RADIO GUIDE

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A Forum for Radio Engineers

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Equipment Guide For Gear

Quite a few of you are using the Equipment Guide to buy and sell your used gear. That's great! As those people have learned, the Equipment Guide really works. We don't limit the number of words you can use to describe your equipment, as other publications do. We feel that if we are going to charge for the placement of the ad, then the least we can do is to let you have your say.

When you send your classified ad in to us, please make sure you let us know how many months you wish the ad to run. Otherwise, it will run for just one month only. Remember, the used equipment market is a prime source of broadcast gear for quite a few stations. Help them out (as well as your Self), and send your list to us. Instructions are on the front page of the Equipment Guide section.

DATs OK?

It seems as though they've finally gotten around to establishing a copy-code, of sorts, for DAT machines. The way I understand it, is that you can make one digital-to-digital copy of a pre-recorded DAT tape (or CD). If you try to copy the copy (digitally), you can't. Of course, you can do anything you want, in the analog domain.

This is supposed to eliminate piracy? Of course, never mind that 99.9% of the public can't tell the difference between a digital or analog copy of the original. I mean, really, we're talking zip distortion and ruler flat frequency response, any way you slice it -- A or D.

Anyone who's into pirating music, is going to circumvent the hardware anyway -- while Joe Public is most likely going to give an analog copy to his friends (it's the music, not the method).

The end result is that DAT will appear on the consumer shelves, and that's great! We all know that it's just a matter of time before recordable CDs engulf the market (probably double sided ones at that). Now, we have to wonder, is DAT too late?

Phase Delay

Last month I asked you for various articles and tips, on what you have done at your station to eliminate (or reduce) to threat of lightning surges on the power line -- three-phase lines, in particular. I did receive a few responses, but I'm going to hold off publishing those until I get a few more. I'd like to see a few more of you let the rest of us know what you've done to shield your site against power line surges, drop-outs, brownouts -- what ever.

Maybe some of you have worked for (or with) the power company, and have some useful tidbits to share with us. Others of you may have found out, through experimentation, what works and what doesn't. Don't allow others to learn the hard way. Share that info with the rest of us, in Radio Guide.

Of course, as always, we have a constant need for any technical articles, tips, special test procedures, or construction projects. I know I sound like a broken record, but you can't ignore me, if you haven't sent in an article -- right? So get out that old Underwood, and remember, please double-space. My eyes aren't so good anymore. I think it was that screwdriver across the spark gap. Fifty kilo-whats?

In This Issue . . .

Corrections - Info & Help

Bandpass vs Notch Filter

Edd Monskie - Hall Communications
Norwich, Connecticut
203-887-1613

In the May-89 issue of Radio Guide, Conrad Troutman of WSYR talked about using bandpass filters to eliminate intermod problems on a "Marti" receiver. However, to avoid the insertion loss, you would do better to install a "notch" filter instead. You have to know the exact frequency and then get a single, double, or triple bottle version of the notch filter. Each bottle added, increases the depth of the notch. If the offending transmitter is not real close to your frequency, insertion loss is almost negligible.

The problem with the bandpass filters is that they are too broad in their bandpass. If you re-tune them for a sharper bandpass or gang several together, again for sharper bandpass, the insertion loss greatly increases. As long as you know the offending frequency, use a notch instead. The same people that make the bandpass bottle like Wacom or DB, also make the notch filters.

RCA BTF-20E Clarification

Joe Puma - WBEN
Buffalo, New York

Just a small correction of a statement on RCA BTF-20E transmitters, made by Mr. Alan Roycroft in the July-89 issue of Radio Guide.

Mr. Roycroft stated that when an SWR problem crops up, a vane moves over the face of the exciter lamp, allowing the photocell to see the lamp. He then states that when the bulb burns out, all conditions of normal appear. This is in error; he's got it 180° out of phase.

When the vane moves over the face of the exciter lamp, it cuts off the light to the photo cell (LDR), thus opening a relay and cutting off the plate voltage. Therefore, when the bulb burns out, the circuit is interrupted and the plates go off. These relay systems are then inherently fail-safe!

Help Needed With Continental 317C

Ken Brenner, CE of WMIN in St. Paul, Minnesota, called to ask for assistance with a Continental 317C. He needs information on, and a diagram for, the solid-state replacement for K8. Give him a call at (612) 739-4433, or you can Fax him the diagram at (612) 739-4784. Let's help him out.

So How Come You Never Write?

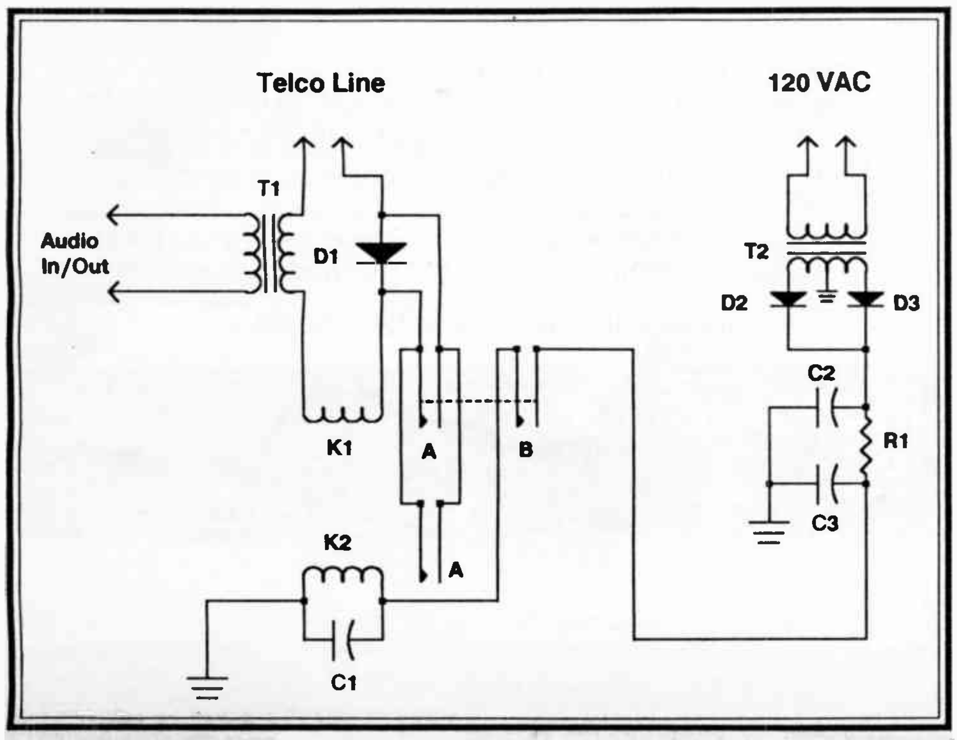
If you have any short tech-tips, send them in. Remember, it doesn't do anyone any good if you keep that information to yourself. Don't assume that everyone knows about your special technical tip - - so send them in!

Editor

Telco Auto Coupler Circuit

By Dave Grant - WLAV Radio
Grand Rapids, Michigan
616-456-5461

How many times have you needed a way to couple audio to or from a phone line without spending major dollars on a factory built unit? I found myself constantly wanting such a device, but not able to find something that was less than a hundred dollars. The circuit shown here, is a versatile brainchild of my own desires. Basically, the unit offers a cheap and simple way to automatically couple audio to or from a phone line. As shown, the circuit will act as a listen line. It can be built mostly from junkbox parts and can be mounted on a relay panel or built into a small box. None of the component values are that critical. Once the circuit theory is understood, you should be able to use whatever parts are handy.



Parts List:

K1 & K2 = P&B R10-E1-X4 24 volt relays

T1 = 600/600 audio transformer

D1, D2, D3 = 1N4001 diodes

T2 = 120 vac primary, 15 vac c.t. secondary, power trans.

C2 & C3 = 1000 uF/50 volt capacitors

R1 = 220 ohm, 2 watt resistor

C1 = 220 uF/50 volt capacitor

(Note: C1 Value may vary depending on K2)

D1 rectifies the ringing voltage, causing K1 to pulse. Contacts B of K1 cause K2 to pull in. C1 keeps K2 on for about one second, long enough for the telco central office to stop sending ringing pulses and put DC on the line. With contacts A of K2 closed, D1 is by-passed and K1 latches via the telco DC, thereby latching K2 through contacts B of K1. Audio is coupled to or from the telco line via T1. When the calling party hangs up, the central office momentarily opens the DC path. This causes the relays to drop out and re-set for the next call.

As you can see, the device locks on with the help of Ma Bell. As long as the central office provides DC, the relays will stay latched. This device is polarity sensitive. If the relays pull in as soon as you plug it in to a phone line, try reversing the leads to the phone line.

I have used this system with great success for listen lines. By adding a Radio Shack DTMF de-coder and a few more relays, you can build a simple dial-up remote control. I am currently using this for a listen line, a dial-up remote, and and auto-answer for a mo-dem. This device has not been used or tested in areas other than Michigan Bell but I suspect most phone companies are basically the same. One note of caution: this device is not FCC registered. Hook up at your own risk.

