

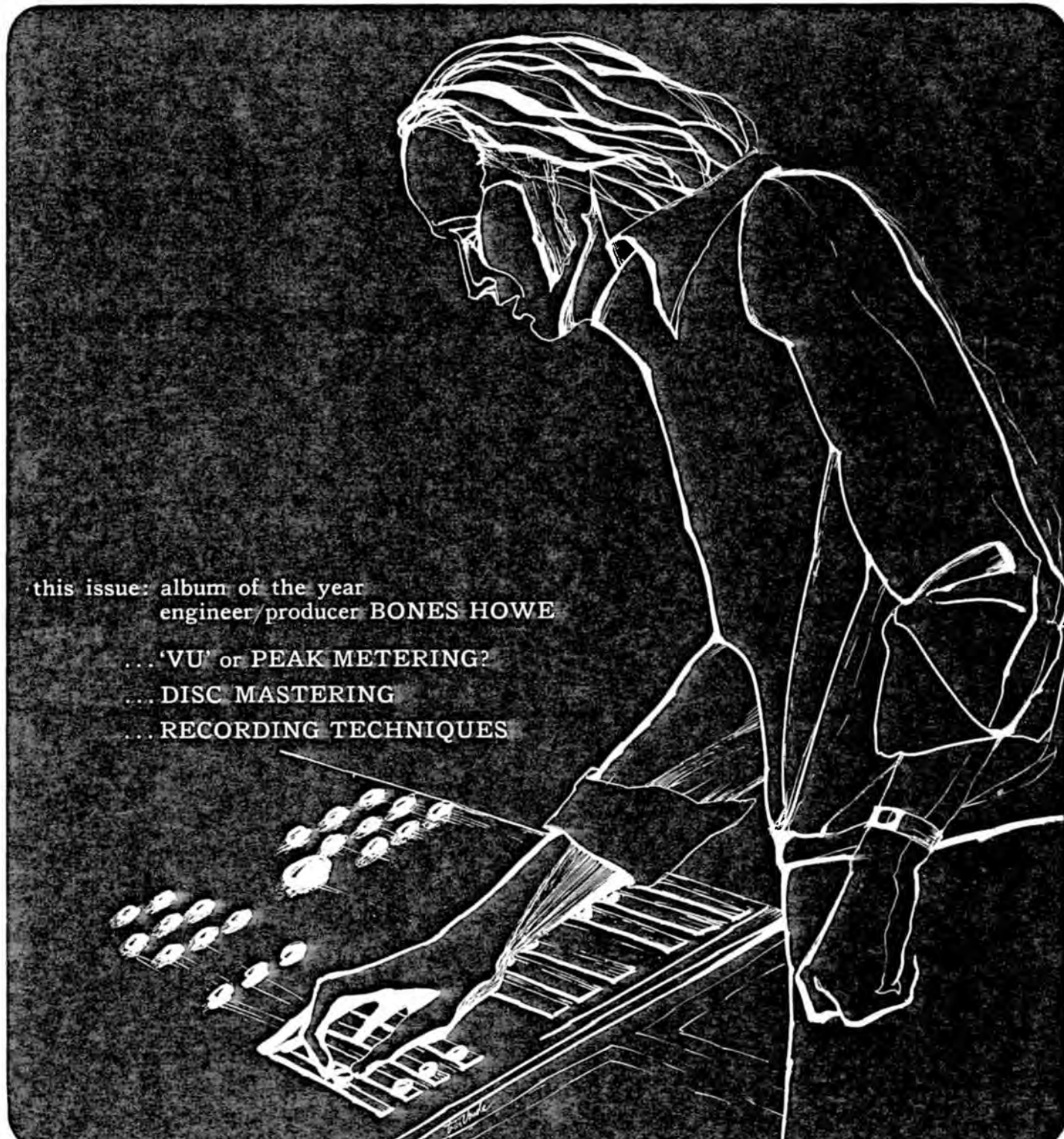


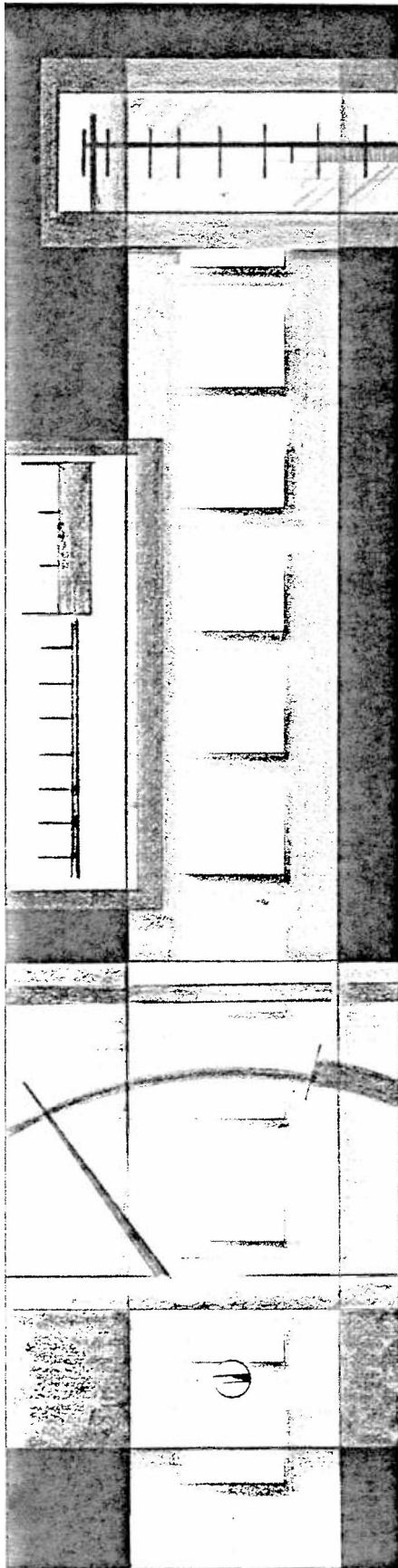
RECORDING engineer/producer

relating recording science • to recording art • to recording equipment

this issue: album of the year
engineer/producer **BONES HOWE**

- ... 'VU' or PEAK METERING?
- ... DISC MASTERING
- ... RECORDING TECHNIQUES





WHAT'S WRONG WITH THE GOOD OLD 'VU' METER?

by PAUL BUFF

**CHIEF ENGINEER
ALLISON RESEARCH DIV
ORIGINAL SOUND RECORD CO.**

-----or the
Case for
Peak
Signal
Metering

I think the question could best be answered by the analogy: "What's wrong with wetting your finger to measure wind velocity?"

In truth, the VU meter does a great job of indicating the average level of a constant state signal. However the VU meter becomes unpredictable when attempting to measure the actual levels involved in a transient passage or in a complex waveform. Since music is composed of complex waveforms and transient passages a problem in accurate monitoring does exist. Engineers have been aware of the problem for years and have learned to cope with it.

Engineers had learned that they could depend on instantaneous peak levels to be about 6 to 8 dB higher than that indicated on the VU meter when the program material was orchestral or vocal music. When engineers were dealing with ordinary performance mixed orchestral or vocal music, on one or two tracks, they simply allowed themselves 10 dB of "headroom" in the electronics, and recorded at a level of 6 dB below the 3% distortion point of the tape. If a cleaner recording was required, the record level was reduced by another 4 to 6 dB thereby reducing the 3% distortion peaks. With only one or two tracks, noise was not the problem it is today. Further, the public ear had been conditioned to accept the transient distortion and the tape noise, even if these had not been masked by the noise levels and distortions produced within the available playback equipment.

Today-it's been happening for about the last five years—we find that our crutches have been kicked out from under us. Each of the following series of events has contributed to the unsuitability of the VU meter as an accurate monitor of levels in modern recording practice.

MULTI TRACK RECORDING

Today, we are monitoring levels of individual instruments more often than we are monitoring ordinary performance mixed material. Consequently, peak levels do not follow traditional 6 to 8 dB reading error. Take, for instance, a tambourine. Traditionally, it was buried in the mix someplace and its transient peaks were low enough not to be a serious problem. Now take the same tambourine and put it on a track of its own. Try to record it at "O" level and you will find yourself in big trouble. Depending on the particular instrument, a specific microphone and the amount of equalization used, you will probably find your VU meter reading to be between 12 and 16 dB off. The only procedure you can follow is to make a calculated guess as to the proper VU reading and go. If you have guessed too high, the result will be transient distortion and a lack of presence. If the recorded level is too low, you have an excessive amount of noise, which leads to the next modern-day metering problem.

