FEEDBACK

FREQUENCY ALLOCATIONS

I was rather alarmed to note from the wallchart of frequency allocations provided with your June edition that it is proposed to move the 200 kHz BBC Droitwich Service to 198 on 1st February, 1988.

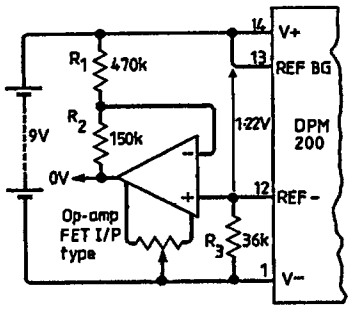
Many people like myself use off-air frequency standards based on the 200 kHz transmission, and these devices will become useless in 1988. I really wonder if the decision to move from 200 kHz has taken the widespread use of the transmission as a frequency standard into account.

H.D. Ford,
Richmond,
Surrey.

ALTIMETER

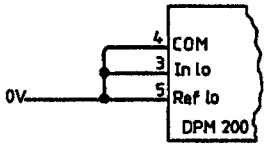
I read with interest Mr F. Ogden's altimeter article (June, 1986) in which he uses one of our DPM 200 panel meters. I would like to make some comments which may be of interest.

The temperature-stable supply can be improved by using the redundant band-gap reference diode on the meter. This device has a temperature coefficient of typically 50ppm/°C. Fig. 1 shows such an application.



The voltage between Ref BG and Ref− is 1.22V nominal. Resistors R_1 and R_2 should be low-drift types. The advantage of this circuit is that it avoids the temperature coefficient of D_5 and the V_{be} and H_{fe} coefficient of the BC212 transistor.

My second comment refers to the analogue inputs of the meter. The ground of the analogue section is COM (Pin 4). This is held by the meter at approximately 2.7 volts below V+. The common-mode rejection ratio of the inputs is 86dB (or 50μV per volt of common-mode voltage.) With In Lo at 5V below V+ there will exist 2.3V of common mode. This can cause 100μV or one count offset. To remove this, simply connect COM to 0V as in Fig. 2.



Although COM will sink a large amount of current to maintain its level below V+, it cannot source more than 10-20μA and can easily be pulled down to the lower potential.

My final comment concerns the use of silicone grease. Avoid grease coming into contact with the l.c.d., especially the conductive rubber connectors inside, as this may cause open circuits and thus missing segments.

Simon Wyre,
Technical Manager,
Lascar Electronics.

The author replies:

Mr Wyre's comments are most helpful. I fully endorse the circuit changes he suggests but would add that the slight improvement in temperature stability they produce is less than the inherent errors of silicon pressure transducers: hysteresis, scaling error, etc. This means that if you've built the original, there is little point in changing anything.

The point about silicone grease hadn't occurred to me. I used the heavy heatsink type which doesn't migrate. Silicone sprays might well give trouble.

BBC CUTBACKS

The silly season in the BBC seems to have started earlier than usual. In recent weeks there have been advertisements in the trade and national press for technical operators in the BBC's Engineering Department: recruitment is being done by an independent consultancy. At the same time this union is negotiating with the BBC on the Corporation's "priorities for the future" proposals. Those proposals, as originally tabled, included the decimation of the BBC's engineering specialists departments, the abolition of consultancy and cut backs in its central appointments and publicity departments. Substantial opposition to these proposals by this union means that the BBC have been forced to rethink their cuts strategy and as yet there have been no compulsory redundancies in the engineering specialists. However the future for at least 60 staff is still not secure. It is nonsensical that an organisation seeking to make cuts on the grounds of so-called efficiency should be negotiating post closures and voluntary redundancies at the same time as it seeks to recruit new staff.

Laura Vincent,
Asst. General Secretary,
Broadcasting and Entertainment Trades Alliance

XY PLOTTER

J. Jardine in his letter in May 1986 gives a line generation program for the XY plotter previously featured in this magazine.

If the motor control circuitry were to allow simultaneous movements in both X and Y directions, then we would have four possible diagonal movements as well as the four axial ones. Thus a combination of axial and diagonal steps would give a closer approximation to the true line.

