

## TM-6701AN HIGH-FRAME-RATE CAMERA SYNC TIMING

The TM-6701AN camera is designed to output a high frame rate, progressive scan (non-interlace) image with asynchronous reset and electronic shutter. The normal speed is 60Hz, VGA format in which the horizontal frequency (fH) is 31.468 KHz and the vertical frequency (fV) is 60Hz (59.94 Hz exactly).

The TM-6701AN takes external HD and VD sync (negative-going TTL pulse) just as any standard TV format camera and the pin configuration of the TM-6701AN is the same as TM-7 series CCD cameras. However, since the frequency is twice as fast as the standard TV format, the external sync is required to be the same frequency as above (fH = 31.468 ± 5%). The vertical sync is 60Hz non-interlace and can be generated by dividing the horizontal frequency by 525.

When the 120 Hz mode is selected, the TM-6701AN scans two horizontal rows together and a total 262 lines (242 active image) per frame of is output at 120 Hz rate. In this mode, the vertical sync can be either 60 Hz or 120 Hz while the horizontal frequency remains the same as 31.468 KHz ± 5%.

In the partial scan mode, the vertical sync condition is more complicated (and also application dependent) while the horizontal sync stays the same. The theoretical vertical reset timing is as follows,

$$\begin{array}{ll} fV_{100} = fH/142 = 221\text{Hz or }220\text{Hz} & 100\text{-line scan} \\ fV_{200} = fH/242 = 130\text{Hz} & 200\text{-line scan} \end{array}$$

Since the TM-6701AN sync is designed for flexible reset, a user can input external vertical sync faster or slower than the above frequency. For example, the standard 60Hz reset can be applied as the vertical reset and capture the first frame output right after the reset pulse (Fig.1). However, there is an inhibited region for the reset pulse timing as follows,

Slower pulse: The reset pulse can not be in the period between 9H and 42H from the V reset edge.

Shorter pulse: It reduces each active horizontal line by the same amount as the deviation from standard number. Example: For 100 line mode, the standard fV is 200 Hz = (1/142)H. If fV = (1/145)H (217 Hz), it loses 3H lines from 100 total. The video output shows 97 lines.

For this reason, PULNiX suggests TM-6701AN partial scan reset as follows:

1. fH = 31.468 KHz ± 5%
2. fV = 220 Hz + 5 Hz for 100 line mode  
(fH/142) -10 Hz  
fV = 130 Hz +2 Hz for 200 line mode  
(fH/242) -4 Hz
3. Any divided number of each frame speed.  
For 100 lines, 220 Hz, 110 Hz, 55 Hz....  
For 200 lines, 130 Hz, 65 Hz, 32.5 Hz...

For frame grabbers which take pixel clock and reset pulses from the camera (*slow scan frame grabber* - ironic name for a fast speed frame grabber), there is an option for the TM-6701AN which outputs clock (Pin #4), HD (Pin #9) and VD (Pin #7) from the 12-pin connector.

**Note:** Video signal is only available from the BNC connector.

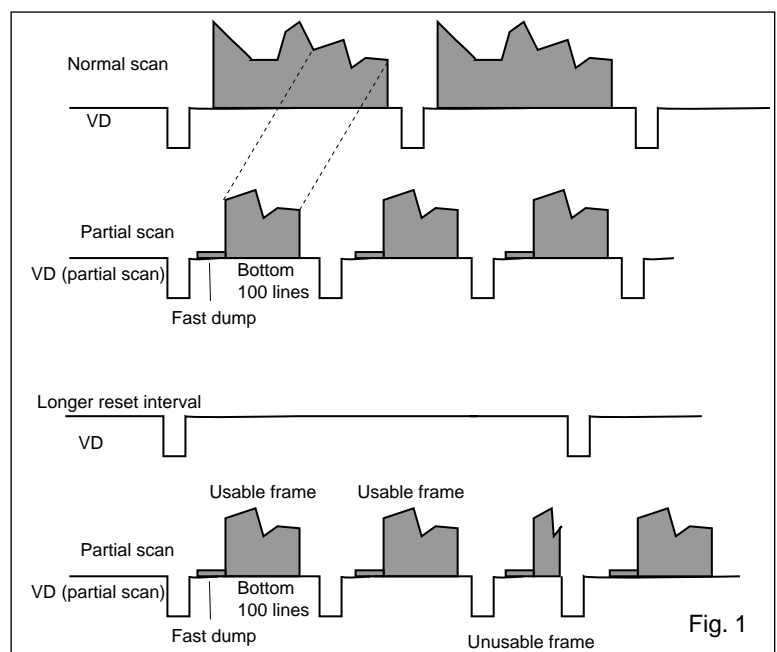


Fig. 1