

PEASE PORRIDGE



BOB'S MAILBOX

Dear Bob:

I have two points to make here.

One: You are absolutely right about spreadsheets telling lies or extrapolating false information. There've been several times I've used a calculator to check values only to find formulae in error. Spreadsheets are great for displaying historical financial data, but when we use them to predict the future, we're in very deep trouble. Perhaps that's why we're in such a mess regarding the national debt.

Two: Tantalum capacitors in audio. Enclosed are data I ran after reading your article. My business is professional audio. I don't believe what I can't measure, but with tantalums the problems are pretty apparent.

Tweakish, molecular audio types are a real cash cow for consumer manufacturers. Fortunately, in the broadcast and recording field there are far fewer tweak heads requesting exotic wire. Keeping product on the air or the client working is the order of the day.

However, the distortion produced by capacitors and op amps is significant when you consider the hundreds in the signal path from microphone, console, recorder, mixer, CD master, CD player, etc. The average solid-state-logic brand recording console contains about 1500 NE5534's!

Mr. Kirkwood's curves show that if you let a tantalum capacitor get biased as much as 0.1 Vdc the wrong way, significant distortion can occur, both harmonic and intermodulation. This can occur with a signal as small as 2 V pk-pk at 20 Hz into a 10 μ F-10 k Ω high-pass network. You can avoid this distortion by applying a good dc bias to the tantalum capacitor. Or you can use an aluminum electrolytic, which gives less distortion in the same circuit.—Ed.

WAYNE KIRKWOOD
dba Media Technology
Dallas, Texas

I agree. If you know where to look, the errors are not unmeasurable.—RAP

Dear Bob:

After surviving a myriad of hiking and canoeing trips, it has become clear that a short checklist is best. This is especially true for "lug-it-yourself" trips in harsh terrain that last a week or two. Having said that, here are some unusual things from my two lists.

Do bring:

1) a Tyvek clean-room suit and booties for evening relaxation. These are great for mutant-mosquito infested areas like Alaska, Canada, or the Everglades; and they're also good as windbreakers. Don't forget netting headgear and some mosquito impermeable gloves (you won't need repellent).

2) two 3-ft.-long, 1/4-in.-diameter aluminum rods when hiking in desert areas. These can be attached with duct tape to your backpack frame and used as a shade support (bend to suit). Put that flap normally used for pack rain protection to good use and don't cook your head under a hat!

DON'T bring:

1) a Nerf football where marmots may be indigenous. They enjoy converting them into nesting material and aren't very concerned with the environmental impact of man-made material strewn everywhere. (They will also steal one smelly sneaker but invariably leave you the other one.)

2) more than five kohlrabi for personal consumption. Although they have a waxy skin that makes them last forever, you will get sick of them. I have placed kohlrabi out in the open at night but nothing seems to want to eat them. Put a kohlrabi in each sneaker and you may have an excellent repellent, but I won't guarantee it.

I'm also considering using the hollow space in the tubes of my backpack frame for regular or rechargeable batteries (perhaps with a small solar cell array for recharging?). You could power-up all sorts of accessories like a low wattage lamp, a radio, or an animal intrusion alarm. Oh, by the way, also bring several engineers on your trip

and you should have everything necessary for fun and survival!

PETER H. SAHM

Sr. Member of Technical Staff
Comlinear Corp.

Urbana, Ill.

Mr. Sahn: You say you prefer short lists? At least my list avoids Nerf footballs and kohlrabi: For Nicad recharging ideas, wait a couple months.—RAP

Dear Bob:

In response to your article, "What's All This Incandescent Stuff, Anyhow?," I am sending you a copy of the Engineering Specs from the Sylvania Miniature Lighting products handbook and catalogue. I have guarded this closely because of its contents which include: Theory of Radiation, Theory of Vision, Standards & Nomenclature, and Properties of Tungsten Filament Lamps. I have found this book very enlightening.

You have previously talked about measuring amplifiers and wanting to know how much "funny" they measured when they said their measurements looked "funny."

In your article, you said if you take a 115-V bulb and run it at 125 V your brightness is way up and the bulb life is way down. You also said that if you put a rectifier in series with the bulb, the bulb life is extended enormously.

In the catalogue, the nomograph on page 12 and the graph on page 15 show how much way up and way down and how much enormously.