I reproduce below another method of generating the next best step when plotting a straight line on a device capable of diagonal motion. It has the advantage of being more efficient than the previous method (a factor of |3 in Basic) and is very amenable to conversion to machine code. The program shown works in the first octant and outputs an 'A' when the next step is axial and 'D' when it is diagonal.

```
10 INPUT "INPUT X"; A
20 INPUT "INPUT Y"; B
30 S = -A
40 BMA2 = B-A+B-A : B2 = B+B
50 FOR I = 1 TO A
60 IF S < 0 THEN INC = B2 :
PRINT "A"; ELSE INC = BMA2
: PRINT "D";
70 S = S+INC
80 NEXT
```

I claim no credit for the method used; it is actually based on the Bresenham line generation algorithm[1] which has been around since 1965 and has been used by many commercially produced plotting devices. It is of course well suited to raster devices as well as incremental plotters.

Reference.

1. *IBM Systems Journal*, Vol. 4, No 1, 1965.

M. Eggleston,
University of Leeds

RELATIVITY

Professor Butterfield's analogy explaining time dilation (June issue) neglects the force accelerating the clock balance wheel round. If this were to decrease as $f = f \times (1-v^2/c^2)^{1/2}$ the clock would mark the table along which it travels at intervals predicted by $t = t/(1-v^2/c^2)^{1/2}$. An observer of these marks assumes that time dilates for an accelerated observer, when in fact clock rotation had slowed down for all observers, accelerated or not. Of course, Professor Butterfield will argue that table recoil due to its acceleration of the clock indicates an increase of mass; therefore a variable force with velocity cannot be true. In reality, as opposed to analogy, the table is an electron accelerator 1 mile long and rather massive regarding a relativistic recoil of 40 000 electron rest mass. It hardly moves at all, while electrons accelerate to velocity: thus ambiguous equations describe experimental effects. The best example of a velocity-dependent force is the precession of the DI Herculis orbits. Multiply the predicted result by a reciprocal of the "discrepancy" and you get the observed result (*New Scientist* 29 August 1985 "Double-star system defies relativity"). These stars have nearly equal mass, therefore transfer detectable relativistic mass, if any, one to the other. Apparently there is none by an

exact amount namely (2.34° + 1.93°) × 0.15 = 0.64°.

Michael Dobson,
Hampton,
Middlesex.

Professor Butterfield has set himself an impossible task. Relativity cannot be simplified; one of its basic postulates is wrong!

This wrong postulate (that the speed of light is the same to all Toms, Dicks and Harrys) leads to a famous but wrong conclusion that mass is energy.

Why, then, does Professor Butterfield *begin* his article with this crazy conclusion? By working backwards, you merely end up with Einstein's wrong postulate!

Physicists have had their minds boggled for decades by Einstein's nonsense; it's high time for de-boggling! It's bad enough having the old, old story of Einstein's nonsense dished out to us, forward-wise. Please don't give us the old, old story backwards.

A.H. Winterflood,
Muswell Hill,
London, N10.

Ezekiel had a vision of wheels arguing circularly around an axle of *presumption*, and so do I. Inertia is a quality of mass which prevents instantaneous change and causes it to happen through time.

Is it then a reasonable proposition to combine trad Newton with a new law that energy has inertia mass, and then to derive a spatially distributed single event which must be inertial mass?

Sorry, Prof.: back to the drawing board and invent the LSM, but please remember that you were not the first because it inhabits the space which Albert could not conceive to be empty.

While you are busy, accept the fact that we do not see what happens, but rather see a distorted vision of what happens which our dirty great egos *presume* to be the truth. When things move extremely quickly, the quickness of the hand deceives the eye and any other massive sensor.

Nor, Mr Burniston Brown, do I like Sachs' belief that Albert changed his mind: further evolution of the thing changed *him*. That is why I like Albert: he demonstrated an active intelligence.

James A. MacHarg,
Wooler,
Northumberland.

ELECTROLYTICS

I would like to answer both Mr Self and Mr Hall in order to remove any confusion about the capacitor test referred to in my previous letter. First, Mr. Hall is correct in asserting that the test is primarily measuring linear distortion. I have found the magnitude of the linear distortion in an electrolytic capacitor to be typically 500 times larger than the harmonic distortion measured under similar conditions. Should we just ignore the linear component, or should we at least consider it as a potential aberration that deserves closer scrutiny?

Mr Self's allegation that what is primarily measured in the capacitor differential test is due to film breakdown is inaccurate, as he is referring to non-linear distortion. It can also be shown that d.c. biasing a polar aluminium capacitor will not improve its measurement in this test.

