

Annex M Aspect Ratio Notation (Informative)

Video formats and display screens come in a variety of aspect ratios. CE aspect ratios are usually 4x3 or 16x9. IT aspect ratios include 4x3, 5x4, 3x2, and 16x10. Modern motion picture film projectors typically support one (or more) of the following six ratios: $\approx 4x3$, 13x9, 5x3, $\approx 13x7$, $\approx 11x5$, and (or) $\approx 12x5$.

The shape of content varies as well. Most television programs continue to be shot at 4:3 (1.333...), while a growing number are shot at 16:9 (1.777...) - in order to accommodate the wider aspect of the new HDTV sets. Sometimes television content is shot in a compromise 14:9 "shoot & protect" format that lies midway between the 4:3 and 16:9 ratios. Here, a 16:9 image is "shot" with a "protected" 14:9 portion that can be more easily fitted into both 4:3 and 16:9 displays - without a lot of distracting waste. The shape of film content is quite variable. Old 35mm "Academy" classics have a $\approx 4x3$ ($\approx 1.37:1$) aperture, which almost matches the 4x3 shape of standard definition television interfaces and display screens. Modern films, on the other hand, are usually shot with very wide ratios - usually wider than HDTV. They are typically composed & projected from a $\approx 13x7$ (≈ 1.85) soft or hard matted¹ letterbox centered within the original 35mm classic Academy film aperture - using flat lenses² on both ends of the process. In Western Europe, things are much the same, except that a 5x3 letterbox and screen are used. Sometimes (x2) anamorphic lenses are used to reshape content, on both ends of the process, so that the entire 35mm "Academy" aperture is utilized. In this case, one lens - in the camera - horizontally squeezes a $\approx 12x5$ ($\approx 2.39:1$) scene into the 35mm Academy aperture, while a complimentary lens in the projector horizontally stretches the content back to normal for projection on a $\approx 12x5$ ($\approx 2.39:1$) screen. 70mm films are normally shot and displayed with an $\approx 11x5$ ($\approx 2.20:1$) aspect ratio - using a flat lenses on both ends. One of the widest films ever shot was MGM's "BEN-HUR", which had a vast 2.76:1 aspect ratio. Here, a 70mm process was used, but with (x1.25) anamorphic lenses on both ends. The IMAX process - a variation of flat 70mm - rotates and enlarges (by 3x) the image on the film so that the projected quality is significantly increased. IMAX captures and projects a 13x9 ($\approx 1.44:1$) image - again using a flat lens on both ends.

When working with video systems that support multiple aspect ratios, it is desirable to have a way to represent aspect ratios very succinctly (e.g. when naming video formats). Therefore, a system of single-letter symbols has been developed to express standard aspect ratios. This system is summarized in Table 96.

¹ Many motion pictures are composed on film having a 1.37:1 "Academy" ratio. In order to obtain the wide aperture of theatrical display, the top and bottom-most areas of the native "Academy" aperture are simply cropped or "matted". This matting operation can be done either sooner (e.g. in the camera), later (e.g. in the projector), somewhere in-between (e.g. in a DVD mastering process), or not at all. Films that are cropped immediately are said to be "hard" or "closed" matted, whereas films that are not, are said to be a "soft" or "open" matted. Maintaining a "soft" or "open" matte, throughout the production process, allows the same 1.37:1 content to be matted in a variety of ways - in the back end - in order to accommodate a variety of aspect ratios - such as those that would be more conducive to television and DVD distribution. Hard matting, on the other hand, insures that spurious content (e.g. boom microphones) will never be accidentally revealed in the final presentation.

² Two different types of lenses are used in film production and display: flat and anamorphic. Flat lenses do not distort the image, while anamorphic lenses shrink and stretch the image along the horizontal axis (usually by a factor of 2).

Value	Fraction	Symbol	Description	Example(s)
1.000	1x1	Q	Quadrate, "Square"	512x512, 1024x1024
1.250	5x4	G	Workstation Graphics	1280x1024, 1600x1280
1.333...	4x3	T	SDTV / Silent Film	640x480, 800x600, 1024x768, 1280x960, 1600x1200
≈1.37	≈4x3	C ¹	"Classic" Film ² w/Sound	0.825x0.602 SMPTE RP40 35mm "C"
1.444...	13x9	I	Maximum Image	IMAX™
1.500	3x2	V	Three Two	1152x768 Apple Computer, (uncropped) Vista Vision™
1.555...	14x9	M	Mid	AFD Shoot & Protect (half-way between 4x3 and 16x9)
1.600	16x10	D	Desktop	1728x1080, 1280x800, see VESA CVT 1.0
1.666...	5x3	E ¹	European Film, "1.66"	1200x720, 1280x768, 1800x1080
1.750	7x4	Z	Legacy Film	Legacy Metro-Goldwyn-Mayer & Disney Films
1.777...	16x9	H	HDTV	1280x720, 1920x1080
≈1.85	≈13x7	A ¹	North American Film	1280x692, 1920x1038, 0.825x0.446 SMPTE RP40 35mm "A"
2.000	2x1	U	Double Width	1280x640, 1920x960, Univisum™
≈2.20	≈11x5	F	"Flat", MPEG "20x9"	1280x582, 1920x874, 1.912x0.870 SMPTE RP91 70mm
≈2.39	≈12x5	B ¹	Anamorphic Film, "2.35" ³	1280x536, 1920x804, 1.650x0.690 SMPTE RP40 35mm "B"
Notes: <ol style="list-style-type: none"> These symbols are compatible with SMPTE RP40 35mm projectable image area style letters – except for the European 1.666 ratio "E". CEA-861-E provides unique symbols for all five ratios mentioned in SMPTE RP40 (Section A.3). In 1932, the shape of film was changed from 1.33:1 to 1.37:1 in order to better accommodate the new optical soundtrack that was added a few years earlier. This slightly wider shape is the true aspect ratio of "classic" film. The aperture is commonly referred to as "Academy" and was the shape of the vast majority of U.S. films produced until the 1950s. Sometimes called "2.35", which was the aspect ratio before it was changed to 2.39:1 in 1971 to keep splices from showing-up in the projected image. 				

Table 96 Aspect Ratio Symbol Table