

# Monitor Calibrations

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# 1 Summary

Monitors	Configurations			Gamma values			Comments
	Contrast	Brightness	Distance(cm)	Red	Green	Blue	
CRT monitor	35	100	200	2.33	2.40	2.52	
	35	100	0	2.33	2.40	2.52	
ASUS 278	50	50	$\approx 20$	2.18	2.23	2.70	(day 1)
	50	50	$\approx 20$	2.18	2.23	2.70	(day 2)
	50	50	$\approx 60$	2.18	2.23	2.70	
	50	50	$\approx 160$	2.10	2.17	2.58	
	0	0	$\approx 160$	2.10	2.17	2.58	
ASUS 258	0	0	$\approx 10$	2.09	2.05	2.25	
	50	50	$\approx 10$	2.15	2.26	2.64	

Table 1: Measured gamma values for different monitors and configurations

## 2 Procedure

### 2.1 ColorCAL MKII Colorimeter, Cambridge Research Systems

1. Install MATLAB + [Psychtoolbox](#).
2. In MATLAB, go to the directory containing the file CalibrateLuminance.m (D:\gamma\_correction).
3. Configure the monitor with parameters you want to measure, e.g., contrast and brightness levels, and put the colorimeter so that it points to the monitor with a distance you want to measure. Remember to keep the monitor in a dark environment.
4. Call as:

```

1 result = CalibrateLuminance( struct( ['screen', 0,] ['useCCal', true,] ...
   ['nMeasures', 17,] ['runNow', true,] ['isDisplayGamma', true,] ['filename', ...
   [],] ['comments', {''}] ) )
2 % screen:   screen index, obtained using Screen('Screens'); 0 by default.
3 % useCCal:  whether use ColorCalII automatically; true by default.
4 % nMeasures: number of measurements, need to be 2^n+1; 17 by default.
5 % runNow:   whether to run the measurement immediately when initialize this ...
   object; true by default, if set to false, one may call result.run() to run ...
   the measurement later.
6 % isDisplayGamma: whether to measure the original display gamma of the monitor ...
   (true), or to test the effect of a calibration (false); true by default.
7 % filename: filename (include path) to save the data, which can be later ...
   read in by calling result.loadData(filename); empty by default, and the ...
   filename would be './calResult.mat'. You can also save the data at any time ...
   later using result.saveData(filename).
8 % comments: any comments you would like to add for the measurement, e.g., ...
   monitor configurations, distance, etc.

```

The program will prompt if you want to do a zero-calibration for the colorimeter, you need to do this only for the first measurement after the colorimeter is connected to the computer; to do this, enter "Y" and then press Enter, then follow the prompts printed in the command window.

5. After the measurement finished, read the fitted gamma values for each color gun, either by printing `result.displayGamma` or looking at the figures plotted. Then open the graphics control panel (e.g., NVIDIA control panel), find the location where you are able to configure the color settings (e.g., color setting in NVIDIA control panel), and set the gamma values of each color gun to the fitted gamma values.
6. To save the data later, call `result.saveData(filename);`; to plot the figures later, call `result.plot();`.
7. To check if those fitted gamma values work well, run the program again with `'isDisplayGamma'` set to `false` after gamma values configured properly in graphic color settings, and then check how well the measured luminance is linearly correlated with intensity.

## 3 Results

### 3.1 CRT monitor

Two contrast/brightness settings had been previously calibrated for the CRT monitor. One of them is re-tested here. Measured luminances are consistent with those measured in June 2016 (see wiki page: <https://wiki.bcs.rochester.edu/ApLab/Equipment-CRTMonitor>).

- 200 cm away
  - Contrast = 35, Brightness = 100
  - R - 2.33
  - G - 2.40
  - B - 2.52
- 0 cm away
  - Contrast = 35, Brightness = 100
  - R - 2.33
  - G - 2.40
  - B - 2.52