Advisory/Alert System

By Michael L. Douthat, CE - KXCV Radio
Maryville, Missouri
816-562-1163

Here at Northwest Missouri State University we have a unique situation where a 100 kW FM station is completely operated by students. It is a real challenge to train and retrain a constantly changing staff of 15 or more people in the technical aspects of the station. I needed an advisory/alert system that would not only tell the student operators that there was something wrong that needed their attention, but would spell out in "plain English" what steps they needed to take to correct the situation.

From this challenge, came my "ultimate" advisory/alert system. The heart of this system is a Radio Shack Color Computer and a 6821 PIA interface card ordered from a company called Fraser Instrument, P.O. Box 712, Meridan, Idaho, 83642, (208) 888-5728. With these two pieces of hardware, plus a relay interface circuit, a monitor and a fairly simple basic program, you can create a system that responds to simple contact closures.

What the system is capable of from there on, is only limited by ones skill in basic programming. Our particular system, for instance, will not only tell the operator that the transmitter is off the air, but automatically raises it again, if the problem is a power outage and is restored in less than 10 seconds.

In the morning, at sign-on, the system locks out the transmitter remote control for four minutes after the filaments are turned on, to prevent prematurely applying the plate voltage to the transmitter.

The system can give any message on the screen you like, plus alert tones that can be varied in volume and frequency by a simple change in programming (or there can be a message with no alert tones).

For the system to be complete, there must already be peripheral equipment that will give you contact closures, or you must purchase or construct this also. An example of these contact closures would be an off-air alert circuit built in to your modulation monitor; some monitors have them and some do not. Your news wire may have external contacts that close when an advisory comes across. If you have three-phase power at your transmitter, you may have to purchase a device that gives you a contact closure in any or all phases are lost. And so on. . .

If you're interested in developing your own system similar to ours, I would be happy to send you a copy of the program. If you are not inclined to computer programming, give me a call and we'll work something out.

Divide and Conquer

By Don Beans - WUOM
Pinckney, Michigan

Sooner or later we all face troubleshooting. Time is of the essence. Obviously, a plan or pattern to follow will help. But it must be simple and easy to remember in those "sleepy times." The best and fastest plan I have found is - - Divide in Half. Then I ask, "Is the problem in this half or the other half." When I know, I divide that half in half, etc. With each test, I eliminate half of the system or area remaining. Looking at a table of the powers of the number 2, shows why it is fast. After only ten steps, over 1000 possibilities have been covered. Its value lies in the fact that it begins with a broad picture and sequentially narrows it to the problem cause.

One final word: make notes! Every maintenance engineer, who has been around a while, has run into a multiple-fault problem. If, at step 10, you discover you have two problems or faults, look back over your notes of the previous steps. If you see a clue back at step 5, you have just eliminated 32 possibilities, compared with no notes. A sleepy mind that remembers the results of a check incorrectly can lead down a false trail.

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Huge expanded scale, -40dB to +3dB, multi-colored LED VU meters (4" & readable in bright light across the room); Four individual meters on dual channel units; Switch programmable muting on each mixer and input; Nine input selects on the last channel; Mono sum output; Plug-in modules for ease of service; Optional switch programmable remote control start/stop; Remote start/stops use front panel input and output selects or input select and pot up start/ pot down stop; Double shielding for total RFI protection...and as you'll see in the rest of this ad ...much, much more.

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FEATURES OVERVIEW:

1. EXPANDED SCALE VU METERS (-40dB to +3dB) multi-colored LED.
2. PLUG-IN SHIELDED INPUT MODULES.
3. MIC/LINE SELECT JUMPERS ON EACH CHANNEL.
4. MONO/STEREO FEED SELECT ON EACH CHANNEL.
5. GAIN SELECT PATCH PANEL ON EACH INPUT.
6. PROGRAMMABLE MUTING SWITCHES ON EACH INPUT.
7. NINE INPUTS ON LAST CHANNEL.
8. 2 WATT CUE AMP.
9. ROCK SOLID, SHORT CIRCUIT PROOF SUPPLY WITH LED INDICATORS.
10. MONITOR SELECT/GAIN CONTROL. Prog1/Prog2/External.
11. PHONES SELECT/GAIN CONTROL. Prog1/Prog2/External/Cue.
12. INTERNAL CUE SPEAKER.
13. VCA CONTROLLED MIXERS.
14. PADDED ARM REST.
15. MONO SUM OUTPUT.
16. PLUG-IN IC'S THROUGHOUT.
17. FOUR INDIVIDUAL PWR. SUPPLIES. Meters, Cue amp., Power amp., Main audio.
18. INSTANT ACCESS. Two, quarter turn fasteners.
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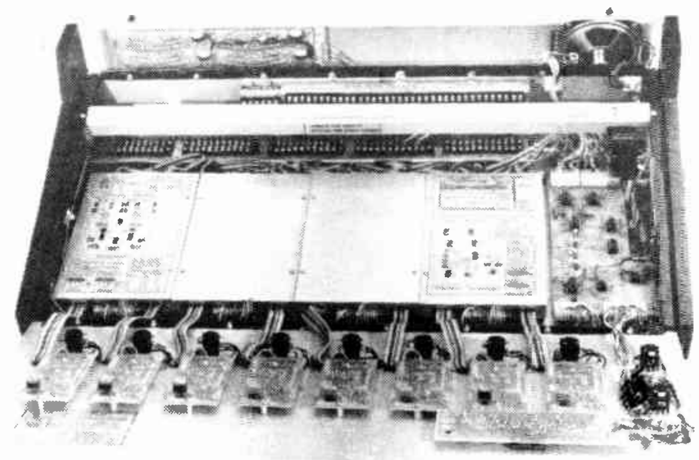
20. HIGH VOLTAGE SOLID STATE AUDIO SWITCHES. Cannot be overdriven nor damaged by overvoltage.
21. EXTERNAL 20 WATT POWER AMP.
22. ON AIR LIGHTS RELAY.
23. REMOTE START/STOP OPTION. Programmable for operation from in/out select switches or mixer pot-up start & mixer pot-down stop.
24. COMPLETE INTERNAL LABELING. All labeling or in's & out's, gain adjusts, programming, levels, etc., is provided internally for easy installation.



PARTIAL SPECIFICATIONS

INPUTS: Two per channel except the last channel which has nine. Balanced bridging 1k ohms in mic mode & 150k ohms high level. Input #1 of each channel programmable mic thru high level. Input #1 of each channel may be strapped for mono or stereo feed.
OUTPUTS: Balanced low impedance, +25dBm max into 600 ohms. May be used balanced or unbalanced. Stereo sum balanced out. Program outputs factory set for +8dBm but may be recalibrated for any other level.
METERING: Expanded scale, 4" solid state tri-color with VU ballistics. 2 each on single channel units & 4 each on dual channel models.
MONITOR: Stereo, muted monitor outputs @ +4dBm. External 20 watt stereo amp included. Three position selector for PRO1, PROG2 & EXTERNAL in.
CUE: Mono-sum to 2 watt internal amp & speaker and phones. Switch programmable speaker muting.
S/N: Mic level in @ -50dBm & +8dBm out; -68db. High level @0dBm in & +8dBm out; -75dB (typically -78dB).
DIST: Below noise floor. Typically .009%.
RESP: 10Hz-20kHz; ±1dB
CROSSTALK: PROG1 to PROG2; -70DB.
SIZE: xL4..19"W x 8.5"H x 17"D.
xL6..25"W x 8.5"H x 17"D
xL8..30"W x 8.5"H x 17"D
POWER: 115VAC, 50/60HZ, 40W. 230VAC available at additional charge.
FINISH: Polyurethane Carbide black, Linear white, Ramko Grey.

MODELS & LIST PRICES:

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4 mixer single channel stereo
xL42S **$1650**
4 mixer dual channel stereo
xL 61S **$1975**
6 mixer single channel stereo
xL62S **$2375**
6 mixer dual channel stereo
xL81S **$2650**
8 mixer single channel stereo
xL82S **$2950**
8 mixer dual channel stereo
RSS4 ..... **$225**
Remote start/stop (xL4)
RSS6/8 ..... **$325**
Remote start/stop (xl6 & xL8)
LF6 ..... **Contact factory**
Linear faders; Available6/89
LF8 ..... **Contact factory**
Linear faders; Available 6/89
PS230B **$50**
230VAC power source

Continental 816-R Gate Cards

By Warren Nystrom - KRDU/KOJY
Dinuba, California
209-486-1130

Our Continental 816 has been in service for about five years and, except for a power module failure right at the beginning, almost all our problems are/were gating card connected.

Our transmitter is about an hour and fifteen minutes away by road, in good weather. In bad, who knows. Luckily several other stations had problems and we joined in renting a helicopter at $400 per hour.

