seems to be the simplest answer to that problem. The pot. could, of course, be replaced by a switch and resistors, giving, say, 2dB steps. Where in the spectrum do you think the "geometric mean of corner frequencies" should be placed? Clearly this involves cabinet dimensions etc.

Also, what f_o and Q should the bandwidth-limiting LPF be given? One of your sketches, dated 30/4/82, gives its f_o as 15221Hz, but how this magic figure was obtained I've no idea!

While mentioning things that puzzle me, I may also say that the transfer functions on the system-sketch you gave me on my Feb 1983 visit are totally baffling and incomprehensible to me! I didn't look at them carefully enough when I was in your office, and hadn't noticed the mysterious quantity "E" in them. It seems to me that a second-order LPF, for example, of S & K type, having unity gain at ZF, must have a transfer function, using s rather than my preferred p, of

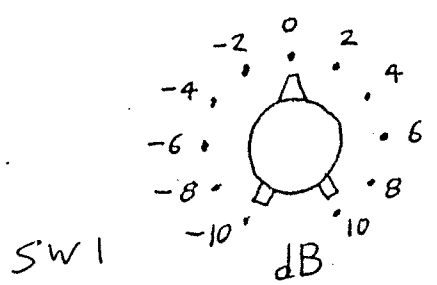
$$\frac{1}{1 + \frac{sT}{Q} + s^2T^2}$$

though, since $T = 1/\omega_o$, some people prefer to write it as

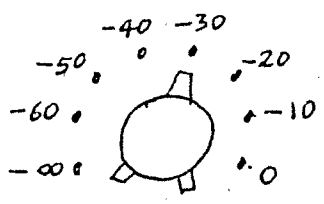
$$\frac{\omega_o^2}{\omega_o^2 + \frac{\omega_o}{Q}s + s^2}$$

But what on earth is E?!

I tried today to solve the remaining part of the design, i.e. the input amplifier. A much more difficult problem than I had thought - I've had many thoughts but havn't yet managed to end up with an arrangement that seems fully satisfactory from all points of view. As far as the gain-setting controls are concerned, I've considered the arrangement on the B & K Measuring Amplifier you mentioned, but the CAL position of the fine control on this is ACW, fo minimum fine gain, and the UNCAL positions give extra gain above the CAL values. But if we had a "volume control knob on our system, the CAL position would be required to be fully CW, the knob permitting one to turn the gain down to zero in the event of external faults etc. But one can't ge volume controls, I think, with a switch operating at the fully CW position, to extinguish the UNCAL LED. Thoughts a the moment tend to favour two switched controls as sketched below:-



SW1



SW2

system gain

(0dB = 0·774V rms input

Deciding on the associated circuitry is quite a problem, for the following notions are involved:-