NOISE

Noise has suddenly become a paramount consideration in the commercial recording industry. Consider the fact that in most mixdown sessions, you are combining the tape noise of as many as 24 tracks, possibly more if "ping ponging" of tracks has been done. If an acceptable overall noise level is to be achieved, it is an absolute necessity that each track receive as high a level of signal as possible . . . yet not high enough to cause distortion. This, of course, is the original function of the VU meter. Unfortunately, the VU meter is not capable of this function with enough accuracy for the complex or transient signals of today's recording.

PROGRAM CONTENT

As has been shown above, there is obviously a very fine line between proper and improper recording levels for complex and transient nature waveforms. If we are going to come up with recordings that satisfy today's critical listener, then we are going to have to hit that very fine line with every track. An analysis of

a typical 1970, 16 track, group session will well illustrate the point:

Track No.

- 1 - electric base
- 2 - very tight transient drum set
- 3 - super-equalized acoustic guitars
- 4 - organ
- 5 - headless tambourine
- 6 - sandpaper blocks
- 7 - lead vocal
- 8 - background vocal group
- 9 - double of track 8
- 10 - handclaps and vocal percussion
- 11 - electronic music synthesizer track
- 12 - overdubbed drum accents
- 13 - maracas and more handclaps
- 14 - horns
- 15 - orchestra bells and vibes
- 16 - piano accents and fuzz guitar lines

Now, the group wants a really clean sound, and the producer wants everything very "hot" (because if you don't record hot you'll get a lot of noise on mixdown). So they all crowd around you like a football team and "help" you watch your meters! (Of course you need help because the meters are strung out over eight feet of control board and your field of vision only covers thirty inches.)

At this point, the inadequacy of VU meters really hits home. You are faced with a real killer of a situation consisting of:

- very transient and delicate program material
- a critical and discerning production staff
- a tight margin of required accuracy
- a distracting environment

In the midst of all of this you sit trying to compute the error factor of 16 meters whose individual errors range from 4 to 16dB, and whose smiling faces require three men and a lap dog to monitor.

I think that these considerations would graphically answer the question of "What's wrong with the good old VU meter?"

Times have changed, requirements are different, and our new technology enables us to provide ourselves with better methods of doing things.

WHAT IS THE ANSWER?

In order to arrive at the ultimate metering methods for use in modern recording systems, I think we should look closely at the requirements. The basic requirement is the same as it has always been...to enable us to record in the optimum region between noise and distortion. This can best be accomplished by placing the recorded signal as near the distortion point as possible without crossing that fine line into audible degradation. Distortion, obviously, is an instantaneous function of the waveform. As such, the only way to accurately control it is to be able to meter the instantaneous (or peak) levels of signal. Once we have this sort of metering, we can establish an accurate correlation between

meter reading and amount of the distortion introduced.

In order that the meter be capable of measuring high frequency transients properly, it is desirable that its attack time be on the order of 100 microseconds or less. This attack, or upwards deflection must then be followed by a slower release time (or downward deflection), for two reasons. First, so that the human eye will be capable of following the meter movement easily. Secondly, so that the meter will tend to integrate a rapid passage of high frequency peaks into a readable display. This would call for release times on the order of 25 to 100 milliseconds.

Judging from the current state of the art, it would appear that such a meter would, in all probability, be one utilizing a segmented light display.

To accomplish the desired degree of accuracy in such a meter, the number of segments should be in excess of fifteen. Otherwise the dB difference between increments will tend to be too great for accurate readout. Additionally, there is a question as to the desirability of a single spot of light. Tests conducted in a recording studio environment have shown a single moving point of light display to be much more readable and considerably less fatiguing to the eye, than a widening line of light. It has been further observed that each increment of light must be either "on" or "off." That is to say that no segment should be allowed to be half on or dimly lit while its companion is in "on" mode. Should this not be the case, readability suffers and eye fatigue tends to increase.

It is definitely within the realm of our industry to develop such a device. When the hardware has been developed, the progressive engineer will have little choice but to change his thinking from VU metering to "Peak Level Metering." This, of course, will require the establishment of a new set of ground rules in the area of studio level measurements and will almost certainly result in a large number of "Bah Humbugs."

We do seem to recall, some years ago, several chorus' of "Bah Humbug" when someone wrote an article entitled "WHAT'S WRONG WITH THE GOOD OLD VACUUM TUBE? . . ."