One thing I learned was that gating cards can cause seemingly unrelated symptoms. In order of occurrence:

1. **Inability to get power up to 100%**
2. **Blown fuses to the exciter**
3. **Main circuit tripped but not the PA breaker**
4. **PA breaker tripped**
5. **Dimmed building lights**

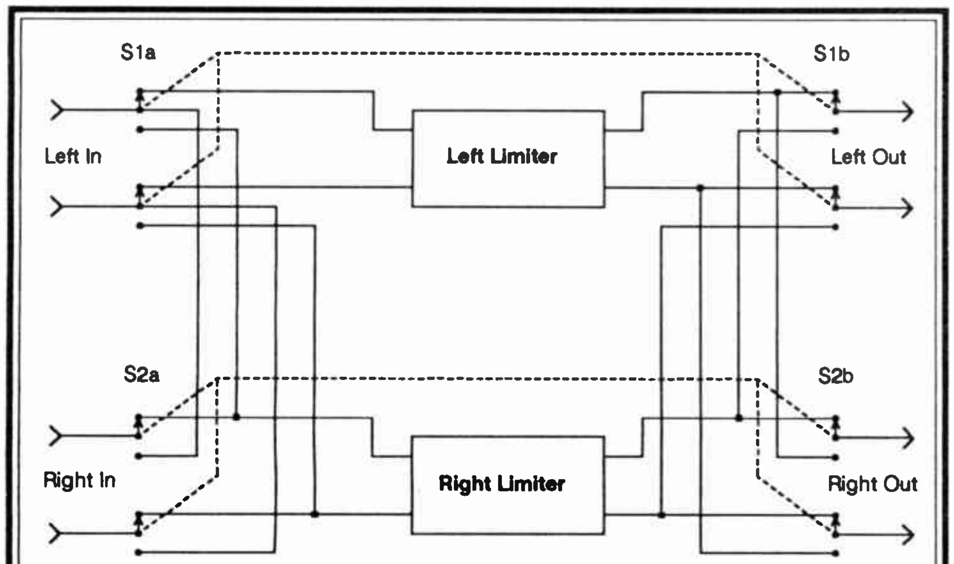
After the manager got fed up with long downtimes, we ordered updated gating cards that are suppose to cure the problem. We just installed them. If they work, they're worth the cost.

It was mentioned in the April Radio Guide that faulty capacitors are usually the culprits. When replacing them, be sure to match the corresponding pairs. The exciter problem, mentioned above, was traced to a 10 mFd capacitor that only measured 4 mFd.

Limiter Bypass Circuit

By Phillip Robillard - Robillard Communications
Haynesville, Louisiana
318-624-0105

This circuit is simple and straight forward. It solved a problem we had with removing either of two stereo limiters feeding our FM exciter. Our biggest problem was with alligator clips and jumper leads. Something always happened to screw up the signal going to the exciter. Let's face it, unless you have both channels feeding the transmitter, even the dumbest listener can tell the difference.



S1-S2 Centralab #1458 4PDT

I used two Centralab #1458 4PDT switches to accomplish my mission. This way, I can switch either amplifier out of the circuit for repairs and not loose audio information. I mounted the switches on a Bud PA-1101 1-3/4 inch relay rack panel and backed it up with a Bud CB-1370 bath-tub chassis. These were held together with pop rivets, making one unit. I placed barrier strips on the back of the bath-tub chassis so that the input and output connections could be made easily.

After either amplifier or limiter is switched out, it is an easy matter to disconnect the incoming and outgoing audio wires from the rear of the defective equipment.

Digital STLs - - A Few Zeros

By Tim McCartney - KBSU
Boise, Idaho

Among many compelling reasons for radio station interest in the use of digital STLs, a few problems exist which are often ignored.

First, an overview of why the digital STL move is thriving: 1) limited 950 mHz spectrum space, 2) excellent specifications: noise, dynamic range, stereo separation, and frequency response, and 3) easier FCC licensing.

The "pseudovideo" digital systems discussed here, Sony's pulse code modulator (PCM), interfaces with a standard video signal and is transmitted in the 23 gHz band. KBSU has been using this digital STL regularly since April, 1988. Figure 1 is a block diagram of the two-hop STL.

In KBSU's application, high RF at the transmitter site renders the use of stereo generators nearly impossible. In fact, of the 13 FM stations at the site, we are alone in the attempt to make a stereo generator perform. The others all use a composite signal with the stereo generator located at the studio. We have done likewise with a redundant 950 mHz analog STL for our hop #2.

Another major problem comes during hand-offs from the Sony PCM's unbalanced, high impedance outputs to an interface amplifier and then to the stereo generator. High RF interferes during these hand-offs, resulting in unacceptable noise of about -35dB.

Experiments with RF shielding, grounding, etc., all proved to be successful only on a limited basis. And, the PCM itself is prone to total signal loss in the event that any coaxial connector is not perfectly crimped and shielded. In fact, double-insulated coax is a must in the high RF environment.

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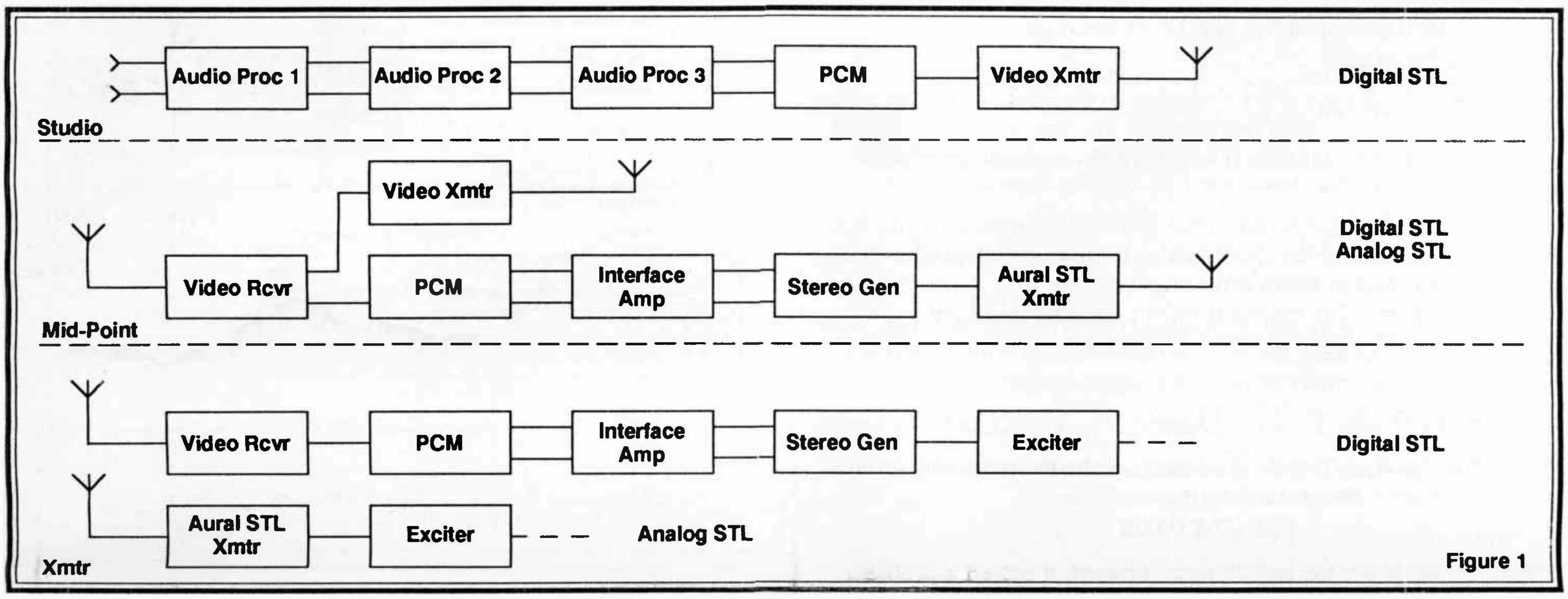


Figure 1

Digital STL . . . (continued)

Audio Processing

KBSU's audio processing equipment comes in three separate black boxes. This allows some choice when selecting the location of various equipment. Figure 1 shows KBSU's final location of each processor in relation to the digital STL.

An interesting choice is the location of Box #3 which introduces the 75 microsecond pre-emphasis. We tried locating this unit in both the studio and mid-STL points, with no differences noted. Convenience concerns kept it in the studio, however.

Since there are few similar situations at other radio stations from which to compare, it is not clear what the impact might be of inaudible digital transients feeding into audio processors. Thus it seems safer to locate all processing in front of the digital STL.

As for engineering convenience, it is most difficult to make adjustments to a stereo generator which is located at the transmitter site, miles away from the studio monitor.

Equipment Shortages

At the present time it is impossible to purchase new PCM units, since Sony has re-allocated resources to development of the Digital Audio Tape (DAT) technology. The firm may, however, provide a similar item at a future date.

The only other competitor, dbx, is no longer producing its D/A and A/D converters (model 700), which are somewhat similar to the Sony PCM, but at a much higher price.

Any STL relying on this technology requires backup units, schematics, etc., to keep the system operational for the next few years until such a replacement item is again available.

Uncertainty

Even if the equipment were readily available, questions must be addressed about better future options.

