

MEASURING MONITOR SCREENS

PRINCIPLES OF MEASURING SCREEN SIZE

Monitor screens are measured in various ways. Some measurements only refer to the opening of the front bezel, while others measure the full size of the CRT. LCD and CRT monitors are measured differently, including horizontally and vertically vs. diagonal or metric vs. English measuring systems. In an effort to provide an industry standard method of defining the usable image area for CRT displays and enable consumers to compared products more easily, the Video Electronics Standards Association (VESA) created the Video Image Area Definition Standard (VIAD) in 1995. However, the measurement of monitor screens can become confusing when they are manufactured in varying aspect ratios. How can we define this measurement?

ASPECT RATIO

Before we can define how to measure a given display active area, we first must define aspect ratio. Aspect ratio is an expression that defines the ratio of horizontal to vertical resolution. It has been calculated that we generally perceive reality with vision that is between 4:3 and 5:3. Television has been defined as 4:3 since its inception, which is a good tradeoff in minimizing bandwidth requirements. Movies (35mm film) are generally shown in a 5:3 aspect ratio, which explains, in part, their overpowering storytelling ability with images that are “larger than life.”

IMAGE AREA MEASUREMENT

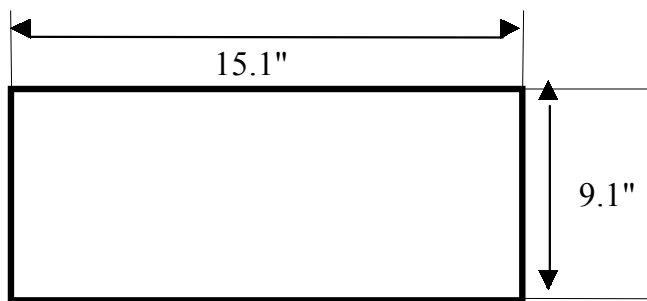
The video image area, which is the actual screen surface on which the image is displayed, should be referred to as the “Horizontal Length x Vertical Height” and expressed in millimeters (easily converted to inches for U.S. users). This is the largest rectangular image that a monitor is capable of displaying as a viewed image. It follows, then, that the video image area is the area that is to be viewed by the consumer. Therefore, this area cannot be larger than the bezel opening. Also, the same area does not include colored or non-colored border area where the individual pixels are not addressable.

Do you remember the Pythagorean theory from high school, where $c^2 = a^2 + b^2$? A display's diagonal visual image size can be determined using this tried and true algebra expression. This particular measurement criteria works quite well for 4:3 aspect ratio displays currently used on the majority of computers and commercial televisions in the world today. However, 16:9 and 16:10 (often called “letterbox”) aspect ratio displays do not fit the above criteria due to their wider horizontal and shorter vertical size than traditional displays. The difference between 4:3 and 16:9 aspect ratios is that 4:3 can be comparable to 16mm film (what we see on TV) and 16:9 is comparable to 35mm film, which is usually associated with what we see at the movies.

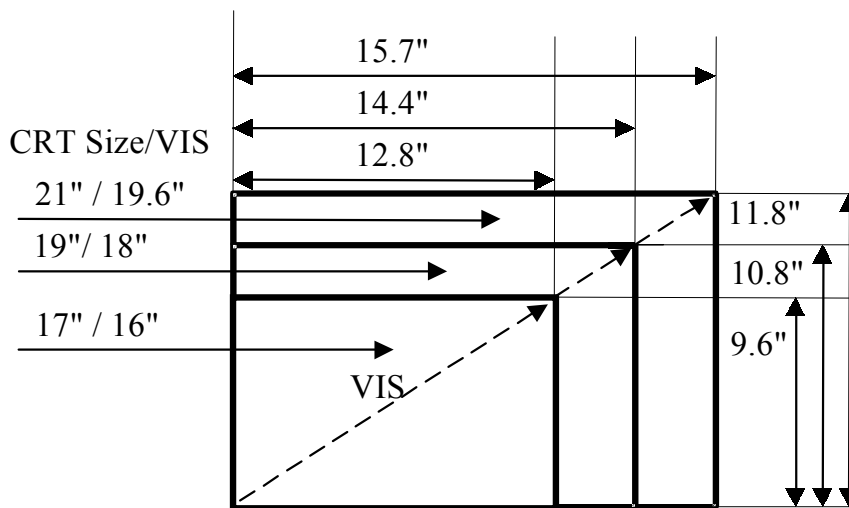
We currently measure 4:3 displays using a measurement of the diagonal of the screen, but 16:9 displays pose a problem in being able to compare image size when discussing the diagonal size of the screen. Typically, we may want to know how big of a 16:9 screen we need to match the height of a 4:3 screen (for the same height of screen, a 16:9 is 33% wider than a 4:3).

