may control these peaks by clipping the waveform. There are no clippers in the **Paragon**; the four-band digital limiter is designed so that all peaks are controlled cleanly, with none of the distortion caused by clipping.

Video Control Screen

The **Paragon** has a high resolution video touchscreen to display control screens. Each screen shows controls that are grouped for a specific aspect of the processing. Just touch the knob you wish to change, on the screen. A small data window will open on top of the knob with the current value displayed. Now turn the large black knob just to the right of the screen to change the value.

All parameters are available for adjustment and are stored on disk for total recall and A/B comparison.If you change the settings and then decide it is incorrect, you may cancel the change and go back to the exact setting you had before. If you do like the new sound, save it as the new default by pushing the save button. It's this simple throughout the **Paragon**.

Audio Animation
6632 Central Ave. Pike
Knoxville, TN 37912
Phone (615) 689-2500
Fax (615) 689-7815

For more information on the Paragon Fill out the ***Radio Reply Card*** *in this issue*

Broadcast BBS

By Mark Shander - KNXV/Fox-15
Phoenix Arizona - (602) 243-4151

High-Speed Modem Debate Continues

My last column (RG Feb-91) served as an introduction to high-speed modems that are in use on broadcast-oriented computer bulletin boards systems. Since that column was authored, high-speed modem technology has made another leap; USRobotics has introduced a dual standard modem that handles both v.32 and HST calls at 14,400 baud.

High-speed modems are still a little pricey, but they're coming down to more reasonable purchase prices quickly.

CompuCom Corporation is still offering one of the most cost-effective high-speed modems, the SpeedModem Combo, which features send/receive group-3 FAX, 2400 Baud data connections with other modems, and 9600 Baud data connections with other SpeedModem Combos.

Although the SpeedModem doesn't offer 9600 Baud HST or v.32 connection, it does offer error correction in hardware (up to 4800 bps effective throughput with straight ASCII files). Buying a pair of SpeedModem Combos for an office will set you back less than half the cost of a USRobotics "Dual Standard, " and will add FAX capability to the PC's they're installed in.

We recently re-evaluated a pair of SpeedModem Combos and found the latest product available from CompuCom Corporation to be very reliable. Instruction for setting up the modems for optimum performance are included in booklet form as well as on diskette. The FAX driver software, BitFax, is very user friendly, and offers features that many dedicated FAX card software drivers leave out.

Support for the SpeedModem Combo is available by calling CompuCom Corp. directly. All questions we had concerning the setup of the modem were answered promptly by a very knowledgeable technician.

CompuCom has announced other PC communication products that will be available soon, including enhanced versions of the SpeedModem Combo that features voicemail.

Many proponents of high-speed modem BBSing criticize the CompuCom SpeedModem Combo as another non-standard 9600 Baud modem choice to confuse users. They claim that their personal experience with the original 9600 USRobotics HST has taught them that purchasing *any* proprietary standard high-speed modem locks the owner into a situation where high-speed communications can only be accomplished with another modem from the same manufacturer.

USRobotics has responded to this concern by marketing a modem capable of high-speed data communications with their HST communications protocol, or the new world-standard v.32.

The CompuCom product is a value to broadcasters who work at home, and may need to FAX something to a station or receive something from an equipment manufacturer. Though a pair must be used for 9600 Baud data communications, the product offers excellent 300/1200/2400 Baud data connections when connected to standard data modems from virtually any other manufacturer.

Several Phoenix area broadcasters were drafted into assisting in the test of the pair of CompuCom Speedmodem Combos. The folks who assisted, varied in communication experience from novice to wizard. Not one person, had a problem with the installation and operation of the SpeedModem.

One person did have a problem connecting to another SpeedModem Combo at 9600, but it was later determined that he had not set up the communications program correctly for high-speed data communications. He did successfully connect to a FAX machine, and even sent a FAX to a dedicated Panasonic PC FAX board. The FAX program worked flawlessly with his XT-class computer and he was able to view and print a received FAX.