With spectrum space always becoming tighter, the FCC will certainly look favorably on new technologies which are spectrum efficient. For example, the 23 gHz system at KBSU occupies 10 mHz of baseband bandwidth (12 mHz minimum with rollout to 20 mHz). By comparison, the 950 mHz aural system currently uses 500 kHz of bandwidth.

Several companies have already met this challenge. Dolby poses the ironic possibility that the 950 mHz band will become home to the digital audio link of the future. Dolby can already transmit two digital 15 kHz audio channels and one narrower auxiliary channel while meeting the FCC 1990 bandwidth standard.

The new Dolby system likely will need FCC approval for any new emission type which may become the standard.

Cost

The typical cost of a 23 gHz STL system, even if the digital converters can be found, is still typically higher that the traditional 950 mHz composite STL system.

However, for a short distance, such as KBSU's STL hop #1 of just a few hundred yards, the digital system is a few thousand dollars less. The inexpensive price of 23 gHz equipment for such short hops accounts for the savings.

Reliability

Stations with STL paths under 15 miles usually can take advantage of digital STL systems, but must consider the impact of rain attenuation at 23 gHz.

For example, a seven mile hop in Chicago would be reliable 99.585% of the time. While that may sound acceptable, it still means that some 80 minutes per year may not be of use. And, if unreliability occurs during a rush hour downpour, the digital choice might seem like a poor one!

On the other hand, a short hop in semi-arid Boise, Idaho is reliable all but a few seconds a year. But, it happened during a heavy rain last December. A digital "roll" made the announcer sound as if

(continued on page 9)

Digital STL . . . (continued)

he had "hiccuped." By the way, this digital "rolling" can become an engineering nightmare once digital STLs have come into regular use.

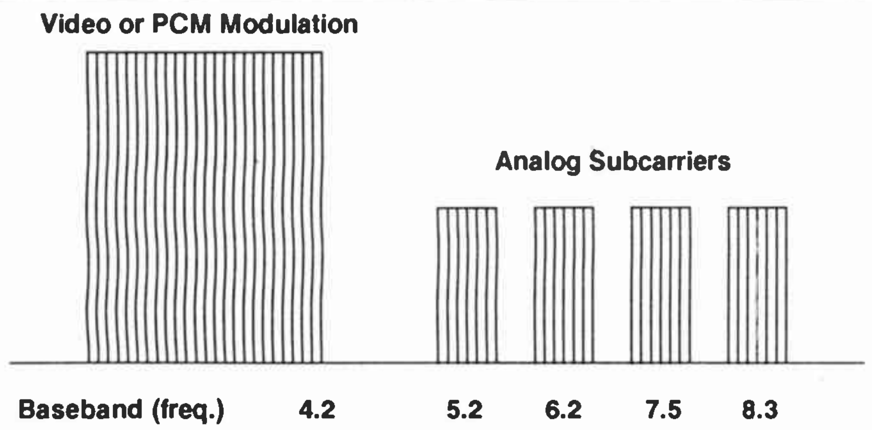
For the most part, however, the digitally modulated video channel is impervious to minor rain fade of this sort.

Licensing

KBSU had no difficulty in 1987 securing the FCC construction permit/license for the 23 gHz video link. However, the same year we applied for a similar link in the 18 gHz band and have yet to receive a decision from the Commission.

Spectrum Use

The wide bandwidth of most video systems is not fully occupied by the Sony PCM. Thus, the remaining space is available for other operations such as analog subcarriers (see figure #2).



Possible Use of Video Baseband

Figure 2

However, our attempts to use two analog subcarrier channels on the 23 gHz hop #1 failed due to high noise from unidentified interference.

Antenna Locations

Such high-frequency systems require very short sections of waveguide. This means that the RF stages for both the transmit and receive sites are located inside the antenna structures and at typically inaccessible locations on tower masts. So, maintenance difficulties increase. The RF portions of 950 mHz systems are mostly indoors and accessible.

Alignment

A narrower beamwidth at the higher frequencies requires a tight alignment of the two antennas. Any errors introduced by wind or lack of structural integrity amount to signal loss.

Dropouts

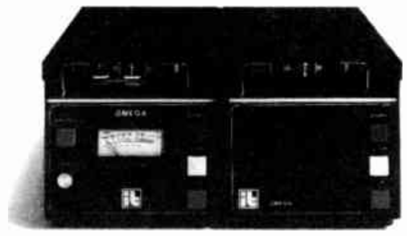
Instead of a fade or a gradual degradation of signal, digital systems move quickly toward total failure. The progression is from a perfect signal, to the "hiccup," to total dropout.

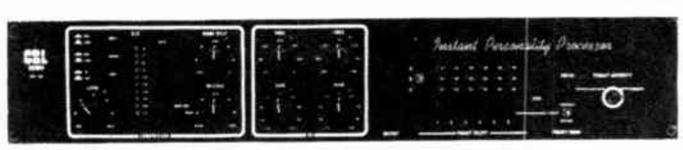
Recently our digital STL dropped out completely after the 23 gHz transmitter had been momentarily disconnected from its antenna assembly. While I prepared the backup land-lines for STL hop #1, the link started working again after 20 minutes. At the time it came back into operation, I was nowhere near the equipment! I later learned that the 23 gHz receiver coaxial connection to the antenna assembly had to be removed momentarily for a quicker system reset.

This type of uncertainty about the source of problems makes one appreciate the relative simplicity of the standard 950 mHz aural system. KBSU uses its analog STL hop #2 regularly, while retaining the digital STL hop #2 for backup only. The station continues regular use of its digital STL hop #1, however.

Digital is Coming

Nonetheless, it is clear that digital systems are in radio's future. So the sooner engineers learn to work with them and overcome their new realities, all the better.





The Octopus

By Bob Schnieder - Broadcast Technical Services
Lubbock, Texas
(806) 798-2601

Contract engineers need to be as fast as possible when it comes to finding faulty components in Broadcast equipment. Many Navy veterans are familiar with the Octopus component tester. If you can find a copy of an Aviation Fire Control Technician 3rd & 2nd Class Petty Officers Manual, it starts on page 574.

All you need for this three hour project are three resistors and a 6.3 volt AC center-tapped filament transformer. Some leads, BNC connectors, and a small box to put it in, and you're on your way to testing circuits and components on de-energized circuits with your oscilloscope.

You will save time because you will not need to un-solder components from circuit boards. In fact, if you have a known good circuit board, the repair becomes even easier. The Octopus gives the operator a visual display of the components condition better than you can find with an ohmmeter. The display is under AC small-signal conditions which, with some practice, is a breeze to interpret on the oscilloscope.

The Octopus is designed to quickly test delicate components because it will not deliver more than one milliampere of AC current. It will test all components for shorts, opens, and will check the front to back ratios on junction components such as diodes and transistors.

Utilizing the Lissajous and combination patterns on the 'scope, the Octopus easily analyzes circuits and reactive components that defy ohmmeter analysis. You will be delighted the first time you identify a noisy potentiometer or a high resistance solder joint.

The figure 1.1 shows the schematic of the simple Octopus. You can get fancy with an on-off switch, fuse, etc., but the basic circuit is very simple.

After you build the Octopus, simply connect its vertical output to your oscilloscope's vertical input and its horizontal output to your 'scope's horizontal input. The vertical and horizontal gain control of your 'scope should be adjusted to prevent trace ends from going off the face of the 'scope. The oscilloscope must be set to the X-Y position to use the Octopus, with the horizontal sweep disabled.

Figure 1.2 shows typical oscilloscope traces. The Octopus is an AC device and you will be able to observe reactive components and Lissajous as well as front to back ratios of junction components. It is therefore unnecessary to reverse the leads. **(continued on page 11)**

