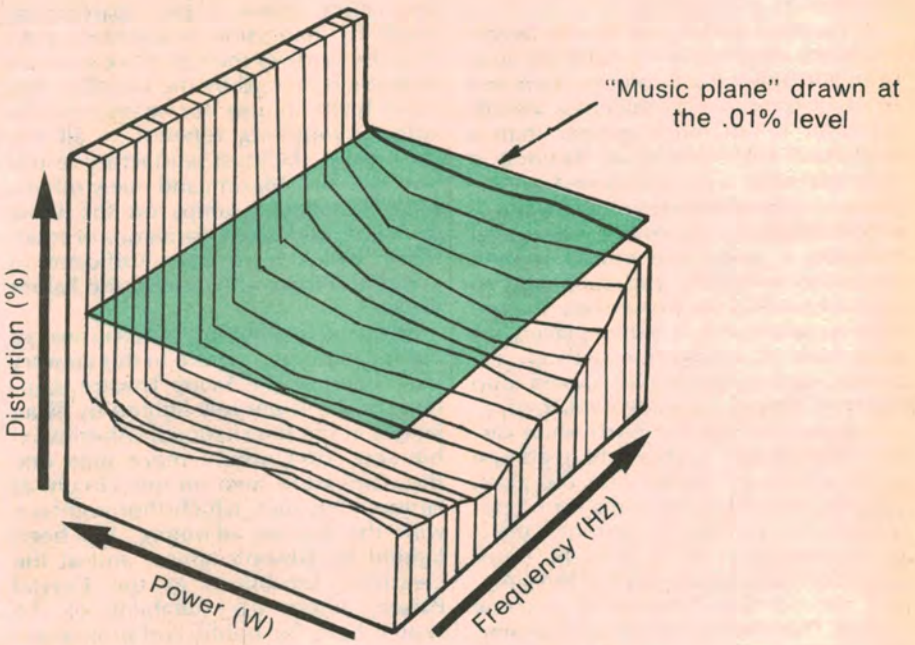
# 3DA What the term signifies

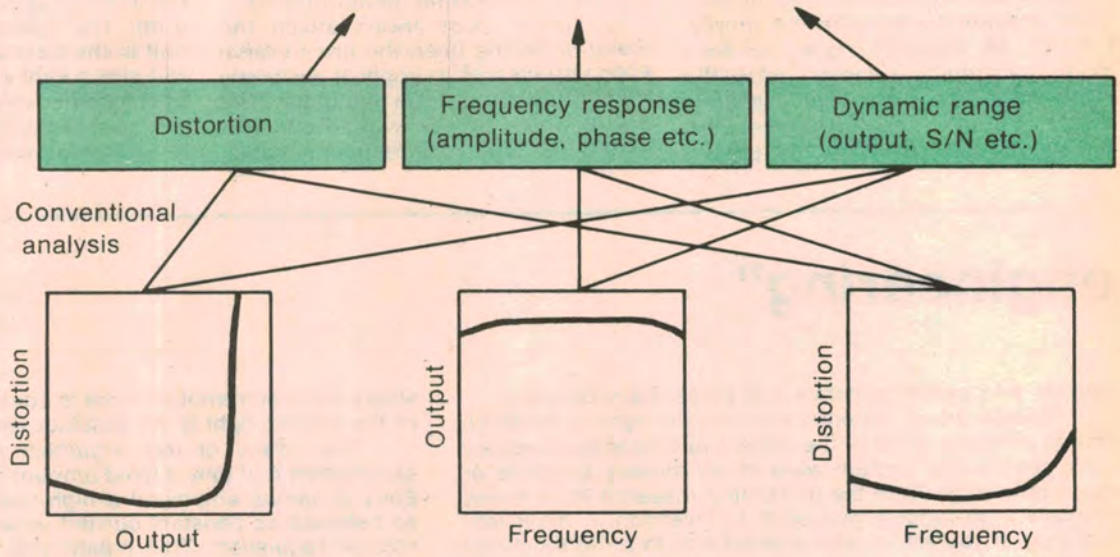
**If you've been thumbing through Technics literature of late, you may well have come across the term "3DA". If you've been wondering what it's all about, the following explanation may help.**




**by NEVILLE WILLIAMS**

While hifi manufacturers are relying as much as ever on cosmetics and gimmicks to sell their latest products over recent years they have had to back their marketing ploys with an intense engineering effort covering initial design, quality control and performance testing.