The product works as advertised, appears to be very reliable, has plenty of manufacturer support, and is a good value for the money. It's up to you to decide whether or not it's prudent to spend $239 on a modem that features a proprietary standard for high-speed data communications. If high-speed communications with broadcast-oriented BBS's is what you're after, consider a modem that offers v.32 compatibility. If you're considering a standard 2400 Baud modem, you should consider spending a few dollars more to move up to the SpeedModem Combo. It performs very well as a 2400 Baud modem, and having the FAX feature available, even if only used occasionally, is a good deal.

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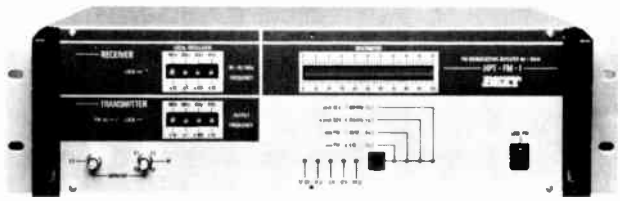

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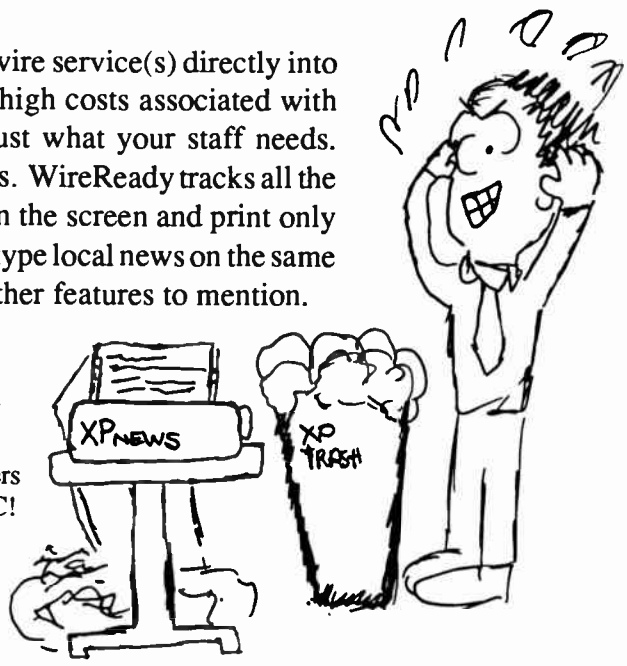

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BBS Listing

Broadcast Oriented BBS Listings

Special thanks to Mark Leff of CNN/Atlanta for the original list.

201 769-1779
Visions Infoline II
Sysop(s): Jeff Morgan
Plainfield, NJ
BBS Type: Wildcat - Speed: 3/12/24
PC-Pursuit Code: NJNEW

201 857-8880
Rockboard
Sysop(s): Adam Curry
Verona, NJ
BBS Type: Hermes (Mac) - Speed: 3/12/2400
PC-Pursuit Code: NJNEW

203-438-9908
Orion's Nebula
SysOp: Ward Carpenter
Ridgefield, CT
BBS Type: OPUS - Speed: 1200/2400

205 859-3030
Traveler
Sysop(s): Mike Bennett
Huntsville, AL - Company: WAHR-FM
BBS Type: Phoenix - Speed: 3-2400

206 443-6170
W. Wash. Freq Coord
Sysop(s): Walt Jamison
Seattle, WA
BBS Type: OPUS - Speed: 3/12/24
PC-Pursuit Code: WASEA

206 566-1155
AmoCat
Sysop(s): Rich Langsford
Tacoma, WA
BBS Type: Wildcat - Speed: 3-9600 HST

209 526-9987
Programmers Retreat Info System
Sysop(s): Brad Johnson
Modesto, CA
BBS Type: Custom - Speed: 2400 N81