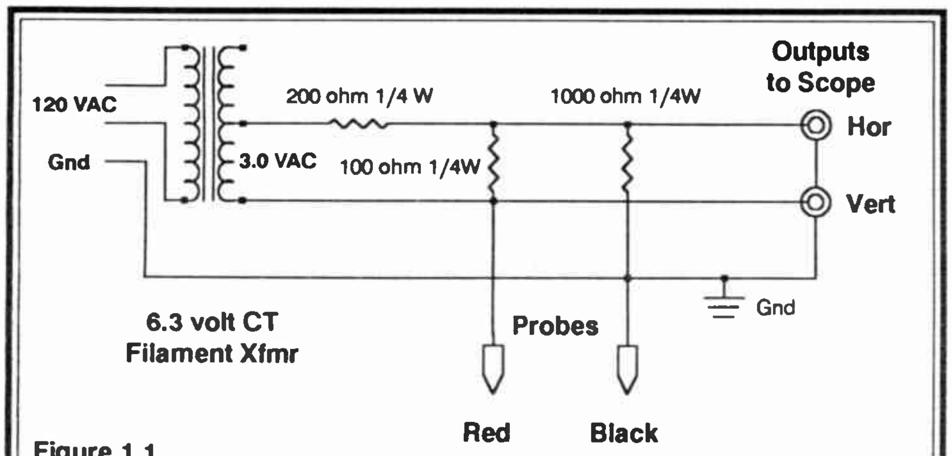


Figure 1.1

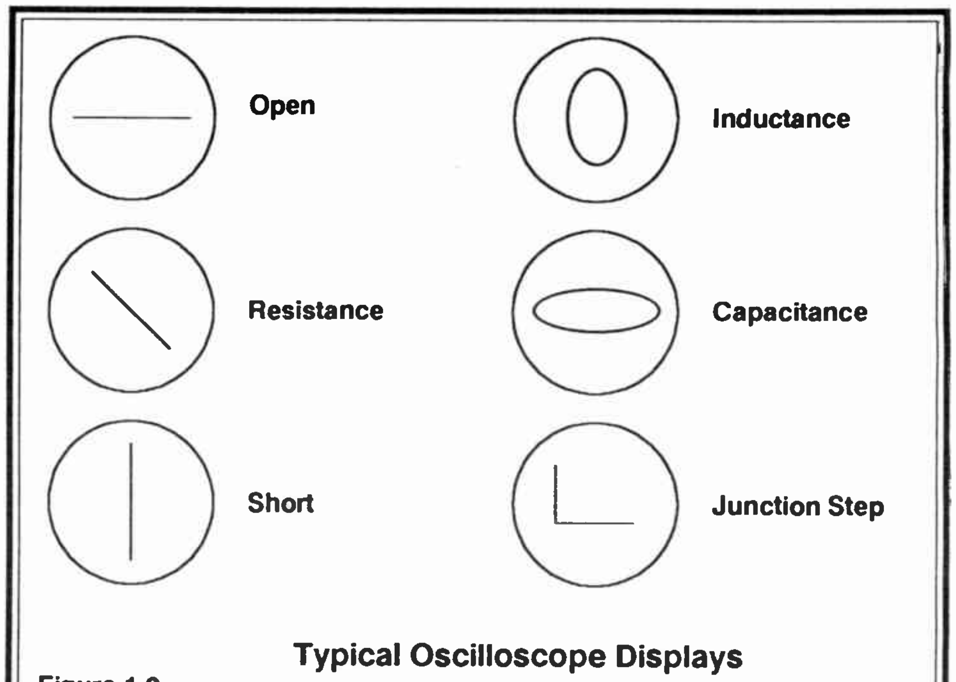


Figure 1.2

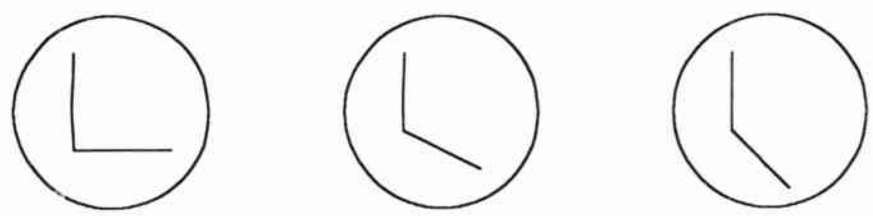
Octopus . . . (continued)

When checking transistors, check first from the base to one side and then from the base to the other side. Since an emitter to collector test would have to pass through two junctions in series, you will usually not get a useable result.

An ideal single junction check will produce a 90 degree step display indicating a very high front to back ratio. This simply means an open in the reverse bias direction and a short in the forward bias direction. A display that is open more than 90 degrees, is something less than perfect. The wider the angle, the less the merit of the junction. Refer to Figure 1.3.

With a little use, you will become proficient in recognizing combinations of patterns arising from grouped components. You will be able to recognize the reactance as either capacitive or inductive and analyze if the circuit is reacting correctly. When you compare to a known good board, the job becomes one that even a new technician can work with. See figure 1.4

Just a few parts from your parts box can become one of the greatest helping hands on your bench. Maybe that is why the Navy calls it an Octopus, since you will feel that it has given you many extra arms in circuit repair.



Highest Merit 90° | Fair Merit 120° | Poor Merit 150°

Single Junction Transistor Check

Figure 1.3

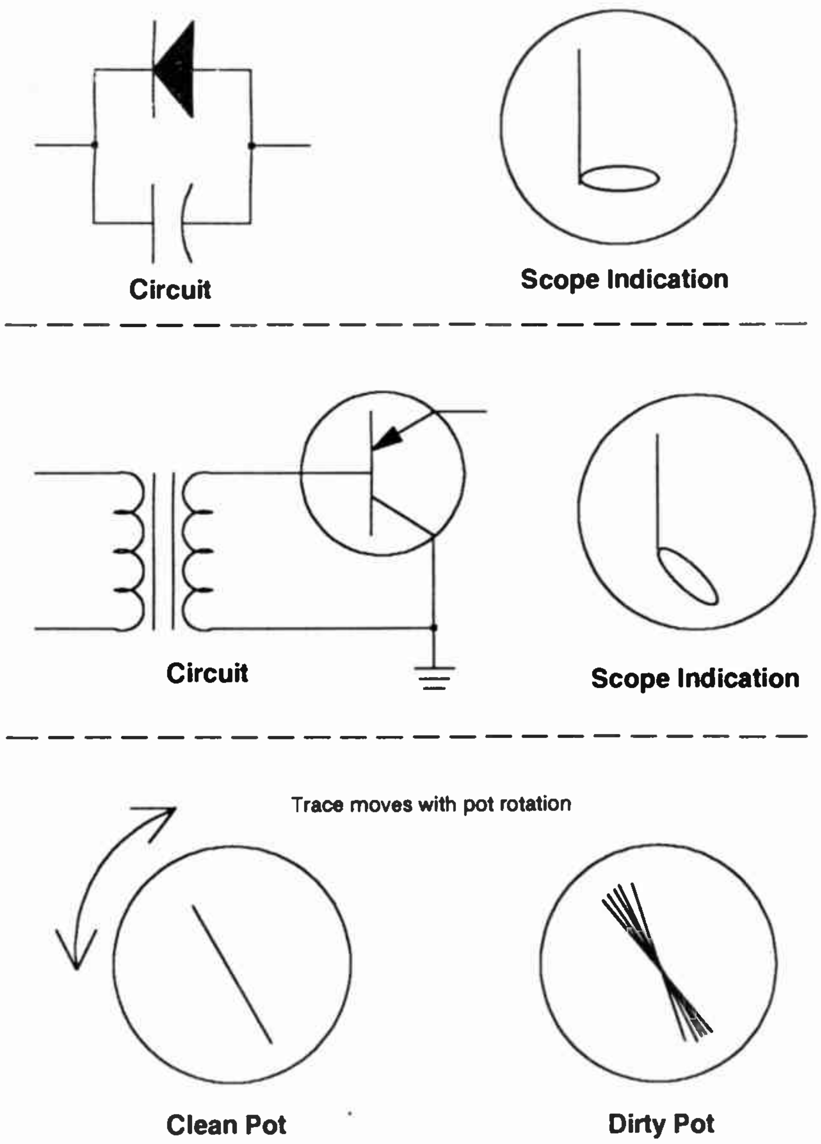


Figure 1.4

Station Woes

By Sal A. Emma - WSLT-FM
Ocean City, New Jersey
(609) 399-1555

Label Woes

Part of a recent station renovation included moving our main on-air studio and replacing the old console with a new one. When everything was installed and the job ninety percent completed, it came time to label the new console for the announcers. One morning, the station operations manager walked in and handed me a Dymo Labelmaker. He said I could use it to make labels for the new console.

"Are you out of your mind," I though to myself? I then politely thanked him for trying to help, and informed him that we would not be using Dymo Labels on the new board. With no offense intended to the Dymo Company, there is simply something inherently offensive about those labels in some situations. They are OK for a lot of jobs, but I can't stand seeing them in plain view of everyone in the on-air studio. In addition, they leave behind a nasty glue residue when removed. When my fine managerial friend offered his assistance that morning, I still hadn't come up with an alternative.

Then, one day as I was driving along, an idea struck me like a ton of bricks (as it tends to do in this business). I procured a length of vinyl siding from the dumpster of a construction site. I trimmed it to size so that it would slide neatly under the LPB Signature Console. Then using garden variety white labels, I notated each channel function using a chisel-tip calligraphic pen.

Now, whenever we make a change in the board set-up, it's very simple to rearrange the labels. As an unexpected bonus, the chunk of siding prevents hundreds of pencils, pens, and hair balls from rolling underneath -- out of reach and tough to vacuum out.

The announcers (clever as they are) also slide their song sheets and whatever other paperwork, under the siding to hold them in one spot.

Now, whenever the PD has to train newcomers, they only have to slide the siding out from its hiding place to read the board configuration. The jocks, who have been using this system for some months, have memorized all the locations, and rarely have to slide it out at all.

Speakerphone Woes

Being a small market station with a small market budget, we cannot afford an expensive telephone interface box. We recently purchased a standard Radio Shack Speakerphone, with separate mike and speaker elements. This worked OK for some announcers, depending on the nature of their voices. However, a few just could not seem to get the mike to actuate from three to four feet away, no matter how loud they yelled. The announcers tape their phone calls on the audition channel, with the mike and speakerphone potted up in audition; the announcers have to keep their mouths somewhere near the console mike for a quality recording. In theory, this worked very well, except that the caller always heard the announcers as though they were inside a barrel.

