



Fig. 4. Elastomer numeric display. Operating voltage is about 70 V. Elastomer (IE) layer is about 8 μm thick.

required for the light intensity to fall to 90 percent of the value of the initial intensity, neglecting the minor slow change of I . The decay time is defined as the time required to return to 90 percent of the value of the final intensity. The rise time becomes shorter as the voltage increases, while the decay time becomes longer as the voltage decreases.

Fig. 4 shows an example of the elastomer numeric display. In this device there are many advantages for display devices, such as low cost, low power, wide operating temperature range, and rapid response time.

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Comments on "Design of Man-Computer Interfaces for On-Line Interactive Systems"

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Dr. Rouse has produced a well written and informative article;¹ but, as Chairman of the Standards and Definitions Committee of the Society for Information Display, I feel obligated to make a few comments on his use of display parameter terms. We have been engaged for some time, in various committees of the SID, IEEE, EIA, and ANSI, in an attempt to standardize these terms and thus bring usage in conformance with international standards, where appropriate. Unfortunately, these standards have not been well disseminated as yet, and I must plead guilty to contributing to this lack, since my book [1], which is one of the references cited by Rouse, while listing the international units, still uses the terms more common in this country, such as footcandle and footlambert. However, this book is over five years old, and the time has surely come to switch to international units wherever possible.

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¹William B. Rouse, *Proc. IEEE*, vol. 63, pp. 847-857, June 1975.

To review these units, luminance should be expressed in candela per meter squared, rather than footlamberts, although the equivalent term, which is nit, is somewhat inappropriate because of its unfortunate connotations in this country. Indeed, the use of millilamberts by Dr. Rouse seems rather arbitrary, since it is neither an international unit, nor one extensively used here. For contrast, the definition used by Dr. Rouse is the least common employed and results in a negative number for most CRT displays. Both EIA and SID now recommend the ratio of symbol luminance plus background luminance to background luminance, which is termed contrast ratio [2]. If contrast must be used, then the ratio of symbol luminance plus background luminance is preferred for CRT displays [3]. Finally, instead of footcandles, one should use lumens per meter squared. As long as we are going metric for all other dimensions, it seems only proper to do the same for display parameters.

To convert from the numbers in the article, multiply millilamberts by 3.183 and footcandles by 10.76. Converting from contrast as defined in the article is somewhat more complicated since it requires solving for both symbol and background luminances. In the cases cited, the equivalent of 0.85 is a contrast ratio of 16, while for 0.94 the equivalent is 32. More appropriate numbers are 10 and 20 for acceptable and preferred contrast ratios.

I trust that this brief review of what may be well known to at least some readers is not inappropriate, and I welcome the opportunity to proselytize for these terms and definitions. Once again, I should like to complement Dr. Rouse on his excellent article, and I hope that this letter will clarify what is a continuing source of confusion in the field of displays.

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Corrections to "Digital Representations of Speech Signals"

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In the above paper¹ on page 676, line 4 should read: ...

$$r(m) = \begin{cases} \sum_{k=1}^p a_k r(m-k), & m \geq 1 \\ \sum_{k=1}^p a_k r(k) + 1, & m = 0. \end{cases} \quad (41)$$

Also, a possible source of misinterpretation has been pointed out to us by N. S. Jayant. The statement in question occurs on page 664, line 34 and reads: ... then it can be shown [4], [7] that about 11 bits are required in order that the signal-to-noise ratio (SNR) be 60 dB. (This is often referred to as "toll quantity".) It is not the misspelling of the word quality that we are concerned about. Rather, the parenthetical remark would seem to imply that 60-dB SNR is toll quality. This is of course not the case, and it was not our intention to so imply. It is true that, in order to maintain toll quality, about 11 bits are required. This is so because speech is a nonstationary process for which the theoretical 60-dB SNR cannot be maintained at all times. The amplitude of speech signals varies widely with speaker effort and analog transmission environment, and, within a given utterance, from voiced to unvoiced conditions. Thus 11-bit uniform quantization, which could give 60-dB SNR for a stationary signal, is needed to provide extra accuracy to accommodate the wide dynamic range of speech signals. We thank Dr. Jayant for calling this point to our attention and hope that this note will correct any false conclusions that might have been drawn by readers.

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¹R. W. Schaffer and L. R. Rabiner, *Proc. IEEE*, vol. 63, pp. 662-677, Apr. 1975.