212 415-3500
HyperCube Systems
Sysop(s): Mike Oswald
New York, NY
BBS Type: PCBoard - Speed: 3/12/24
PC-Pursuit Code: NYNYO

212 645-8673
Communication Specialties
Sysop(s): Rich Brooks
New York, NY
BBS Type: Searchlight - Speed: 12-9600HST
PC-Pursuit Code: NYNYO

214 647-0670
DFW Freq Coord Counc
Sysop(s): Darryl Doss
Allen, TX - Company: SBE Chapter 67
BBS Type: OPUS - Speed: 3-96 HST
PC-Pursuit Code: TXDAL

215 364-3324
Satalink
Sysop(s): Ron Brandt
Huntingdon Vly, PA
BBS Type: PCBoard - Speed: 12/24/9600

216 529-0121
Signal BBS
Sysop(s): Lynn Laymon
Rocky River, OH
BBS Type: PCBoard - Speed: 3/12/2400
PC-Pursuit Code: OHCLE

219 256-2255
Radio Daze AM & FM BBS
Sysop(s): Mike Shannon
Mishawaka, IN
BBS Type: Wildcat 2.55N - Speed: 300-14.4

301 725-1072
FCC Public Access
Sysop(s): Bob Weber
Suburban DC, MD - Company: FCC
BBS Type: custom - Speed: 300/1200
PC-Pursuit Code: DCWAS

303-341-0129
Colorado Broadcast Frequency Coordinating Committee (CBFCC)
SysOp: Jeff Brothers
Aurora, CO
BBS Type: OPUS - Speed: 2400 Baud

303-949-3253
Master Control
SysOp(s): Lynn Osburn
Avon, CO
BBS Type: OPUS - Speed: 300-9600v.42

305-828-7909
Telcom Central
SysOp: Ray Vaughn
Miami Lakes, FL
BBS Type: OPUS - Speed: 300/1200/2400/9600HST

315 474-5070
SBE Chapter 22
Sysop(s): Steve Hines
Syracuse, NY - Company: SBE
BBS Type: RBBS - Speed: 3/12/2400

317 935-0531
Harris-Allied Bulletin Board
Sysop(s): Bob Groome
Richmond, IN - Company: Harris-Allied
BBS Type: Michtron - Speed: 3/12/2400

402 289-2515
KFMQ 102 Connection
Sysop(s): Dan ?
Lincoln, NE - Company: KFMQ Radio
BBS Type: WWIV - Speed: 1200/2400

404 320-6202
AV-Sync Atlanta (tm)
Sysop(s): Bill Tullis
Atlanta, GA
BBS Type: PCBoard - Speed: 12-9600HST
PC-Pursuit Code: GAATL

404 982-0960
Rock & Roll Atlanta
Sysop(s): Bob Helbush
Atlanta, GA
BBS Type: PCBoard - Speed: 1200-2400
PC-Pursuit Code: GAATL

407 239-2607
Producer's Circle
Sysop(s): Skeeter Durham
Orlando, FL
BBS Type: GT Power - Speed: 3/12/2400

407 649-9834
Electronic Arts Info
Sysop(s): Jeff Alwin
Orlando, FL
BBS Type: QuickBBS - Speed: 3/12/24

408 985-8675
KOME Silent Side
Sysop(s): Greg Argendeli
San Jose, CA - Company: KOME-FM
BBS Type: Michtron(Atari) - Speed: 300/1200
PC-Pursuit Code: CASJO

412 981-3151
Mabel's Mansion
Sysop(s): Charles Ring
Sharon, PA
BBS Type: OPUS - Speed: 12-9600HST

414 873-7807
Second Opinion
Sysop(s): Terrance Baun
Milwaukee, WI
BBS Type: Wildcat - Speed: 14.4 HST
PC-Pursuit Code: WIMIL

415 391-2657
NCFCC
Sysop(s): Tim Pozar
San Francisco, CA - Company: Northern Calif. Freq. Coord. Cmte.
BBS Type: RBBS - Speed: 3-2400
PC-Pursuit Code: CASFA