MEASUREMENT COMPARISON

Recently a 22" 16:10 aspect ratio LCD monitor was introduced to the market. With this introduction, it is important to start paying attention to how displays are measured, however, in that this display is a wide aspect ratio, 16:10 display. Since all displays are measured on the diagonal, the diagonal measurement of a rectangle will always seem larger than the diagonal measurement of a square (which is what most displays are), so a 22" display sounds huge. In terms of the height of the display, however, the 22" is actually more like a 15" monitor stretched. This wider display taxes the human peripheral vision as it is not as tall as we would expect from a display, so we tend to see dead space at the top of these 16:10 displays. As a comparison, a 21.3" 4:3 aspect ratio display (such as the NEC MultiSync LCD2110) will actually be a larger display than the 22" 16:10 display. An easy way to look at it is by pixel count. A display with a resolution of 1600 x 1200 pixels vs. a display with only 1600 x 1024 pixels clearly shows that the former is capable of showing more information.



16:10 Aspect Ratio (1600 x 1024)



CRT Diagonal Measurements	CRT Size	Recommended Resolution
17" = 12.84 x 9.63 = 16.05 in	17"	≤ 1024 x 768
19" = 14.46 x 10.86 = 18.08 in	19"	≤ 1280 x 1024
21" = 15.73 x 11.81 = 19.67 in	20-21"	≤ 1280 x 1024, Or < 1600 x 1200
22" = 16.04 x 12.05 = 20.06 in	22"	≤ 1600 x 1200

4:3 Aspect Ratio

Comparison of 4:3 and 16:9 screen sizes.

16 x 9 Diagonal Size	16 x 9 Hor. Size	16 x 9 Vert. Size	SQ. Area X * Y	16 x 10 Diagonal Size	16 x 10 Hor. Size	16 x 10 Vert. Size	SQ. Area X * Y	3 x 4 Diagonal Size	3 x 4 Hor. Size	3 x 4 Vert. Size	SQ. Area X * Y
12	10.5	5.9	61.531	12	10.2	6.4	64.719	12	9.6	7.2	69.120
14	12.2	6.9	83.751	14	11.9	7.4	88.090	14	11.2	8.4	94.080
16	13.9	7.8	109.389	16	13.6	8.5	115.056	16	12.8	9.6	122.880
18	15.7	8.8	138.445	18	15.3	9.5	145.618	18	14.4	10.8	155.520
20	17.4	9.8	170.920	20	17.0	10.6	179.775	20	16.0	12.0	192.000
21.3	18.6	10.4	193.862	21.3	18.1	11.3	203.906	21.3	17.0	12.8	217.771
22	19.2	10.8	206.813	22	18.7	11.7	217.528	22	17.6	13.2	232.320
24	20.9	11.8	246.125	24	20.4	12.7	258.876	24	19.2	14.4	276.480
26	22.7	12.7	288.855	26	22.0	13.8	303.820	26	20.8	15.6	324.480
28	24.4	13.7	335.003	28	23.7	14.8	352.360	28	22.4	16.8	376.320
30	26.1	14.7	384.570	30	25.4	15.9	404.494	30	24.0	18.0	432.000
32	27.9	15.7	437.555	32	27.1	17.0	460.225	32	25.6	19.2	491.520
34	29.6	16.7	493.958	34	28.8	18.0	519.551	34	27.2	20.4	554.880
36	31.4	17.6	553.780	36	30.5	19.1	582.472	36	28.8	21.6	622.080
38	33.1	18.6	617.021	38	32.2	20.1	648.989	38	30.4	22.8	693.120
40	34.9	19.6	683.679	40	33.9	21.2	719.101	40	32.0	24.0	768.000
42	36.6	20.6	753.757	42	35.6	22.3	792.809	42	33.6	25.2	846.720
44	38.3	21.6	827.252	44	37.3	23.3	870.112	44	35.2	26.4	929.280
46	40.1	22.6	904.166	46	39.0	24.4	951.011	46	36.8	27.6	1015.680
48	41.8	23.5	984.498	48	40.7	25.4	1035.506	48	38.4	28.8	1105.920
50	43.6	24.5	1068.249	50	42.4	26.5	1123.595	50	40.0	30.0	1200.000
52	45.3	25.5	1155.418	52	44.1	27.6	1215.281	52	41.6	31.2	1297.920
54	47.1	26.5	1246.006	54	45.8	28.6	1310.562	54	43.2	32.4	1399.680
56	48.8	27.5	1340.012	56	47.5	29.7	1409.438	56	44.8	33.6	1505.280
58	50.6	28.4	1437.436	58	49.2	30.7	1511.910	58	46.4	34.8	1614.720
60	52.3	29.4	1538.279	60	50.9	31.8	1617.977	60	48.0	36.0	1728.000
62	54.0	30.4	1642.540	62	52.6	32.9	1727.640	62	49.6	37.2	1845.120
64	55.8	31.4	1750.219	64	54.3	33.9	1840.899	64	51.2	38.4	1966.080
66	57.5	32.4	1861.317	66	56.0	35.0	1957.753	66	52.8	39.6	2090.880
68	59.3	33.3	1975.834	68	57.7	36.0	2078.202	68	54.4	40.8	2219.520
70	61.0	34.3	2093.768	70	59.4	37.1	2202.247	70	56.0	42.0	2352.000

Table courtesy of *The Guide to Digital Television, 2nd Edition, Revised and Expanded*, Silbergleid and Pescatore, Miller Freeman PSN, Inc., p. 132 (1999).

This white paper was published in and based on information as of September 2001. Technical information is subject to change.