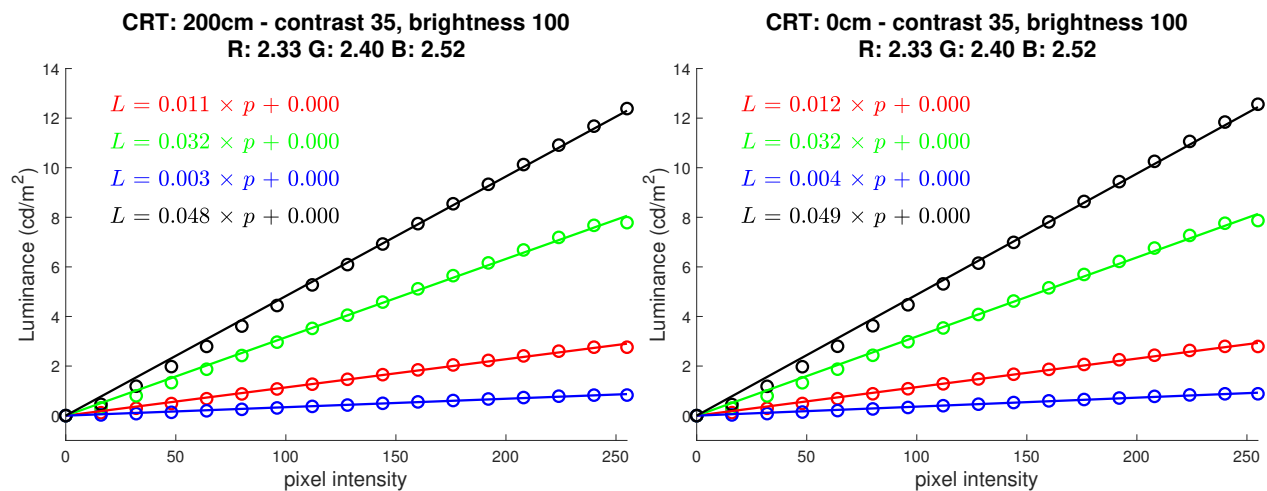


Figure 1: CRT luminances measured for each color channel (red, green, blue) and achromatic scale (black) from two different distances (160cm away and at the monitor surface). Both appear linear though a small systematic error is also seen.

### 3.2 ASUS 278

Two contrast/brightness settings were tested - though it seems the same gamma correction can be used when the contrast/brightness ratio is constant and the distance to the monitor is large:

- Contrast = 50, Brightness = 50
- R - 2.10
- G - 2.17
- B - 2.58
- Contrast = 0, Brightness = 0
- R - 2.10
- G - 2.17
- B - 2.58

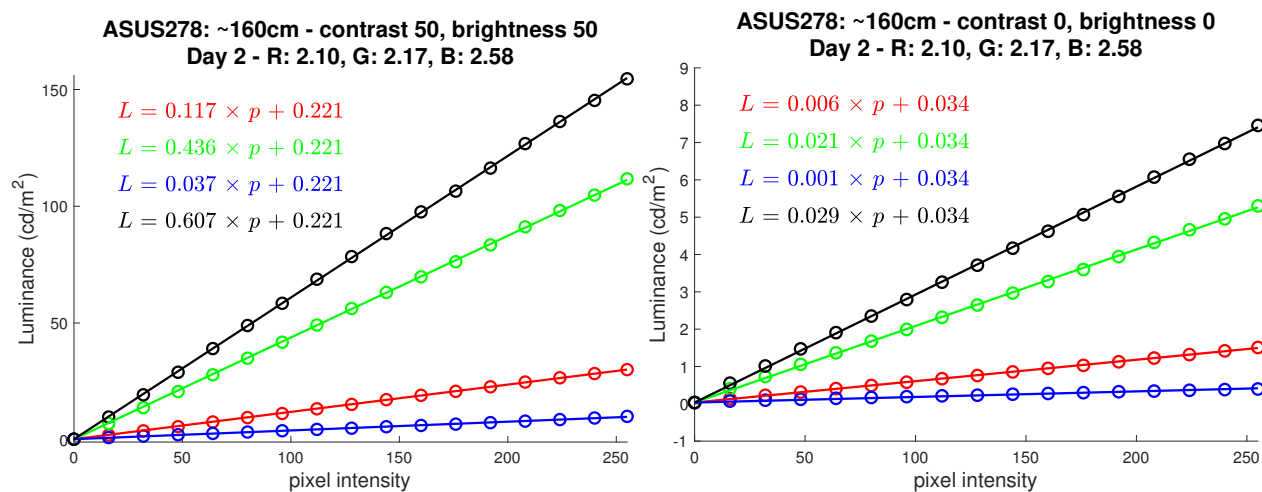


Figure 2: ASUS278 luminances measured for each color channel (red, green, blue) and achromatic scale (black) at two different contrast/brightness settings. Both are linear. Note the 30-fold difference in luminance scales.

### 3.2.1 Different Days

When tested at a nearer distance, these gamma corrections still worked when the monitor was re-tested the day afterwards.