415 571-6160
Production World
Sysop(s): Wes Dorman
San Mateo, CA - Company: Film/Tape World Magazine
BBS Type: Red Ryder Host - Speed: 3/12/24
PC-Pursuit Code: CAPAL

415 641-4373
Information Radio
Sysop(s): Dave Evans
San Francisco, CA
BBS Type: Wildcat - Speed: 3-2400 v42
PC-Pursuit Code: CASFA

419 228-7236
Black Hole BBS
Sysop(s): Fred Vobbe
Lima, OH
BBS Type: TBBS 2.1 Multiline (8 Lines) - Speed: 3-14.4

501 753-6536
N.L.R.-80
Sysop(s): James Padgett
Little Rock, AR
BBS Type: Spitfire - Speed: 12-2400

518 283-4067
Northeast Networks
Sysop(s): John Nelsen
Albany, NY
BBS Type: PCBoard - Speed: 12/24

601 373-0160
Net-Works
Sysop(s): Herb Jolly
Jackson, MS - Company: Myers Bdcst Svcs/J&J Software
BBS Type: Galacticomm - Speed: 1/24

BBS Listing

Broadcast Oriented BBS Listings

602 438-0459
CRL
Sysop(s): Hank Langlinais
Phoenix, AZ - Company: CRL
BBS Type: Wildcat - Speed: 12-2400
PC-Pursuit Code: AZPHO

602 482-1001
Catalyst
Sysop(s): David Kidder
Phoenix, AZ - Company: Take 3 Inc.
BBS Type: TBBS - Speed: 3/12/24
PC-Pursuit Code: AZPHO

602 872-9148
Broadcasters BBS
Sysop(s): Mark Shander
Phoenix, AZ
BBS Type: RemoteAccess - Speed: 3/12/2400
PC-Pursuit Code: AZPHO

608 274-7776
Communications Exch
Sysop(s): David Willow
Madison, WI
BBS Type: GT Power - Speed: 12-9600HST

614-766-2162
Radio Link
Sysop(s): Steve Craver
Columbus, OH
BBS Type: Quick BBS - Speed: 300-2400
FidoNet: 1:226/140

616 530-0821
Trillion
Sysop(s): Dick Castanie
Grand Rapids, MI
BBS Type: Wildcat - Speed: 3/12/24

617 439-5699
Boston CitiNet
Sysop(s): JAE/Koch
Boston, MA - Company: Applied Videotex
BBS Type: Yellow - Speed: 300/1200
PC-Pursuit Code: MABOS

619-268-9625
Radio-Active BBS
Sysop(s): Steve Asaro
San Diego, CA
BBS Type: WW4 - Speed: 300/1200/2400

619 298-4027
So. Calif. MediaLine
Sysop(s): Steve Tom
La Jolla, CA
BBS Type: PCBoard - Speed: 12/24/96H
PC-Pursuit Code: CASDI

703 455-1873
VideoPro
Sysop(s): Tom Hackett
Burke, VA
BBS Type: PCBoard - Speed: 3/12/24
PC-Pursuit Code: DCWAS

703 538-6540
East Coast Pub Net
Sysop(s): Charlen Kyle
Suburban DC, VA
BBS Type: PCBoard - Speed: 3-2400
PC-Pursuit Code: DCWAS

707 553-8452
KDA Message System
Sysop(s): Keith Davidson
Vallejo, CA
BBS Type: PICS - Speed: 3-2400

713 997-7575
Ed Hopper's
Sysop(s): Ed Hopper
Houston, TX
BBS Type: PCBoard - Speed: 3/12/24
PC-Pursuit Code: TXHOU

713 855-4382
Cloud Nine
Sysop(s): David Armstrong
Houston, TX
BBS Type: PCBoard - Speed: 3-96HST
PC-Pursuit Code: TXHOU
Second node at 859-8195.

