Connecteur VGA

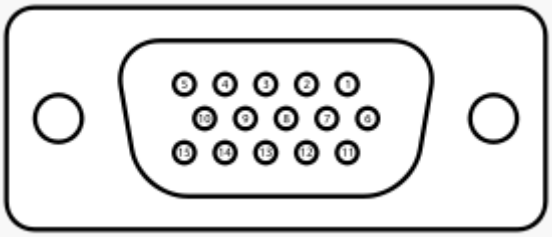
Un **connecteur VGA** est un connecteur de type DE-15, utilisé pour connecter une carte graphique à un moniteur informatique en analogique. Ce connecteur est parfois appelé **connecteur RGB**, **HD-15** ou **D-sub 15**. Il possède 15 broches organisées en trois rangées. Ce connecteur existe en deux générations : version originelle[1], et version DDC2, qui permet la détection automatique du type de moniteur[2]. Certains ordinateurs portables sont équipés d'une variante miniature de ce connecteur, le Mini-VGA. D'anciennes cartes graphiques ont utilisé un connecteur de type DE-9.

Les câbles et connecteurs VGA sont utilisés pour transmettre les composantes vidéo analogiques RGBHV (rouge, vert, bleu, synchronisation horizontale, synchronisation verticale), ainsi que des signaux numériques DDC2 d'identification des moniteurs. Ces derniers signaux utilisent un bus I²C qui occupe deux broches (données et horloges).

La spécification de Microsoft PC 99 a attribué la couleur bleue aux connecteurs VGA. Les fabricants se sont rapidement conformés à ce code de couleurs.

Malgré une utilisation de plus en plus fréquente du connecteur DVI, le connecteur VGA à 15 broches continue d'équiper la plupart des cartes graphiques, moniteurs informatiques, vidéoprojecteurs, etc.

Connecteur VGA	
 Un connecteur VGA	
Type	Connecteur d'écran informatique analogique
Historique de production	
Concepteur	IBM, à partir de la famille D-subminiature
Conçu en	1987
Produit	1987 à aujourd'hui
Remplacé par	DVI (1999)
Spécifications	
Signal vidéo	signal vidéo RGB, et éventuellement synchronisations horizontale et verticale
Signal de données	bus I²C pour les informations DDC
Broches	15
Connecteur	DE-15

Brochage		
 Prise DE-15 femelle.		
n°1	RED	Vidéo rouge
n°2	GREEN	Vidéo vert
n°3	BLUE	Vidéo bleu
n°4	N/C	Non connecté
n°5	GND	Masse (HSync)
n°6	RED_RTN	Retour rouge
n°7	GREEN_RTN	Retour vert
n°8	BLUE_RTN	Retour bleu
n°9	+5 V	+5 V (DDC)
n°10	GND	Masse (VSync, DDC)
n°11	N/C	Non connecté
n°12	SDA	données I²C (DDC)
n°13	HSync	Synchronisation horizontale
n°14	VSync	Synchronisation verticale
n°15	SCL	Horloge I²C (DDC)
L'image et le tableau de brochage traitent des connecteurs VESA DDC2. La numérotation des broches sur le diagramme correspond au connecteur femelle situé sur une carte graphique. La numérotation d'un connecteur mâle, généralement monté sur un câble, est symétrique.		

Video Graphics Array - VGA

The term **Video Graphics Array** (**VGA**) refers specifically to the display hardware first introduced with the IBM PS/2 line of computers in 1987[1], but through its widespread adoption has also come to mean either an analog computer display standard, the 15-pin D-subminiature VGA connector, or the 640×480 resolution itself. While this resolution has been superseded in the personal computer market, it is becoming a popular resolution on mobile devices.[2]

VGA was the last graphical standard introduced by IBM that the majority of PC clone manufacturers conformed to, making it today (as of 2008) the lowest common denominator that all PC graphics hardware supports before a device-specific driver is loaded into the computer. For example, the Microsoft Windows splash screen appears while the machine is still operating in VGA mode, which is the reason that this screen always appears in reduced resolution and color depth.

VGA was officially superseded by IBM's XGA standard, but in reality it was superseded by numerous slightly different extensions to VGA made by clone manufacturers that came to be known collectively as "Super VGA".