One idea: wire one side of the stereo mike mixer inside the board to feed the speakerphone. This works well, and there are quite a few talk radio stations around the country using this very system. However, I really did not want to modify the board and chop up the telco switches inside.

Second idea: mount the speakerphone mike near the announcer's mike. We removed the small condenser mike from the speakerphone box, and ran a piece of un-balanced shielded audio cable from the mike terminals inside the speakerphone box, up to the announcer's mike. There, we mounted the mike inside a plastic tube and attached it to the mike stand with a couple of nylon wire ties. Now, the announcer's mouth is no more than a few inches from the both mikes. To the caller, they sound just as though they are using a regular phone. The callers have always been able to hear the announcer's voice, since making this simple modification. This set-up has really improved the quality of recorded phone calls for contest winners and other actuality applications.

(continued on page 13)

Station Woes . . . (Continued)

Electronic Phone Woes

Management recently installed a new phone system in the building. This system was acquired through some financial hocus pocus, and not purchased with the radio station in mind. It's am electronic system, so that each desk phone is something like a "dumb terminal" to the central brain, which hangs on the wall in the computer room. Using this system, we could no longer interface telephone audio using a QKT adapter, or any combination of transformers and capacitors, due to the lack of pure audio at the phone and the presence of hold pulses and other digital nonsense on the phone line.

The only place from which you can take pure audio on these phones is at the handset. I simply took a piece of two-conductor cable and soldered it to the handset terminals inside the phone unit at each location where the audio is needed. I then installed a cut-out switch across the transmitter, to allow the news department to record actualities without the room noises.

This audio is high impedance, so it may need a transformer to interface with some consoles. On a Marantz portable cassette recorder, it works just fine feeding the mike input, but not the "phone" input. If you want to try such connections, you may have to experiment with various inputs and impedance matching networks before you get it to work. This plan constitutes another way to make it work by spending little or no money, and we all know that the station loves its engineers when they do that.

Cart Deck Delay Timer

By Bill Meyers - WBEZ
Chicago, Illinois
(312) 563-0487

Although most stations, today, are probably using electronic delay units for their talk shows, we've never had one; so we used the old "reel/reel tape delay" (two rack mounted machines and a tape loop). We found that the spacing between the recording machine and the "on-air" playback machine, happened to give us a six second delay. Since these machines were stereo, we decided to enable the program host (and guests) to remain on the air, even while a caller's audio was being "killed." This was accomplished by keeping the phone caller audio (only) on one channel, and all other program material on the second channel. These two channels were fed to a small mixer and then on to our transmitting system.

"Killing" the phone audio became a simple matter of applying a "short" (relay contact closure) across the output channel of the playback tape deck that contained the telephone audio, before it reached the mixer input.

We really wanted a controlled length of "kill" time, so that the operator was not forced to watch the clock while he held the relay contacts closed.

We selected a relay with the proper coil rating and connected it's coil in parallel with the solenoid of one of our system cart machines. The normally open relay contacts were wired across the phone caller's audio at the tape machine output, as mentioned above.

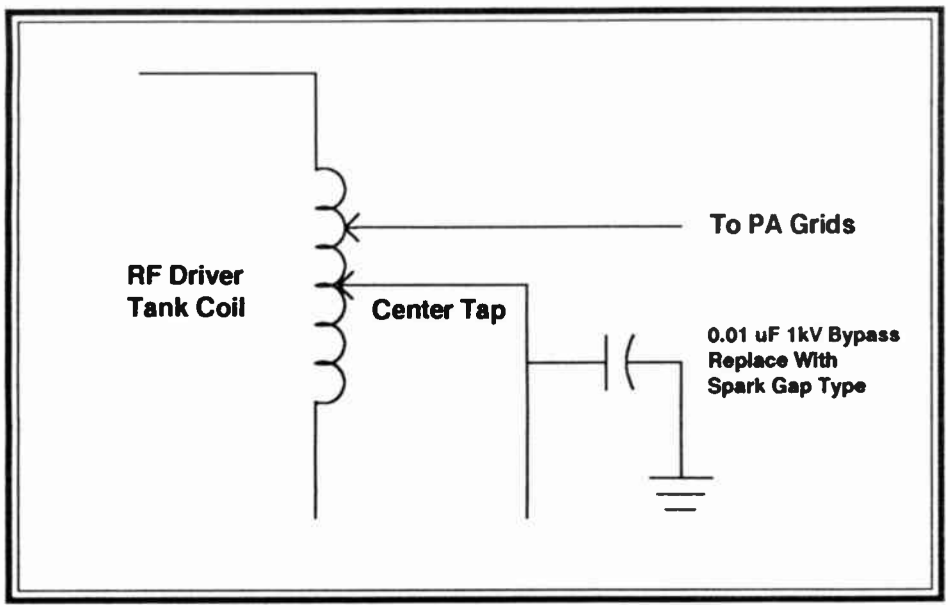
The cart machine was to be used for timing only, so a blank cart was selected. We recorded "stop tones" only, spaced 10 seconds apart. Now, simply starting the cart machine would remove the phone caller's audio from the air for 10 seconds, while our host and guests could still hear the callers remarks.

We also wanted to delegate the decision of "what to kill, and when" to the program host. We simply added a remote START pushbutton for the cart machine and placed it in front of the host and labeled it "KILL SWITCH" -- they loved it! It's a good idea to disable this remote switch during normal programming so that someone in the studio doesn't try to "find out what this switch does," thereby starting your cart (and your heart) by accident.

Harris/Gates BC1-T, G and H Transmitter Modifications

By Jim Alexander - Broadcast Engineering Services
Russellville, Arkansas
501-968-7270

The center-tap of the RF driver tank coil, in this series of similar transmitters, is by-passed to ground through a .01 uF, 1000 volt disc ceramic capacitor. This capacitor is prone to fail during thunderstorm activity, and I have seen a number of these transmitters with connections showing frequent replacement and/or replacement with a large surplus type mica capacitor.



I have, for years, replaced this capacitor with a Mallory AT103A. This unit consists of a .01 uF ceramic capacitor which features a built-in spark gap in a single package. This change will normally preclude further problems with the bypass capacitor.

Continental Gate Cards - Matched Caps

By Stephen R. Weber Jr.
Fresno, California

Recently, I was called on to diagnose and repair a 10 kW Continental at KOJY in Dinuba. It was randomly blowing out exciter and control supply fuses and tripping the main HV breaker. As you may guess, the problem turned out to be one of the gating cards. One of the 10 mFd caps tested about 3 mFd. We installed a re-built spare card and cured all symptoms.

If you maintain one of these transmitters, I highly recommend adding and inexpensive capacitor meter to your toolbox. Even one of the ones built into some of the new digital VOMs are good enough for this. Use this unit to periodically check the three capacitor pairs on the gating boards. Also use it to check any caps you may want to use for spares or replacements for these boards.

The important thing here, according to Continental, is the value MATCH of the caps in each of the pairs, more than their absolute value. They should always match within a few percent. "Shotgun" replacement with unmatched capacitors should thus be avoided, as randomly picked electrolytics, with the terrible tolerances they have, could create more problems than you had to start with.

If you opt to replace your gating cards with a set of the new generation "capacitorless" IC gating cards (which Continental now offers), beware of a possible problem. Before you install them, check to see that the cards you receive are made of the same thickness PC board material as your original cards! One of the three sent to KOJY was thinner than the others and refused to stay in the card edge-connector properly, when inserted. There may be more like this out there somewhere.

Almost A Nightmare

By Steve Griesbach - WOZZ-FM
New London, Wisconsin

Here at WOZZ-FM, in New London, we have a gates FM-3G transmitter operating at 3 kW on 93.5 mHz. It began in April of 1989, at the 4:50 a.m. sign-on.

Upon inspection of our transmitter logs, I noticed that we had been operating below power until about 10 a.m. After re-tuning the transmitter (too many times too count), it still didn't improve the operation. So I consulted with our corporate engineer, and told him of the the problem, and what had been done to try to correct it.

He came up to the station about mid May, and we began our hunt. We first checked all the connections to make sure they were tight. While doing that, we noticed some masking tape on the BNC connection on the coax coming out of the exciter. Why the masking tape was there, was beyond my knowledge. While inspecting the coax for breaks and cracks, he had noticed that this was not a typical 50-ohm cable; it was 75-ohm RG-59. We switched to the auxiliary exciter and replaced the cable. Before the cable was replaced, we had an exciter output of 6-8 Watts. After the cable was replaced, the exciter was delivering about 20 Watts to the transmitter.

Was the problem solved? That was the question in our minds. The only thing to do was wait and see. Upon inspection of the next day's log, the problem was solved, but a new one had appeared -- one that hadn't been there before we changed the cable. The output power was fluctuating all day long. It wasn't a normal fluctuation, since we had to raise or lower the power every 30 to 40 minutes. The big question was, now what!?!?