In the process, they have had to go far beyond traditional audio instrumentation and techniques in an effort to convince would-be customers that their latest amplifier (or other device) will perform as impeccably on actual music as it appears to do on instrument-generated signals.




*When amplifier parameters are plotted separately (bottom curves) it is difficult to see exactly how they interrelate over the whole dynamic area. The problem is overcome by bringing them together in a pseudo 3D plot.*

Facing heavy competition, most major manufacturers have up-graded their designs and procedures along parallel lines. The relative importance of the various refinements is open to some debate but, certainly, little is being left to chance in amplifier design at least.

It is one thing, of course, to perform a lot of tests; it is quite another to present the information in a way which will be comprehensible and convincing to hifi dealers and the buying public. Tables of data can too readily dissolve into a blur of figures, while multiple graphs are quite daunting to those not accustomed to them.

That's where Technics' concept may well score.

Looking at multiple graphs, intended to correlate power output, frequency response and distortion, Technics engineers realised that they could be combined into a single simulated three-dimensional presentation, with the aid of modern computer graphics techniques. As such, they would be seen by the viewer as a shape or a contour, and interpreted as being generally good, bad or indifferent.

So, in collaboration with the Hewlett-Packard Corporation, Technics engineers devised a system which would accept data from an amplifier test set-up (including a spectrum analyser) and plot a "3D" diagram correlating vital parameters:

- Power output from 200 milliwatts to above the rated figure;
- Frequency response from 10Hz to 100kHz;
- Distortion above 0.0001%, involving components to 1MHz.

A rack full of equipment is involved plus a graphics display unit and a hard printer. During the course of one run, some 4000 reference points are taken, each representing a particular combination of frequency, power level and distortion.

A typical "3DA" plot is shown in the accompanying diagram. With it, engineers had a graph which they could read in as much detail as they might require; sales-technical staff had a diagram which they could explain readily enough to would-be customers; and copywriters had a term which offered just about the right amount of mystique!

In explaining the diagram, Technics engineers point to zone A, which shows low distortion at the lowest frequencies over the whole power range — a tribute to power supply design and to the use of DC coupling wherever possible.

Zone B, with low THD (total harmonic distortion) over the frequency range, with very low output, is only possible because of good signal/noise ratio.

The smooth characteristics in zone C indicate freedom from spurious coupling at high frequency and high power levels, while sustained power and low distortion at extreme frequencies mean that there are negligible slew rate limitations.

But, in general, if it is possible to draw a plane at 0.01% THD, or some other very low level, above which distortion never rises under any condition, the amplifier should indeed behave impeccably with any likely program input.

In discussing the wealth of information in such a 3DA graph, Technics stress the potential limitations of any amplifier for which power vs distortion plots are available at only spot frequencies within the normal audio passband.

With modern signal sources, they say, or with those in the immediate offing, very high amplitude and very high frequency transients can be presented to the amplifier input. It is vitally important that they do not overload the amplifier. Even though the transient itself may be inaudible to an ageing listener, or completely outside the audio spectrum, the disturbance caused by an overload may be evidenced in other ways. A uniform power capability over an extended frequency range must therefore be considered as highly desirable.

Another distinct possibility is that the rise time of a transient may be shorter that the response time of the negative feedback network(s) present in most amplifiers. In such a case, the overload can be gross, because the amplifier responds with its full intrinsic gain, undiminished by feedback. However, if it can be shown to handle signals easily up to 100kHz, the chances of its being upset by transients from within the audio spectrum are remote.