713 284-1090
SBE Chapter 105
Sysop(s): Frank Rainey
Houston, TX - Company: SBE
BBS Type: PCBoard - Speed: 3-12-2400
PC-Pursuit Code: TXHOU

717 731-8966
Cat's Castle
Sysop(s): Dale Fedorchik
Harrisburg, PA
BBS Type: Wildcat - Speed: 3/12/2400

719 634-5661
ColoSprgs Broadcast
Sysop(s): John Anderson
ColoradoSprings, CO
BBS Type: TBBS - Speed: 3/12/2400

800-766-1720
Idiot Box BBS
SysOp: Michael White
Hemet, California
BBS Type: RBBS - Speed: 1200/2400

800-283-5313
The Spin-Off BBS
SysOp: Michael White
Hemet, California
BBS Type: RBBS - Speed: 1200/2400

801 266-2426
Planet Vulcan
Sysop(s): Chuck Condron
Salt Lake City, UT
BBS Type: Paragon - Speed: 3-14.2KHST
PC-Pursuit Code: UTSLC

804 393-6390
Tidewater Media Link
Sysop(s): George Randell
Portsmouth, VA
BBS Type: PCBoard - Speed: 12/2400

804 550-3338
Flamethrower
Sysop(s): Jeff Loughridge
Richmond, VA
BBS Type: Binkley/OPUS - Speed: 3/12/24

804 973-8235
Broadcasters BBS
Sysop(s): Pat Wilson
Charlottesville, VA
BBS Type: PCBoard 12 - Speed: 3/12/24

806 352-2482
Radio Online
Sysop(s): Ron Chase
Amarillo, TX
BBS Type: PCBoard - Speed: 12-96HST
Second node at (806) 352-9365.

813 527-5666
St Pete Pgm Exchange
Sysop(s): Bill Blomgren
St Petersburg, FL
BBS Type: PCBoard - Speed: 12-96HST

818 248-3088
Hot Tips
Sysop(s): Mike Callaghan
Glendale, CA
BBS Type: Wildcat - Speed: 1200/2400
PC-Pursuit Code: CAGLE

818 363-3192
Call Sheet
Sysop(s): Wayne Parsons
Los Angeles, CA
BBS Type: TBBS - Speed: 300/1200
PC-Pursuit Code: CAGLE

818 567-6564
Hotline
Sysop(s): Jon Badeaux
Glendale, CA
BBS Type: PCBoard - Speed: 12-19.2HST
PC-Pursuit Code: CAGLE

916 338-5227
KBBS
Sysop(s): Mark Stennett
Sacramento, CA
BBS Type: QBBS - Speed: 3/12/24
PC-Pursuit Code: CASAC

916 646-3600
FM102
Sysop(s): Les Tracy
Sacramento, CA - Company: KFSM Radio
BBS Type: QuickBBS - Speed: 300/1200
PC-Pursuit Code: CASAC

916 646-9358
Scratching Post
Sysop(s): Stacy Rothwell
Sacramento, CA
BBS Type: QuickBBS - Speed: 3/12/24
PC-Pursuit Code: CASAC

916 728-5700
Entertain-Net
Sysop(s): Les Tracy
Citrus Heights, CA
BBS Type: TBBS multiline - Speed: 3/12/24
PC-Pursuit Code: CASAC

918 437-9004
The Radio BBS
Sysop(s): Clark Dixon
Tulsa, OK
BBS Type: QuickBBS - Speed: 2400

919 481-2947
Recording Studio
Sysop(s): Greg Nowak
Cary, NC
BBS Type: WWIV - Speed: 3/12/24
PC-Pursuit Code: NCRTP

Computer Connection

By Kelly Klaas - KEZJ
Twin Falls, Idaho - (208) 733-7512

In the last article, I touched on the fact that our IBM AT was having some power supply trouble. After investigating the situation in depth, I found it was not just a switch problem like I had surmised. The problem was actually the power supply itself. It finally got to the point where it was not turning on at all, even after turning the switch on and off a few times.