We re-tuned the transmitter once again, and it cured the problem for a day or so. During the next couple of weeks, I watched the RF INPUT level to our McMartin TBM-4500A mod monitor. As the days passed, the input was slowly fell each day. The first thing to cross my mind was, "Are we losing the final tube?" So, on Friday, June 3rd, I decided to try the spare final. After sign-off, I shut off the plate, but left the filaments on.

While the transmitter was cooling, I made a visual inspection of the transmitter cabinet. During this inspection, on the underside of the PA cabinet, I noticed a red glow and some sparking -- not good! I shut the filaments off and the glow disappeared. I took a small light and looked to see where this glow was coming from. I found it came from a buss bar that connects the filament transformer to the tube filament. The first things on my mind were a loose connection or a bad transformer.

On Saturday, we took the transmitter down at 1:00 p.m. and began our search. We checked all capacitors, and those were OK. Next we took the buss bar off; it was charred. We cleaned it off, and cleaned all the connections that the bar came in contact with. We replaced a wire going to the tube, because it was melted from the heat of the glowing buss bar.

After 6 hours of repairing and cleaning, we put the transmitter back together and fired it up. What do you know -- no more glowing buss bar. After a few days of watching the transmitter meters and inspecting the logs, the problem had finally been solved. Our output power and signal quality was better than ever.

Our guess was that this problem had been going on for a while (by the looks of the buss bar). The title says it all. It was almost a nightmare. If this had continued for any longer, we could have had a transmitter fire.

66-block Tip

By George Mimbs III - WIKS-FM
New Bern, North Carolina

If you're using or going to use a 66B style punch block for your station wiring, this hint may be of use.

Place the block on your copy machine and copy it! Then you've got a life size identifier for your wiring lists. You may want to enlarge it if your copy machine will do that.

Radio Guide

August, 1989 Volume 2 - Issue 8
Mail to: Radio Guide 511 18th Street SE
Rochester, MN 55904

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Equipment Guide

August 1989

Box 7001 Rochester, MN 55903 (507) 280-9668 Ray Topp - Editor

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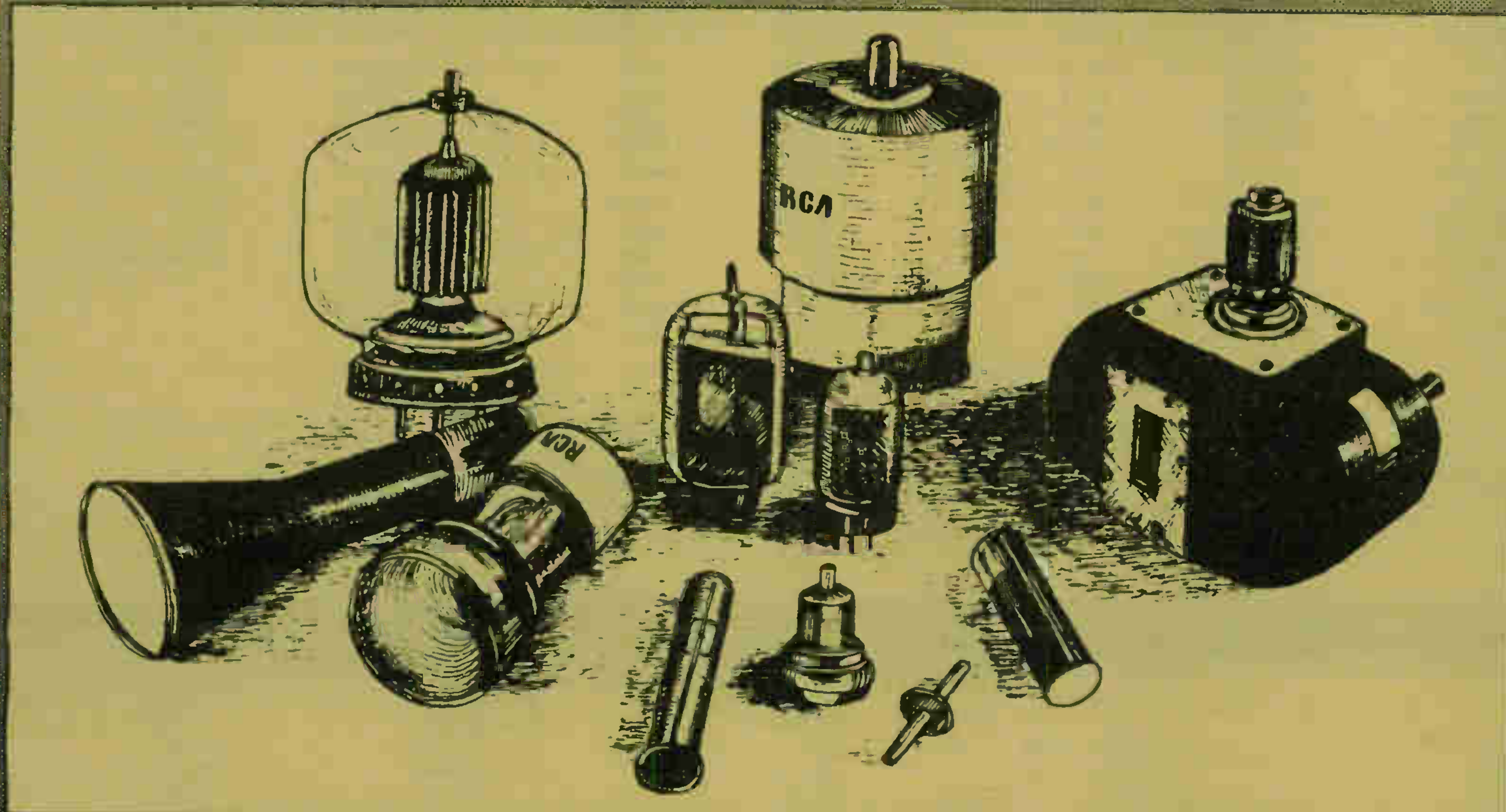

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3CX10000A7	1210.00	5619	1280.00	6423	1540.00	8461	6600.00
3CX15000A3	$1325.00	5658	$1725.00	6423F	$1450.00	8773A	$2970.00
3CX15000H3	1215.00	5667	1450.00	6424	1425.00	8795	6930.00
3CX15000A7	1320.00	5668	900.00	6425	1800.00	8990/4CX20000	1375.00
3CX20000A3	1590.00	5669	1400.00	6425F	1775.00		
3CX20000H3	1600.00	5681	5700.00	6426	1590.00		
3CX20000A7	1585.00	5682	5950.00	6427	2300.00		

Prices assume the return of a rebuildable dud. If a dud must be supplied from ARS, an additional 20% of the rebuilding price will be added to the price of the tube.

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2C39A	4-400C/6775	6BA6	813	5840	7558
2E26	4-1000A/8166	6BE6	872A	4876A	7580W
3-400Z	4CX250B/7203	6C4	4055	5886	7586
3-500Z	4CX250BC/8957	6CW4	4631S	5894	7587
3B28	4CX300A	6DJ8	4691	5902	7609
3CX1000A7	4CX350A/8321	6L6GC	4847	6005	7645
3CX1500A7/8877	4CX600J	6SN7GTB	5636	6012	7649
3CX2500A3/8161	4CX1000A/8168	6SL7GT	5639	6072A	7650
3CX2500F3/8251	4CX1500A	6V6GTA	5651	6080	7651
3CX2500H3	4CX1500B/8660	6X4	5654	6111	7801
3CX3000A1/8238	4CX3000A/8169	7C24/5762/7459	5670	6112	7895
3CX3000F1/8239	4CX5000A/8170	12AT7	5675	6136	7898
3CX3000A7	4CX10000D	12AU7A	5686	6146B	8106
3CX3000F7/8162	4CX1500A/8281	12AX7	5687	6201	8122
3CX5000A3	4CX20000A/8990	12AY7	5687WA	6205	8156
3CX5000H3	4CX35000C/8349	12BH7A	5702WA	6386	8791
3CX10000A1/8158	4X150A/7034	12BZ6	5702WB	6442	8792
3CX10000A3/8159	4X500A	25L6GT	5703WA	6688	8794
3CX10000H3	5CX1500A	25Z6GT	5703WB	6883B	8806
3CX10000A7/8160	5CX1500B	26C6	5718	6939	8807
3CX15000A3	5CX3000A	VA220 series	5719	7034	8890
3CX15000A7	5R4GB	VA221 series	5721	7059	8891
3CX15000H3	5U4GB	356/5771	5725	7060	8916
3CX20000A3	5Y3GT	Y572BAL	5726	7077	8976
3CX20000H3	6AK5	575A	5727	7167	8977
4-65A/8165	6AN5	673	5749	7289	8984
4-125A/4D21	6AQ5W/6005W	678	5750	7486	8986
4-250A/5D22	6AS7GA	810	5751	7543	8988
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4-65A	4-1000A	833A	2E26