Dielectric absorption (d.a.) in a capacitor can be simulated by adding parallel branches of series RC components[3]. This extended capacitor model can be shown to closely approximate the actual dielectric absorption. Therefore, one can add the appropriate RC branches to a nearly ideal capacitor and obtain an almost complete null when paired against a typical electrolytic capacitor in the differential capacitor test. Alternatively, in a computer simulation of the different capacitor test, one can model a non-ideal capacitor (with d.a.), paired against an ideal capacitor, and note the similarity of the output waveform to what is typically measured with the differential capacitor tester.

In conclusion, I again invite those who are interested, to try the test themselves. There is much more to be learnt about capacitor differences than has been published thus far. I still recommend the AD524 or equivalent IN-AMP for serious measurements in order to head off any potential criticism of measurement accuracy.

John Curl,
Lineage Corporation,
New York,
USA.

References

1. J.J. Curl, *WW*, "Letters", Nov., 1985
2. W. Jung and J. Curl, "If the Cap Fits", *Hi-Fi NEWS & Record Review*, April, 1986
3. R.A. Pease, National Semiconductor Corp., "Understand capacitor soakage to optimize analog systems", *EDN* Oct., 13, 1982.

I am sorry to have to disagree with Ben Duncan in public as I usually find his writings most entertaining. However, I found his views on The Great Capacitor Crisis more than a little obscure, and I fail to see how any of his points clarify the vexed question of whether or not a capacitor in normal audio use can cause audible problems.

It is obviously true that music signals are made up of harmonics, but these are in themselves sinusoidal, because that is how Fourier transforms work. Fourier transforms work that way because they are a mathematical expression of the behaviour of things in the real world. How Mr Duncan takes the next step in his reasoning, which is to say that musical waveforms are therefore accompanied by a varying d.c. component, I do not understand. No one denies that real waveforms are often markedly assymmetrical, but this is an assymmetry of the peak value of the signal, which is why professional peak–reading level meters invariably use full-wave rectification. The positive and negative peaks can vary by 8dB or more, particularly on speech. However, this has *nothing whatsoever* to do with the mean level of the signal, which almost by definition is centred on zero volts. This is always the case, unless a d.c. error exists in the circuitry, or some sort of really gross slew limiting, clipping, or suchlike is taking place.

A moment's thought will show that this must be true, because the bandwidth of the audio chain does not reach down to d.c. I submit that the barometic pressure in the recording studio is not a parameter that needs to be reproduced for the best subjective effect. In reality any acoustic signal will lose its d.c. level on encountering either the microphone, the guitar pickup, the tape machine, or the phono cartridge, all of which are quite incapable of passing on d.c. levels. As for the ill-fated bass driver, I suggest that simply excessive level or an amplifier d.c. fault accounts for its demise. Occam's razor is still as sharp as it ever was.

I resignedly repeat I accept that some capacitors, such as electrolytics, object strongly to having voltage changes impressed on them. In fact I demonstrated it myself in a previous letter,[1] though I pointed out at the time that the effect would never intrude on a properly designed circuit. I much appreciate Mr Duncan's invitation to 'offer my skills to the work' but I thought I already had, even if the results were not convenient for everyone; I do wish that someone else would join in on the problem from the measurement side. In fact, I suggest it is up to Mr. Duncan to show us exactly how his mysterious d.c. waverings are generated, specifying circuitry that does it and showing us diagrams of the relevant waveforms.

As for Mr Curl's capacitor tester, once again there seems to be a logical step missing. Nobody would deny that all capacitors possess series resistance and leakage to some degree, but the question is, how does this affect signals passing through it? The subjective effect has often been described, though sadly the reports contradict each other. Sometimes it is called 'compression', sometimes a 'a delayed echo of the original signal'. In no case can anyone provide a model of how such effects could be induced by any amount of e.s.r. or other defect. I can only hope that someone will produce an objectively testable hypothesis, so that the matter can be laid to a well-earned rest one way or the other.

Finally, back to the furtive practice of gold flashing. If I interpret Mr Duncan's position on this one correctly, it is that non-noble contacts suffer a sort of continuous high-speed unreliability of connection, rather like drop-outs on poor quality tape. This one can surely be simply checked with a storage oscilloscope; I could find no trace of such an effect with the grottiest connectors I could lay my hands on. For readers having a distortion analyser handy, it is instructive to try all sorts of duff contacts in an attempt to induce even tiny levels of distortion into the signal. It is quite surprisingly difficult. Am I really the only one that actually tries this sort of thing, as opposed to theorising about it?

D.R.G. Self,
Bow,
London E3.

Reference

1. Self, D. 'Feedback', *Wireless World*, February 1986, p43.