For example, if you *increase* the voltage 20%, the current increases 10%, the candlepower increases to 190% (almost double), and the life expectancy goes down to about 12%. Likewise, if you *reduce* the voltage to 65%, the current drops to 78%, the candlepower drops to 23%, and the life expectancy goes to about 180 times the normal life of the bulb.

If you take this one step further and reduce the voltage to 50%, the current goes to 68%, the candlepower goes to

WAYNE KIRKWOOD
dba Media Technology
3102 Tennessee Avenue
Dallas, Texas 75224-3140
214-330-4464

Mr. Robert Pease
National Semiconductor
PO Box 58090
Santa Clara, California 95052-8090

14 September 1992

Bob;

Two points to make here.

One: You're absolutely right about spreadsheets telling lies or extrapolating false information. There've been several times I've used a calculator to check values only to find formulae in error!!! Spreadsheets are great for displaying historical financial data, but when we use them to predict the future we're in very deep trouble. Perhaps that's why we're in such a mess regarding the national debt.

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Thanks for the very entertaining feature in *Electronic Design*.

Sincerely;

Wayne Kirkwood
Wayne Kirkwood

P.S. THE VOLKSWAGONS ON THE DEAD CAR LIST YOU SENT ME AREN'T DEAD, THEY'RE JUST RESTING! - Outta Gas - outta spark
Fortunately, it's easy to keep 'em running

Dear Mr. Kirkwood,
Thanks for writing!
Good stuff. I've asked
Bob Milne to print a
lot of this.
Thank you!
[Signature]

I agree - if
you know
where to look,
the errors
are NOT
unmeasurable!

But in most
audio channels, does the
audio go through more than
4 or 5 gain blocks??
You tell me

Alloillayne

WAYNE KIRKWOOD
dba Media Technology
3102 Tennessee Avenue
Dallas, Texas 75224-3140
214-330-4464

Mr. Robert Pease
National Semiconductor
PO Box 58090
Santa Clara, California 95052-8090

16 October 1992

Bob;

Thanks for your reply to my letter. I apologize for not getting back to you sooner. Business is good!

Thank you for the clues!

All distortion measurements were made at 20 Hz. The biased capacitor scheme works very well; I've not tested it for use with tantalums because they are not only horribly sounding, but very expensive as well in large values. With aluminum capacitors the distortion is already pretty low.

SSL does not consistently use this scheme, but you'll see it, or variations of it, in some of the enclosed prints.

Levels in consumer audio gear are higher than you might think. Most CD's are recorded with "0 VU" (as read on an averaging meter) about -12db below digital full scale to provide headroom. If the player's "0 VU" output reference is specified to be 0.5V rms, then peaks could be as high as 5.6 volts (peak to peak) at digital full scale. CD's have amazing dynamic range.

In regard to professional audio production there are a lot more gain blocks (and peak level) in the signal path than you might think. Enclosed are schematics for some blocks of the SSL console and Otari MTR-90 analog multitrack recorder for your amusement.

Op Amps	Path
41	Microphone To Multitrack Tape Head
26	From Multitrack to Mix Buss
7	Console Mix Buss to 2 Track Input
7	2 Track Recorder Input to Head
11	2 Track Head to Recorder Output
==	
92	Op Amps from Mic to Master Tape!

of course - believe it - and the opamp are not even the biggest source of noise!

(2 Track and Mix Buss Prints not enclosed)

There are approximately 92 op amps per audio channel! There are 24 tracks on the multitrack (instruments) all combined on the 2 track master to produce the tape used to make the CD. All production elements making it to the 2 track combined go through about 2200 gain blocks! (Some of the gain blocks are used twice, once for cutting, and again in

mixdown). Audio goes through a lot of caps too. No wonder why SSL is one of the largest customers Signetics has for NE5534's!

I service a lot of older gear; my largest selling parts, item are electrolytic caps. After about ten years, or more if its hot, the caps dry out. Place a cap near an Exar or TI NE5532 and its toast in about 3-4 years. (By the way, Raytheon makes horrible 5534's.)

Went to a Volkswagon race the other day. I've never seen a Bug go 160 mph before. Quite special to see. They rebuild the engines after every race!

By the way, when Washington says revenue enhancement, you can bet some spreadsheet numbers are being fudged. Compounded projections are a very dangerous thing.

Looking forward to corresponding with you in the future.

