Pluge Method of Adjusting Picture Monitors in Television Studios — A Technical Note

A REPRINT

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THE PLUGE METHOD is a method of setting up picture monitors, and is an acronym meaning picture lineup generating equipment. It was originated by the British Broadcasting Corporation. A pluge generator delivers a video waveform for connection to picture monitors to aid adjustment of the peak white and black luminances. The Pluge waveform (Fig. 1) is formed of a large white area on the right-hand side of the picture monitor and a black area on the left-hand side, broken by two vertical ribbons, one of which is slightly whiter than black, and the other which is slightly blacker than black. The procedure is to adjust the white area to a predetermined value (for example 20 fL), using a [luminance] meter, and to adjust the black area so that the whiter-than-black ribbon is visible, but not the blacker-than-black ribbon. The two picture-monitor controls, contrast and brightness, are not independent, and a certain amount of "juggling" is necessary to obtain the correct black-and-white conditions. The advantages of Pluge are as follows:

(a) Adjustment of monitors is quick and easy.

(b) Uniformity of lineup can be achieved by relatively unskilled personnel.

(c) Only one meter is required. In practice, once the studio control-room lighting conditions have been evaluated, it is necessary only to measure peak-white luminance as a routine matter, and a simple, cheap, and robust foot-candle [illumination] meter is sufficient for this purpose.

Some preliminary tests indicated that this method of subjectively setting the monitor blacks was promising. A certain complication was found regarding the proper amount of "setup."* Further experimental work was thought necessary to resolve this matter. To this end, five sets of reference conditions for picture-monitor settings (Table I) were derived from results of tests previously reported.† They reflect practices in monitor adjustment preferred by the majority of CBC technicians. They are spaced by 0.10 fL of base luminance and cover the whole practical range of base luminance. The range within which matching pictures is possible is indicated by the "high-limit" conditions accompanying each reference set of values. Base luminance is defined as the ambient light reflected from the screen of a switched-off picture monitor.

The test signal employed in the earlier experiments was the window signal, and it will be noticed that the black luminance is higher than the base luminance for each reference condition.

In resolving this matter of the proper amount of "setup," the requirement was to determine the Pluge waveform, which matched, in turn, the five sets of reference conditions.

The procedure, at every reference condition, was as follows:

(1) A picture monitor was adjusted on the window test signal to the reference brightnesses.

(2) The Pluge waveform was connected in place of the window test signal, and the pluge black level was adjusted to make the whiter-than-black ribbon visible, but not the blacker-than-black ribbon.

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* Setup is defined as "the separation in video level between blanking level and reference black level" (CBC glossary of terms). [See also *American Standard Definitions of Electrical Terms*, ASA C42.65–1957.]

† C. A. Siocos, "Operational adjustment of picture monitors in television studios," *Jour. SMPTE, 74:* 11–14, Jan. 1965.

Figure 2 shows, in graphical form, the variation in required Pluge black level with base luminance. Figure 2 also includes the range of base luminance within which pictures match. The equivalent range of Pluge black level is 3 IRE units.

After installing Pluge, the preliminary procedure is to measure the base luminances of all the picture monitors. The values should be within the limits of Table I for good matching. The smallest value should be taken as the reference to determine from Table I the required white luminance and from Fig. 2 the Pluge black level. The day-to-day procedure is as outlined earlier. Care has to be taken to adjust the pluge generator and subsequent distribution amplifiers, to obtain the correct waveform amplitude.

The data presented here are for old-style control rooms, where ambient lighting levels are very low. The most recent control room of the CBC uses high ambient lighting (about 51m/ft²) and polarized front-plate filters at the picture monitors. In this case the data of Table I and Fig. 2 have been found not to apply. Clearly, further work is necessary to obtain preferred adjustments of picture monitors under these new conditions.

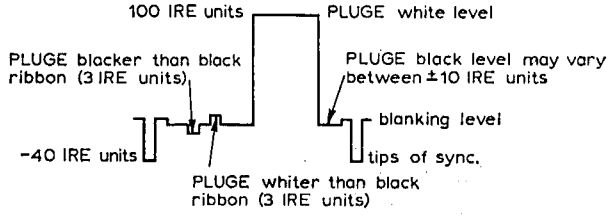

Fig. 1. Pluge waveform at line rate.

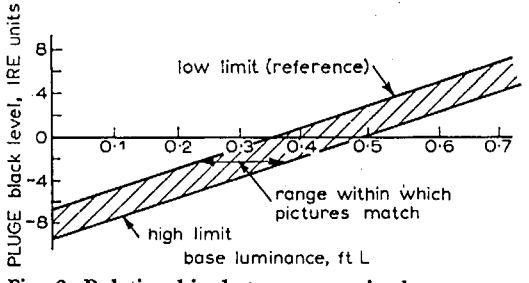

Fig. 2. Relationship between required Pluge black level and base luminance.

Table I. Five Sets of Reference Conditions for Setting Up Picture Monitors

Set		Base luminance	Black luminance	White luminance
		fL	fL	fL
1	Low limit (reference)	0.15	0.31	18.5
	High limit	0.285	0.445	19.85
2	Low limit (reference)	0.25	0.41	20.0
	High limit	0.40	0.56	21.5
3	Low limit (reference)	0.35	0.51	24.0
	High limit	0.51	0.67	25.6
4	Low limit (reference)	0.45	0.61	25.5
	High limit	0.62	0.78	27.2
5	Low limit (reference)	0.55	0.71	27.0
	High limit	0.72	0.88	28.7