Blackburst/Genlocking: Synchronization and its Significance in Preservation

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The NTSC standard states that we in North America, capture video at 30 frames per seconds based on our power infrastructure, operating at 60 Hertz per second. Each Hertz lines up with a field of video and one frame is made up of two interlaced fields. But how do you ensure that each field and frame is being captured at the same time? Simply put, a reference video needs to be sent to the devices to synchronize the capture.[1] This is a crucial part of digitization and preservation of video. Many terms are used, at times interchangeably, to describe this process. Some of the terms that are most commonly used are: blackburst, genlocking, sync generator, frame synchronizing, etc. Though these differ slightly in how they function, they each make reference to the same overarching process of synchronization, which will be discussed in greater depth through Blackburst, specifically.

First, in order to better understand Blackburst, let us consider this analogy posted as an entry on *worshipimag,* which compares it to an orchestra. If you told each musician to individually start a metronome at the same time, it is inevitable that the very slight variations of timing would cause for them to be out of sync. This is why the conductor's role of setting the reference pace for musicians is so important to ensure that they are all on the same beat, at the same time. In other words, they need one common reference to make sure that they are all in sync. In this analogy, the orchestra is video (including all elements such as frames, image, color, etc) and blackburst is the conductor. To reintegrate the initial NTSC concept of our power infrastructure affecting video capture, here, Hertz is the metronome that the conductor

[1] "Genlock: What Is It and Why Is It Important?" *Worship IMAG*, 11 June 2011, worshipimag.com/2011/06/11/genlock-what-is-it-and-why-is-it-important/.

(Blackburst) follows in order to guide all the individual musicians.[2] This is the role of Blackburst.

Now that we understand the concept of Blackburst, what does it consist of more specifically, and how does it work? Put simply, Blackburst is a blank video signal that is black. Its generator is often a box with one or more video outputs.[3] This sync generator has an oscillator that sends out a signal, referred to as the "color subcarrier", that is used as a reference carrying the color information portion of the signal.[4] With this signal, frequencies are output to create specific pulses in order to ensure that all equipment is identically timed. The following is a breakdown of these pulses.

There are two types of **synchronizing pulses**, horizontal and vertical. Horizontal synchronizing pulses function on a line to line basis and synchronize monitors and receivers to the information that the camera is sending out.[5] Vertical synchronizing pulses are part of the broadcast signal, there is a total of six pulses and they occur between fields.[6] To drive this camera, there are vertical and horizontal **drive pulses** that catalyze circuits called "sawtooth waveform generators", which simply refers to the shape of the waveform. Depending on the orientation of these deflection circuit, the waveform will allow for the scanning of a field (vertically) or a line (horizontally). At the end of each line and each field that is scanned, there is a retrace period during which the camera's electron beams shut off and back on.[7] These are

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[2] "Genlock: What Is It and Why Is It Important?"

[3] "Black Burst." *InSync*, 27 Oct. 1998, www.sweetwater.com/insync/black-burst/.

[4] Weynand, Diana. *How Video Works: from Analog to High Definition*. Focal, 2015.

[5] Weynand, 26
[6] Weynand, 30
[7] Weynand, 28

referred to as **blanking pulses**. In addition to this, before and after the vertical sync signal, the sync generator puts out **equalizing pulses**. These assure continued synchronization throughout the retrace period and allows the system to detect odd from even fields in order to properly interlace and create a frame.[8] Oftentimes, these pulses will be combined into one signal that we call "composite".[9]

Now that the different types of pulses have been outlined, let us revisit the blanking pulse as it pertains specifically to the horizontal period, which is denser and rather important throughout the process of synchronization. The horizontal blanking period allows for the images to be displayed on a monitor and contains important synchronization signals such as: the front porch, the horizontal synchronizing pulse, the breezeway, and color burst reference, which are illustrated in Figure 1 and described briefly below it.

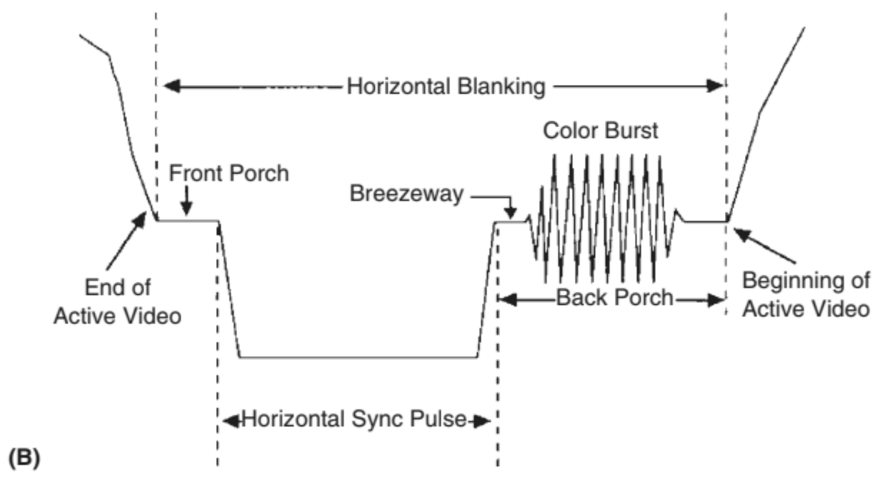

Figure 1[10]

[8] Weynand, 31
[9] Weynand, 26
[10] Weynand, 29

The front porch is the area of the composite video waveform that defines a scan line. In fact, a single scan line is said to start at the front porch and end with active video.[11] The horizontal sync pulse links the receiver to the creator source of the image. The back porch marks the end of active video and contains the color burst reference. Finally, the breezeway in horizontal blanking is the area of composite video signal that marks the time between the rising edge of the sync pulse and the start of color burst.

The many different key players of the process have been outlined and explained, but what would happen if all the different elements of equipment were not synchronized at all? The image in the monitor would lose stability, causing a poor-quality transfer. This would mean a loss of color fidelity especially in special effects and dissolves. These special effects and computer-generated images can also shift positions if not synced.[12] In other words, there would be visible artifacts on the image. When digitizing tapes for preservation, it is highly important that we are not making significant and detrimental changes to image, and that the latter is not losing any original information. That being said, Blackburst plays a crucial role in tape digitization.

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[11] The AudioPedia. *What Is Horizontal Blanking? What Does Horizontal Blanking Interval Mean?YouTube*, YouTube, 8 Dec. 2017, www.youtube.com/watch?v=YtE6ing1UVk.

[12] Weynand, 30

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