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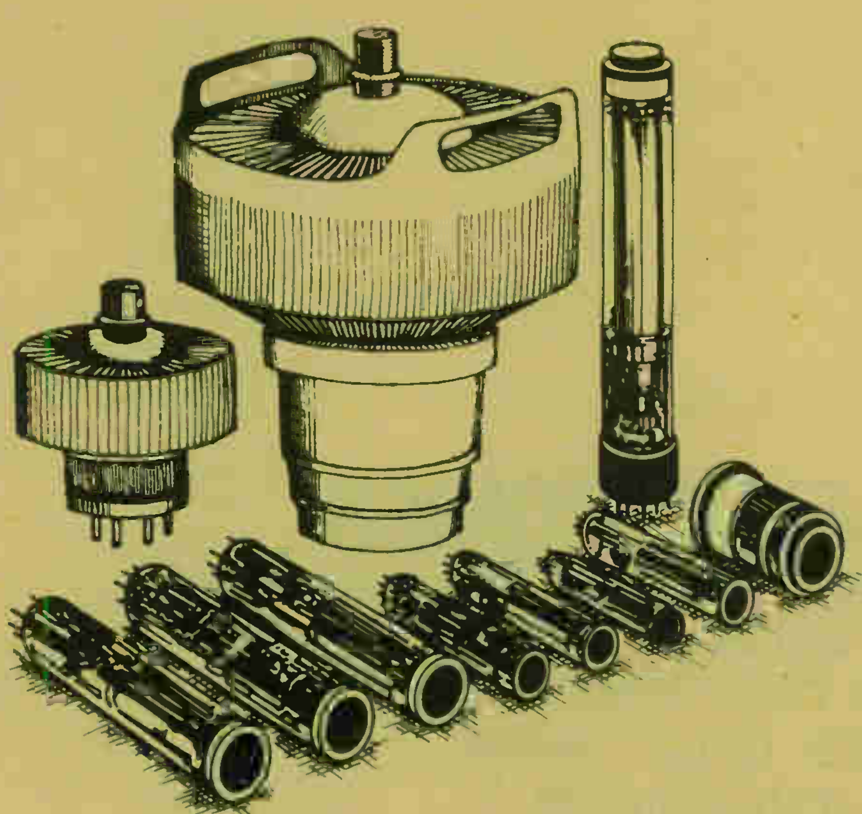
4389	BC4922B,G,R	P8132	P8436	P8497	XQ1413
BC4390B,G,R	BC4923B,G,R	P8133	P8438	P8498	XQ1415
BC4391B,G,R	BC4927B,G,R	P8135	P8452	P8499	XQ1427
BC4396	BC4937B,G,R	P8142	P8453	80XQZ	XQ2170
BC4532U	BC4992B,G,L,R	P8144	P8454	83XQ	XQ2175
BC4592B,G,R	BC4993R	P8146	P8455	XQ1020R,B,G,L	XQ2177
BC4593B,G,R	BC4994G,L,R	P8147	P8456	XQ1023	XQ3070
BC4594B,G,R,L	BC7735	P8148	P8457	XQ1025	XQ3075
BC4809B	BC8134B	P8160	P8460	XQ1070	XQ3077
BC4892B,G,R	BC8480	P8161	P8461	XQ1071	XQ3410
BC4893B,G,R	BC8507	P8199	P8462	XQ1073	XQ3415
BC4894B,G,R	BC8541	P8197	P8463	XQ1075	XQ3427
BC4908B,G,R	P8022	P8400	P8474	XQ1076	XQ4500
BC4909	P8024	P8401	P8490	XQ1080	



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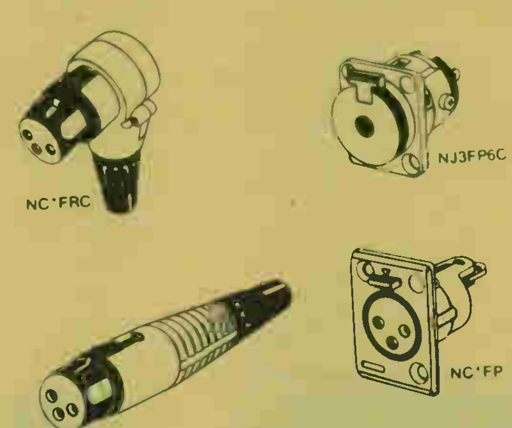

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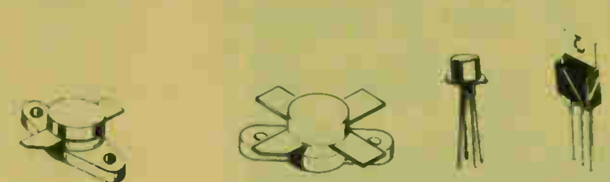

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BLW-75	MRF604	2N3839	2N5179	2N6304	2SC1970	1N82 "
BM80-12	MRF607	2N3866	2N5583	2N6305	2SC1971	1N358 "
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DME150	MRF628	2N3870	2N5641	2N6603	2SC2100	1N630 "
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MPSH-12	MRF641	2N3872	2N5643	2SC710	2SC2237	1N831 "
MRF212	MRF644	2N3873	2N5645	2SC730	2SC2290	1N832 "
MRF215	MRF646	2N3896	2N5646	2SC731	2SC2395	1N833 "
MRF216	MRF648	2N3897	2N5829	2SC908	2SC2420	1N1838 "
MRF221	MRF901	2N3898	2N5835	2SC994	2SC2494	1N3665 "
MRF222	S15-12	2N3899	2N5836	2SC998	2SC2509	1N4294 "
MRF223	S100-12	2N3902	2N5837	2SC1011	2SC2538	1N5719 "
MRF224	S30-28	2N3903	2N5841	2SC1120	2SC2539	
MRF237	S100-28	2N3924	2N5842	2SC1121	2SC2540	
MRF243	SD1013	2N3926	2N5847	2SC1122	2SC2630	
MRF245	SD1015	2N3927	2N5848	2SC1165	2SC2694	
MRF250	SD1019	2N3946	2N5849	2SC1176	2SC2695	
MRF250A	SD1077	2N3947	2N5862	2SC1177	2SC3103	
MRF260	SD1089	2N3948	2N5941	2SC1178	2SC3104	
MRF261	SD1098	2N3959	2N5943	2SC1239		
MRF262	SD1127	2N3960	2N5944	2SC1251		
MRF264	SD1141-1	2N4072	2N5945	2SC1306		
MRF315	SD1143	2N4073	2N5946	2SC1307		
MRF316	SD1144	2N4427	2N6080	2SC1314		
MRF321	SD1200	2N4428	2N6081	2SC1509		
MRF422	SD1201	2N4429	2N6082	2SC1589		
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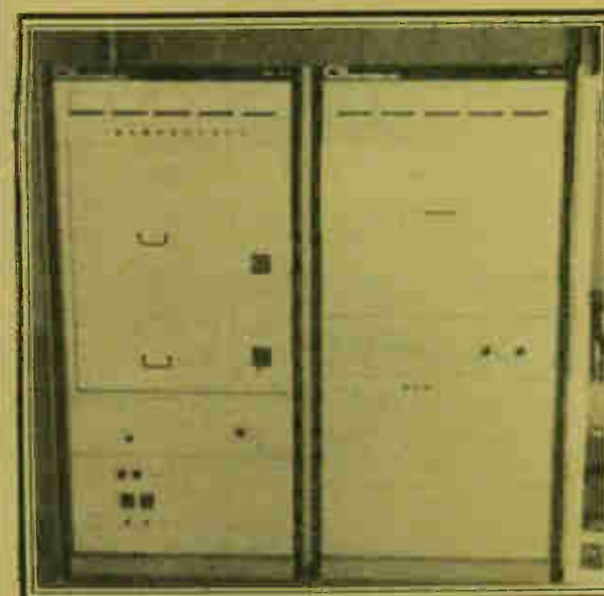

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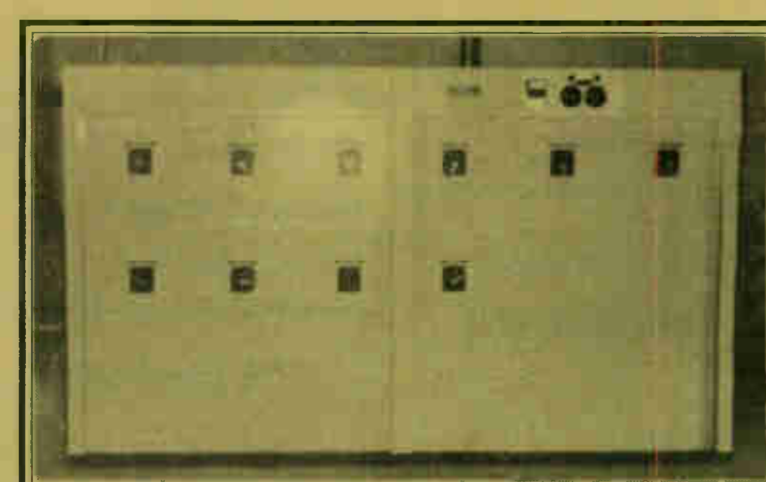

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