

# LCDs for Retinal Stabilization

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Updated: February 13, 2019

## Question

Can we do retinal stabilization on LCD monitors with CRT quality?

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- Strobing backlight (i.e. Motion Blur Reduction)
- 200 Hz
- NVIDIA G-SYNC compatability

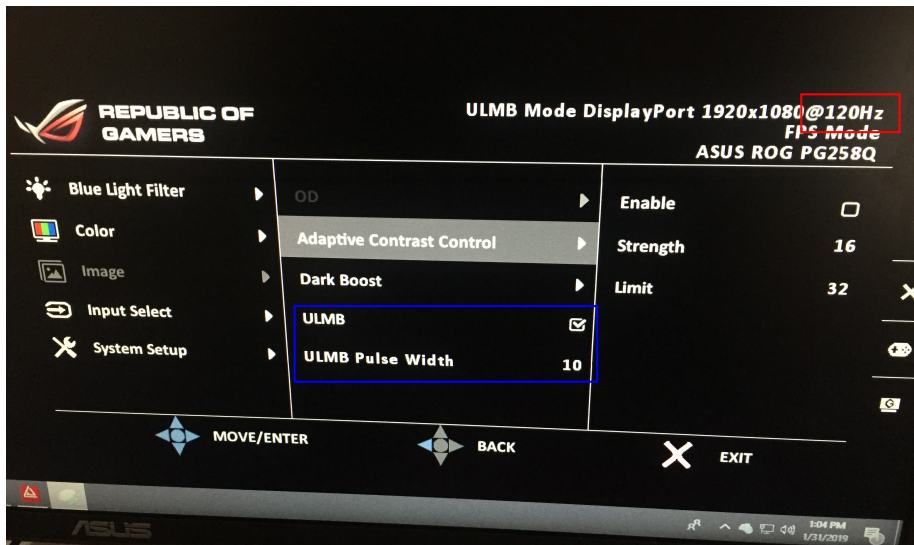
# Getting CRT quality: strobing backlight (motion blur reduction)

<https://www.blurbusters.com/faq/motion-blur-reduction/>

Several monitor manufacturers have released many brands of Motion Blur Reduction modes in recent gaming displays, with names such as:

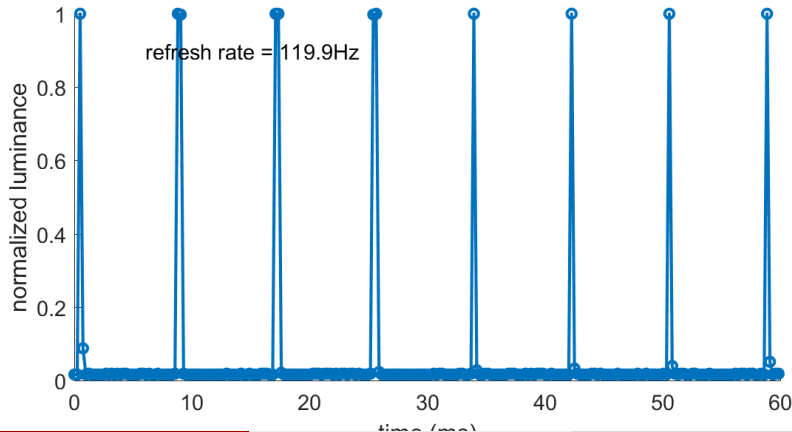
- **Motion Blur Reduction**
- **LightBoost** (by NVIDIA)
- **ULMB** - Ultra Low Motion Blur (by NVIDIA)
- **DyAc** - Dynamic Accuracy (by BenQ ZOWIE)
- **ELMB** - Extreme Low Motion Blur (by ASUS)
- **VRB** - Visual Response Boost (by Acer)
- **MotionFlow Impulse** (by Sony)
- **1ms MPRT** (by LG) — *up to 16x clearer motion than "1ms GtG"!*

# Ultra Low Motion Blur on ASUS 258 (most common monitor in lab)



## Ultra Low Motion Blur on ASUS 258 (most common monitor in lab)

Steady-state presentation of a stimulus. Note the luminance pulses in each frame. ULMB is limited to refresh rates  $< 144\text{Hz}$ .



## Alternatives?

240Hz strobing monitors exist but most are not G-Sync compatible.

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240Hz strobing monitors exist but most are not G-Sync compatible.... until about a month ago!!!

# Nvidia's latest GPU driver expands G-Sync support to FreeSync monitors

By **Paul Lilly** 20 days ago

**You might have to enable support manually, depending on which FreeSync monitor you own.**





# Let's try this BenQ monitor

## ZOWIE XL2740 240Hz 27 inch e-Sports Monitor

- **G-Sync compatible** ::: <https://zowie.benq.com/en/product/monitor/xl/xl2740.html>
- **Strobing at 240 Hz** ::: (to be tested further) <https://forums.blurbusters.com/viewtopic.php?f=2&t=3803&start=10>

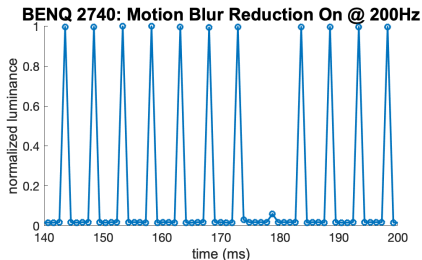
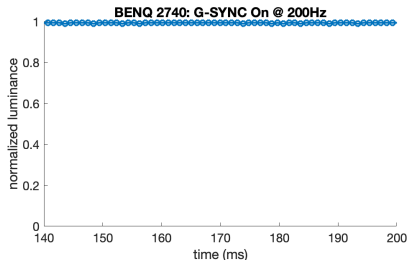
# We tried the BenQ 2740 monitor

## Summary:

- 1 This monitor does not run natively at 200Hz. This is only an issue for the the *dDPI* rig which does not allow custom refresh rates.
- 2 Motion Blur Reduction works at 200 Hz
- 3 Motion Blur Reduction and G-SYNC **cannot** be enabled at this same time. So the trade-off is:
  - We can have G-SYNC on and be sure we aren't skipping frames. This is a good option for experiments that require less precise timing and have long stimulus durations.
  - We can have MBR on at 200Hz, use the photocell to synchronize data, and check offline that frames were not skipped. This is similar to running experiments on a CRT.

## BenQ: backlight comparison

Note that we tested on the dDPI, on which EyeRIS cannot force the monitor to run at 200Hz. So, we recorded luminance dynamics on a steady screen (for now because it's quick).



**Figure:** Luminance during steady state presentation of a white screen when G-SYNC is enabled (left) and when MBR is enabled (right). Note that MBR has the desired pulsing backlight at 200Hz (1ms on, 4ms off), but occasionally misses a frame. (Here we sampled at 1024Hz - we could increase to 4096 to more precisely check how often skipped frames occur)