- Day 1
  - Contrast = 50, Brightness = 50
  - R - 2.18
  - G - 2.23
  - B - 2.70
- Day 2
  - Contrast = 0, Brightness = 0
  - R - 2.18
  - G - 2.23
  - B - 2.70

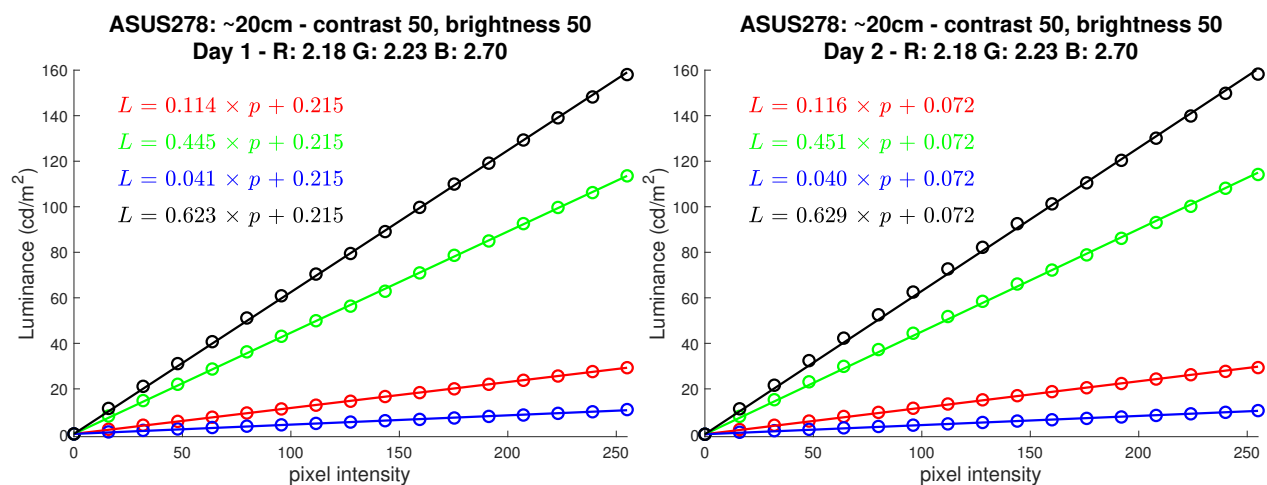


Figure 3: ASUS278 luminances measured for each color channel (red, green, blue) and achromatic scale (black) on two different days. Both are linear. Small, systematic errors on day 2 could originate from slightly different position of colorimeter relative to monitor.

### 3.2.2 Different Distances

Distance to the monitor seems to make a small difference for the LCD.

- 20cm (top) or 60cm away (bottom)
- Contrast = 50, Brightness = 50
- R - 2.18
- G - 2.23
- B - 2.70
- 160cm away
- Contrast = 0, Brightness = 0
- R - 2.10
- G - 2.17
- B - 2.58