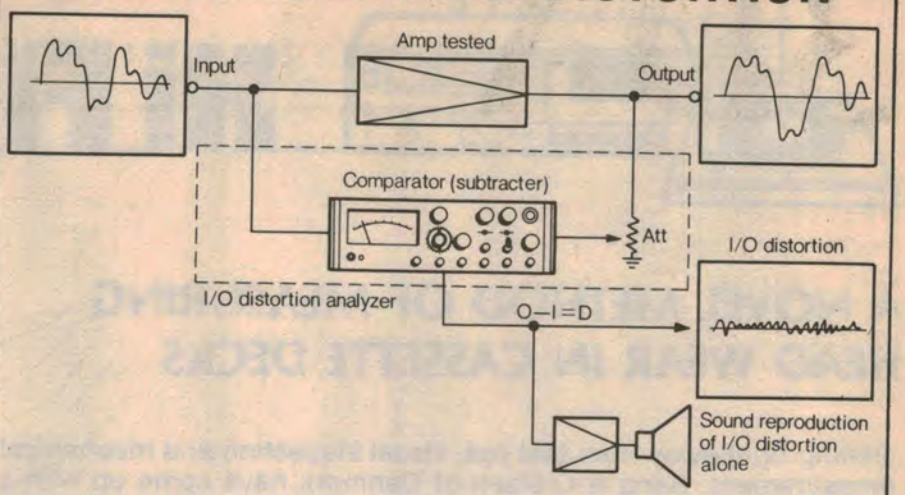
These desired characteristics are indicated when a "3D" plot reveals a wide plateau where the distortion remains low at all power levels up to clipping point and for all input frequencies up to 100kHz. Technics engineers claim that research has shown that, in such cases, the amplifier can be relied upon to have very low transient intermodulation distortion (TIM) and excellent slew rate characteristics — both a measure of its ability to cope with difficult program material.

And, true to the traditions of the hifi industry, Technics have coined a term for this plateau.

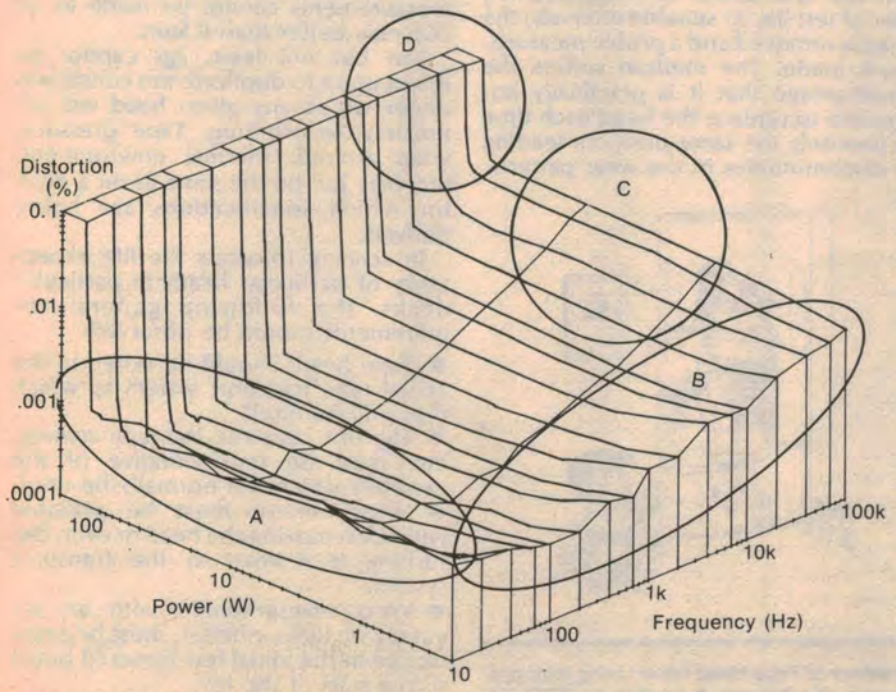
If their term catches on, future hifi buyers will not be concerned just about a flat frequency response.

They'll be insisting on a flat "music plane"!

## ISOLATING SUBTLE DISTORTION




While Technics engineers are satisfied that the 3DA will reveal the strength and weaknesses of an amplifier, they have anticipated the criticism that it uses instrument-generated signals rather than live program material. As a back-up, therefore, they have done parallel work on what they call "I/O Distortion Analysis" or input/output transfer distortion. As illustrated above, actual program signals are fed to the amplifier under test and a sample of its output is used to cancel the original signal in a comparator-subtractor. The difference signal can be viewed on an oscilloscope, or reproduced on a loudspeaker to evaluate its audibility and subjective effect. The frequency response of the comparator input is tailored to match exactly that of the amplifier, all other differences being regarded as distortion. The method can expose THD levels above .001%.




*A 3DA plot of the Technics SU-8099 amplifier. A plane drawn at the 0.01% THD level, as in the lead illustration, would show that the THD would never rise above this plane under any likely signal condition, up to actual overload.*