Sincerely;

Wayne Kirkwood

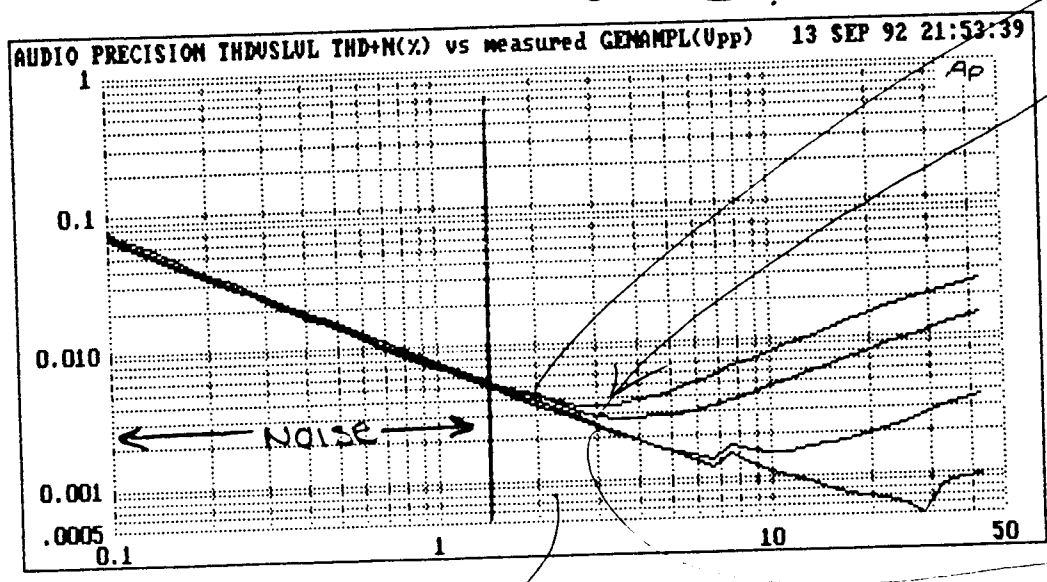
✓
✓
✓
(?)

good
point!

Robbits &
Presume?
You can get an
old Formula Vee
up a lot better
than they were
always called for
acceleration, not
top-end speed.