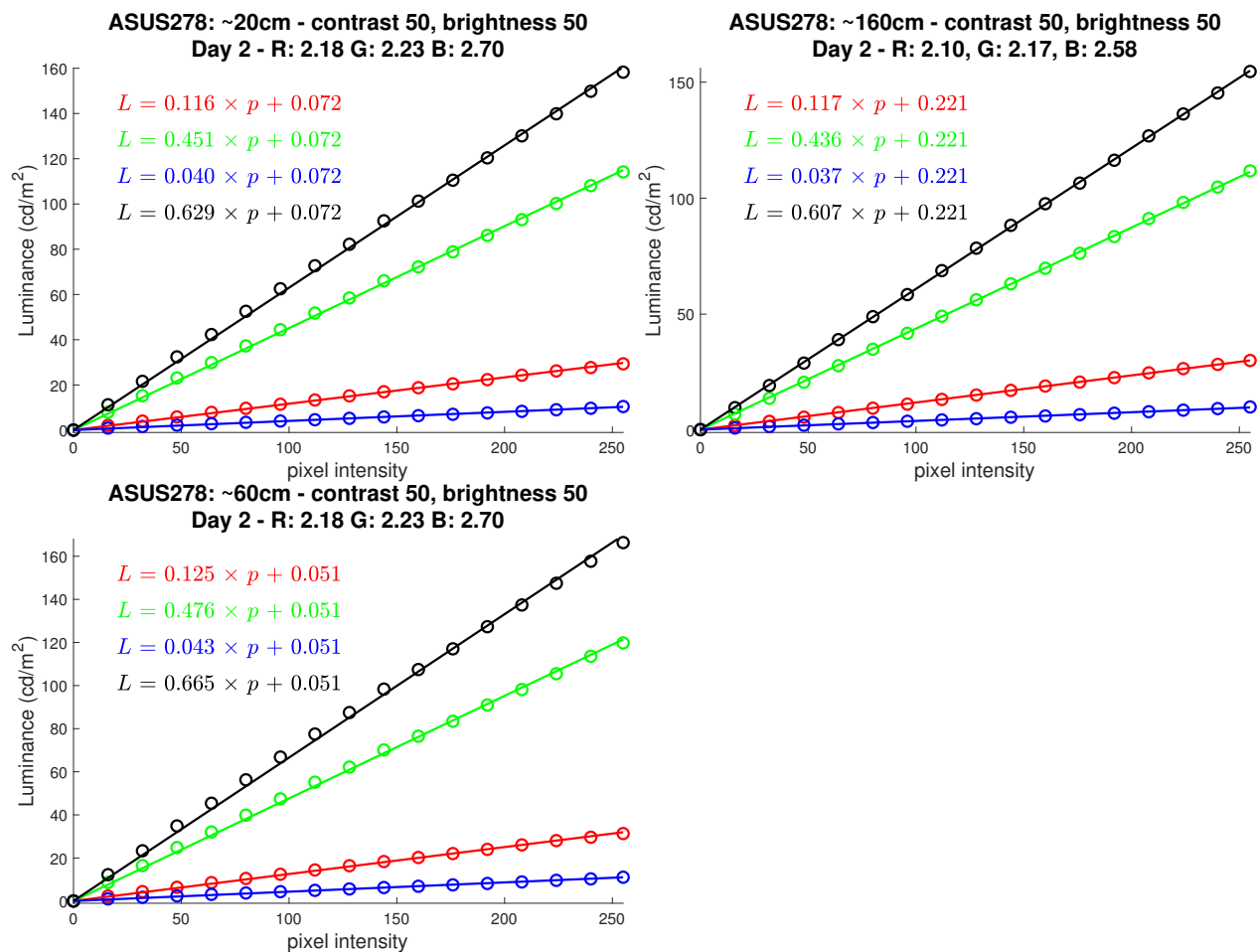


Figure 4: ASUS278 luminances measured for each color channel (red, green, blue) and achromatic scale (black) on two different days. Both are linear. Small, systematic errors on day 2 could originate from slightly different position of colorimeter relative to monitor.

### 3.3 ASUS258

Two contrast/brightness settings were tested at a near (10cm) viewing distance. More testing should be done with these monitors.

- Contrast = 50, Brightness = 50
- R - 2.15
- G - 2.26
- B - 2.64
- Contrast = 0, Brightness = 0
- R - 2.09
- G - 2.05
- B - 2.25

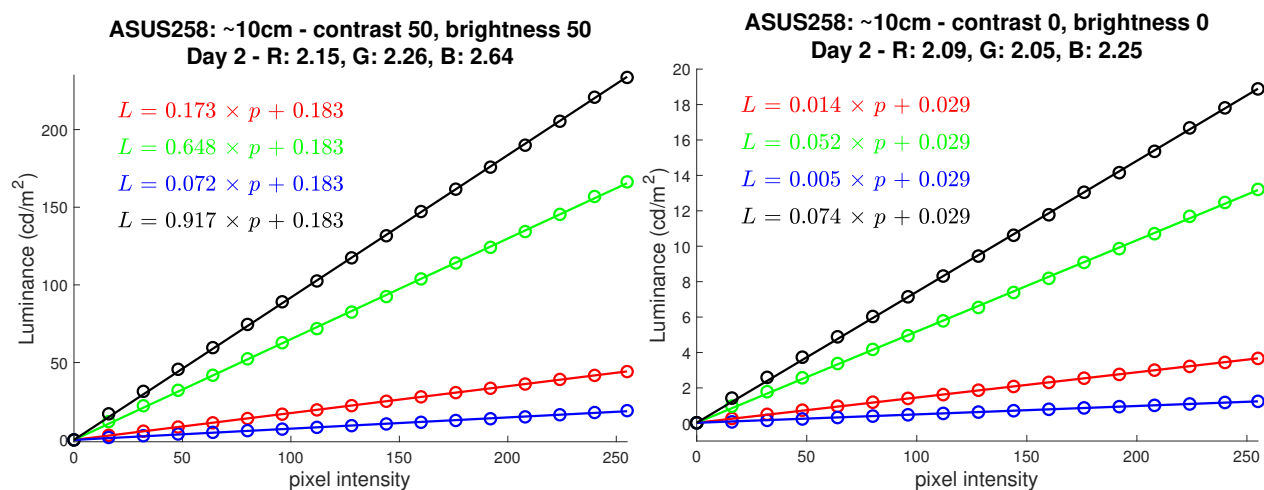


Figure 5: ASUS258 luminances measured for each color channel (red, green, blue) and achromatic scale (black) at two different contrast/brightness settings. Both are linear. Note the 10-fold difference in luminance scales.