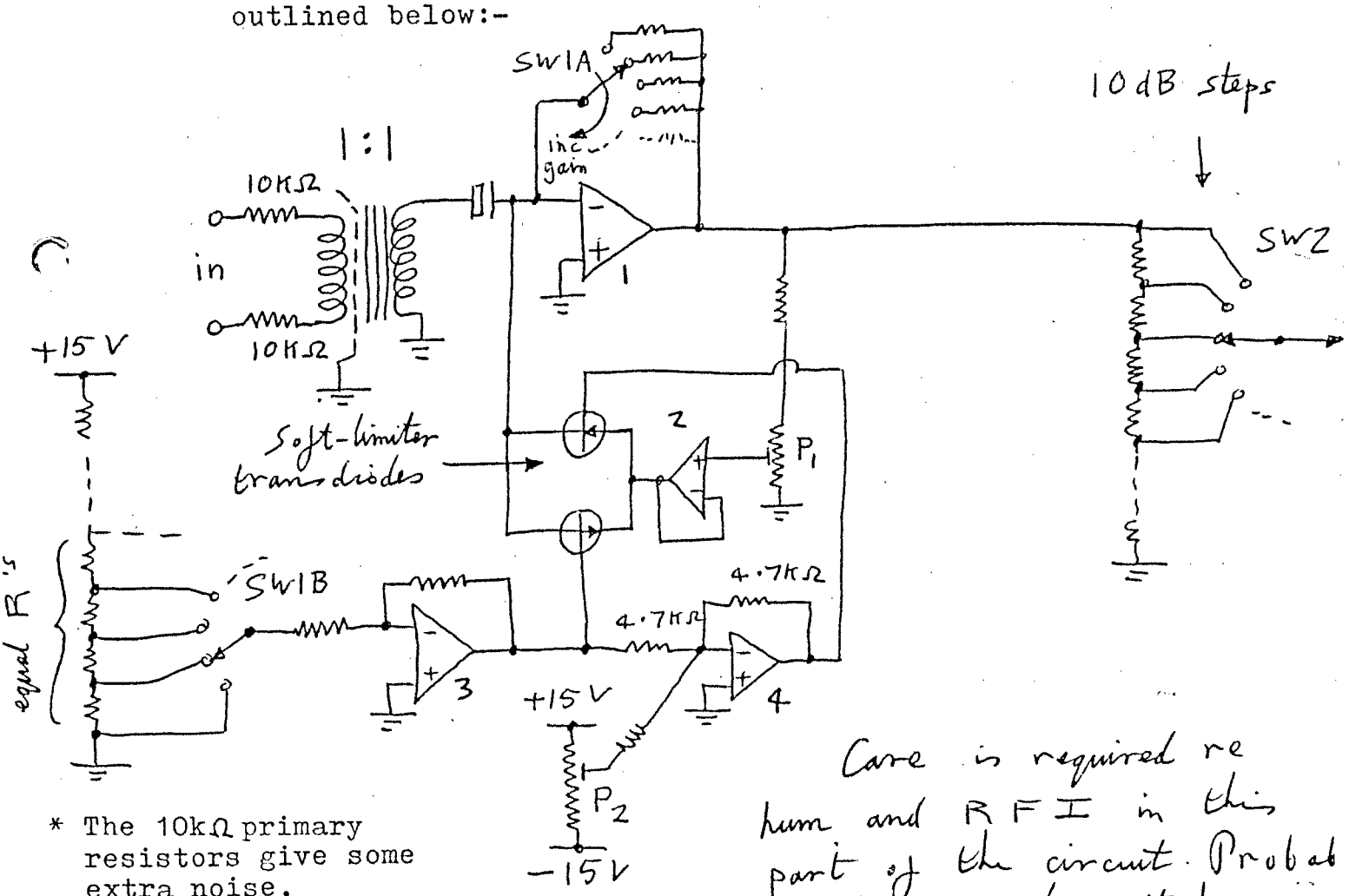
(a) There is much to be said for feeding the transformer secondary to a virtual earth, since this greatly reduces the transformer distortion and permits the use of a smaller and cheaper and easier-to-design transformer.*

(b) It would be possible to eliminate the transformer altogether and use an electronically-balanced input arrangement. Worth careful consideration.

(c) It is necessary to involve soft-limiting considerations right from the beginning of the design - one cannot necessarily add soft-limiting satisfactorily as an afterthought to an existing design. The parts of the circuit preceding the soft limiter have got to be able to handle signal levels much greater than the level that would give full output without the soft limiter. If a circuit is designed without thought for soft limiting, it may not be able to cope with this requirement, at least at some gain settings, if later adapted to give soft limiting. Retaining optimum noise performance is closely involved in all this.

(d) BBC may be keen that the input impedance of the system should remain $>20k\Omega$ <u>even if the mains is not switched on</u>. Then it can be left shunted across any signal line in general use with impunity. Any comments?

Though I haven't yet clarified all my ideas, I am thinking at the moment of something along the lines very roughly outlined below:-



* The 10kΩ primary resistors give some extra noise, however.

Care is required re hum and RFI in this part of the circuit. Probably best put in die-cast box.

The softness of limiting is adjustable by P1, P2 then being set to make the peak limited output voltage be such as just not to make the 405's clip. The SW1B scheme is necessary to ensure that the limiting characteristic obtained is independent of the value of feedback resistor switched in by SW1A.

There is a feedback stability problem since the gain round the loop involving the transistors and op. amps. 1 and 2 is very large. This is easily dealt with, however - I had the same problem in designing logarithmic amplifiers at RRE.

A complicating thought in all this, tending to throw it all in the melting pot again, is that perhaps we should have three soft limiters - LF, MF and HF? Indeed, for optimum performanc we must do. Owing to the crossover characteristics, and maybe slightly different settings of the three preset pots feeding the 405's, it does not follow that the peak instantaneous voltage at the input to the crossover system at which one or other of the 405's clips, isindependent of frequency and/or waveform shape.

If we go to three soft limiters, maybe the present proposed ma input level to the Quads of 2V rms is too high to ensure sufficient pre-soft-limiter headroom?

Thus, as you will see, I am finding it quite a problem and don feel to have satisfactorily solved it as an entity yet.

When the enemy from Sony has retreated, I will get back to all this with enthusiasm!

With best wishes,

Peter

PS Squared paper graph sheet dated 2/4/83 is also enclosed. This shows that the choice of preset pot. value in relation to the resistor values in the x(-1) circuit has been carefully made to give a gentle linear-in-dB's slope near max gain, but permit the gain of one channel to be reduced to zero, which could be useful during checking, testing and setting-up procedures.