P.S. you
said
that pramp
was dumb

20 Hz!

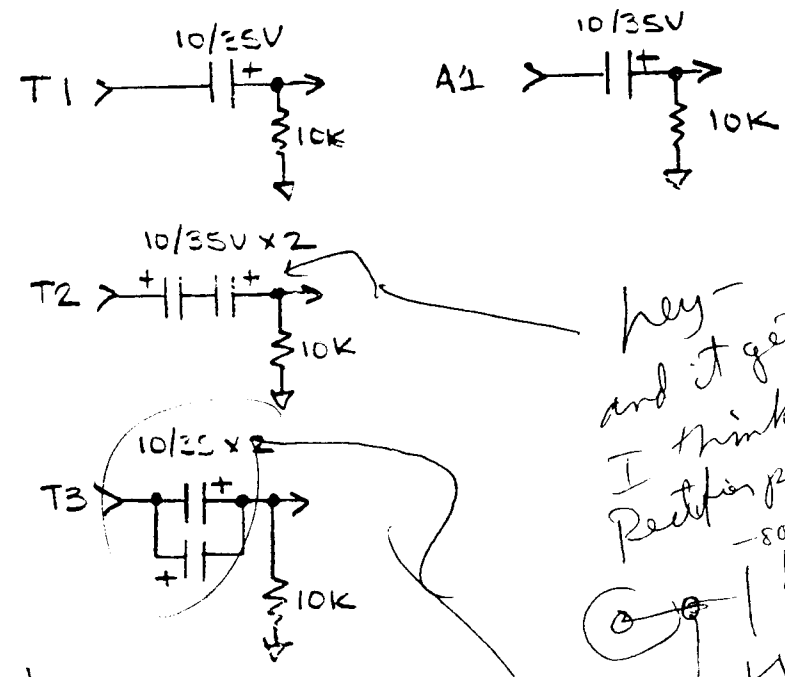


T1
T2
T3
A1

this is pretty low distortion, 0.003%

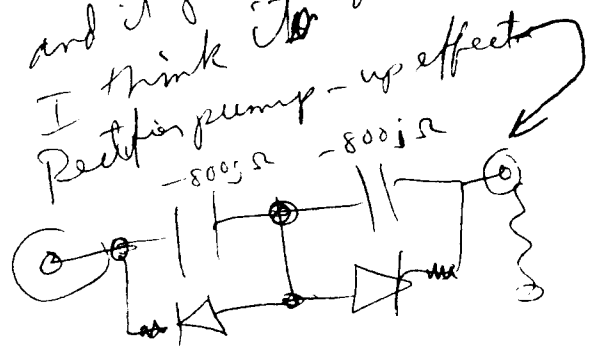
TANTALUM

ALUMINUM



I might not be able to hear any difference at 0.003% distortion, but I surely could not say that nobody can hear this!!

hey - this is 5uF - and it gets better - I think it's due to the Rectifier pump-up effect

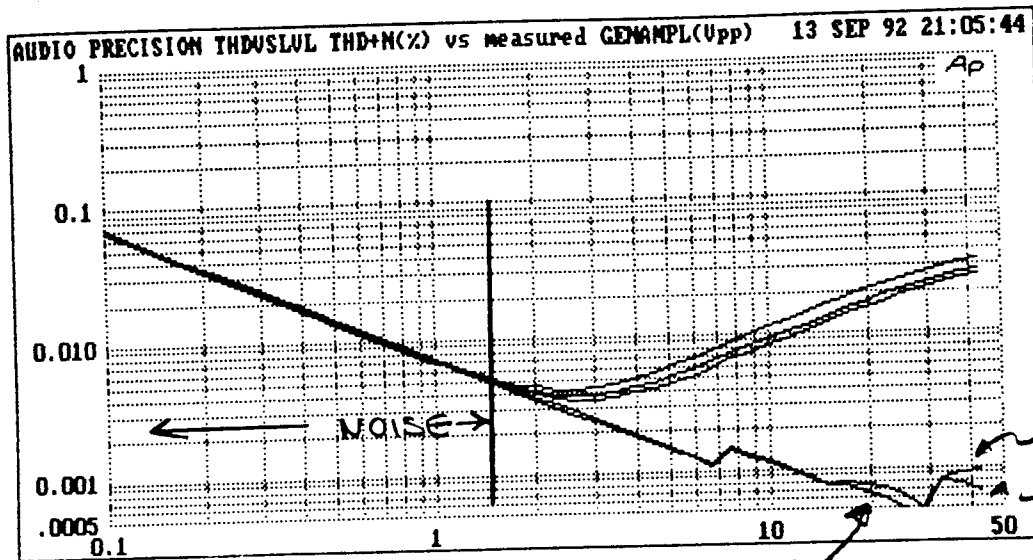


40Vp-p \approx +24 dBu
 \checkmark (C dEU \approx .775 VRMS)

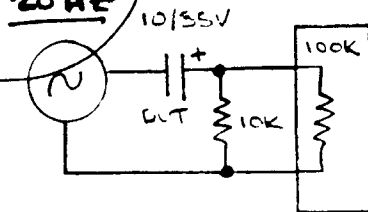
hey, this is 20uF - and it gets better, too!

Note
 10uF & 10K gives a 1.6 Hz corner for a 5° phase error @ 20 Hz. This is normally safe & conservative...

THESE HIGH LEVELS ARE TYPICAL IN PROFESSIONAL AUDIO - but not for general audio work



ANALYSER (ECK EW)



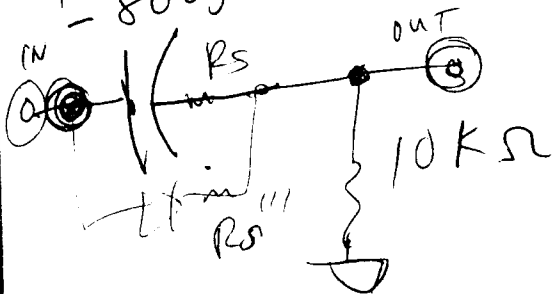
TEST CIRCUIT FOR ABOVE. CAP IS REVERSE POLARISED DURING NEGATIVE PEAKS. True, and more than 1/4 volt is excessive.

THIS CONFIGURATION IS USED IN THE CCG CONSOLE; V+ IS DECOUPLED FROM THE CHASSIS RAILS.

good

This is all at 20 Hz?

Then we have - 8005 Ω



Q. = When you do that, does the distortion go away? Shrink rapidly?