When I told our office manager that the AT had a problem and that the AT might be down for awhile, I was told that was *not* acceptable. They needed the AT immediately. Therefore, I did what any self respecting engineer would do. I picked up the phone, called the local IBM dealer and ordered a new power supply. Luckily, they had an AT power supply on the shelf. I sent one of our sales reps to the place and she returned a few minutes later with a replacement.

It was then merely a matter of putting the new one back in the spot where the old one was. In the same morning, the AT was back in business, and our office manager was well pleased.

I, like any engineer, enjoy a good challenge. But tackling a switching power supply, without a manual, and with the pressure of someone standing over me flipping their fingernails on the workbench waiting for me to finish, is not my idea of an enjoyable challenge. Besides, I had other things to do as well.

Now, the power supply is sitting on my bench waiting for an opportune time for me to apply my golden screwdriver to it ... and the challenge of engineering continues.

I don't know how many of you need to write technical papers from time to time. But when and if you do, I want to draw your attention to the Equation Editor in Word Perfect 5.x. This little jewel allows you to enter nearly any equation known to man in your Word Perfect document. It is only available in version 5 though and not in the earlier versions. If you do any kind of technical writing at all and need to illustrate an equation, check it out. If you have Word Perfect 5.x, you can try it out by accessing the graphics mode, ALT-F9, and choosing 6. Equation from the resulting menu.

Another way to illustrate formulas, or any kind of special symbols that are available in the ASCII set in Word Perfect, is to simply hold down the ALT key, tap out the ASCII number corresponding to the desired symbol on the number key pad, then letting up on the ALT key. This gives you access to any number of symbols such as the square, degrees, even the quarter fraction and the half fraction You can tap these out on the fly. Remember though, they cannot be accessed by using the numbers along the top of the keyboard, they must be the numbers from the number key pad.

You can find the ASCII set in many books. I found one in my Turbo-Basic book from Borland/Osborne. It's handy to keep by your computer for such occasions.

Many of the top word processors today allow you to use the ASCII set in one way or another. I am only familiar with Word Perfect 5, but yours may let you use them in the same manner. There are times when the ability to use the ASCII set is handy, if only when writing notes to the rest of the station personnel. Sometimes a symbol is better than a thousand words (I think someone said that same thing in a little different way).

Something else I have used extensively in Word Perfect, is the line draw feature. I am one of the die-hards who still requires the staff to sign a log and take meter readings. I keep telling them they will appreciate me for that some day! I can draw my masters for the logs in Word Perfect using line draw, CTRL-F3, Line Draw. All you can do is vertical or horizontal lines, but that's really all you need. Put in your headings for Ip, Ep, etc. and you have a professional looking log. Especially if you print it out on a laser printer.

If you are not using your word processor to create some of your logs and other correspondence, you are missing out. The boss will love you for saving all that money. With the power of a good word processor and a copy machine, you can make some very professional looking documents and save the station loads on the printing bill. A laser printer is a fine addition, but even with today's 24-pin dot matrix printers, you can still make them look next to type-set quality. To let you in on a little secret, I still use a 9 pin dot matrix printer. For in-house logs and documents, that's really all you need.

Let me encourage you to send me your ideas, even your articles. If you want to write an article about computers in engineering, send me a manuscript. Try to keep the length in 1000 word increments. Mail them to: Kelly Klaas, 176-B Highway 74, Twin Falls, ID 83301. Or, you can mail them to me at the radio station. KEZJ AM/FM, c/o Kelly Klaas, PO Box 346, Twin Falls, ID 83303. Please have them typewritten, double spaced on standard size paper, one side only. With your help, we can make this the best computer engineering column in all the trade magazines. Subjects can range anywhere from a program you have written, to a unique way you use your computer, to a new piece of hardware you have invented. Get them to me so I can let the rest of the world know.

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