Technical details

VGA is referred to as an "array" instead of an "adapter" because it was implemented from the start as a single chip, replacing the Motorola 6845 and dozens of discrete logic chips covering a full-length ISA board that the MDA, CGA, and EGA used. This also allowed it to be placed directly on a PC's motherboard with a minimum of difficulty (it only required video memory, timing crystals and an external RAMDAC), and the first IBM PS/2 models were equipped with VGA on the motherboard.

The VGA specifications are as follows:

- 256 KB Video RAM (The very first cards could be ordered with 64KB or 128KB of RAM at the cost of losing some video modes).
- 16-color and 256-color modes
- 262,144-value color palette (six bits each for red, green, and blue)
- Selectable 25.175 MHz [3] or 28.322 MHz master clock
- Maximum of 800 horizontal pixels[4]
- Maximum of 600 lines[5]
- Refresh rates at up to 70 Hz [6]
- Vertical blank interrupt (Not all clone cards support this.)
- Planar mode: up to 16 colors (4 bit planes)
- Packed-pixel mode: 256 colors (Mode 13h)
- Hardware smooth scrolling support
- Some "Raster Ops" support
- Barrel shifter
- Split screen support
- 0.7 V peak-to-peak [7]
- 75 ohm double-terminated impedance (18.7mA - 13mW)

The VGA supports both All Points Addressable graphics modes, and alphanumeric text modes. Standard graphics modes are

- 640×480 in 16 colors
- 640×350 in 16 colors
- 320×200 in 16 colors
- 320×200 in 256 colors (Mode 13h)

As well as the standard modes, VGA can be configured to emulate many of the modes of its predecessors (EGA, CGA, and MDA).

The pinout can be found in the VGA connector page.

[edit] Standard text modes

Standard alphanumeric text modes for the VGA use 80×25 or 40×25 text cells. Each cell may choose from one of 16 available colors for its foreground and 8 colors for the background; the 8 background colors allowed are the ones without the high-intensity bit set. Each character may also be made to blink; all that are set to blink will blink in unison. The blinking option for the entire screen can be exchanged for the ability to choose the background color for each cell from among all 16 colors. All of these options are the same as those on the CGA adapter as introduced by IBM.

Like EGA, VGA supports 512 simultaneous characters on screen by disabling one color bit. The glyphs on 80×25 mode are normally made of 9×16 pixels. Users may define their own character set by loading a custom font onto the card. As character data is 8-bit wide, some characters are normally made 9 bit wide by repeating the last vertical line, especially those defining horizontal IBM box drawing characters.[8]

VGA adapters usually support both a monochrome and a color text mode, though the monochrome mode is almost never used. Black and white text on nearly all modern VGA adapters is drawn by using gray colored text on a black background in color mode. VGA monochrome monitors were sold (intended primarily for text applications), but most of them will work at least adequately with a VGA adapter in color mode. Occasionally a faulty connection between a modern monitor and video card will cause the VGA part of the card to detect the monitor as monochrome, and this will cause the BIOS and initial boot sequence to appear in greyscale. Usually once the video card's drivers are loaded (for example by continuing to boot into the operating system) they will override this detection and the monitor will return to color.

In color text mode, each screen character is actually represented by two bytes. The lower, or character byte is the actual character for the current character set, and the higher, or attribute byte is a bit field used to select various video attributes such as color, blinking, character set, and so forth. This byte-pair scheme is among the features that VGA inherited ultimately from CGA.

The VGA color palette

See also the List of monochrome and RGB palettes article — 18-bit RGB section, and the List of 16-bit computer hardware palettes article — MCGA and VGA section.

VGA 256 color palette

The VGA color system is backwards compatible with the EGA and CGA adapters, and adds another level of configuration on top of that. CGA was able to display up to 16 colors, and EGA extended this by allowing each of the 16 colors to be chosen from a 64-color palette (these 64 colors are made up of two bits each for red, green and blue: two bits × three channels = six bits = 64 different values). VGA further extends this scheme by increasing the EGA palette from 64 entries to 256 entries. Two more blocks of 64 colors with progressively darker shades were added, along with 8 "blank" entries that were set to black. [9]

In addition to the extended palette, each of the 256 entries could be assigned an arbitrary color value through the VGA DAC. The EGA BIOS only allowed 2 bits per channel to represent each entry, while VGA allowed 6 bits to represent the intensity of each of the three primaries (red, blue and green). This provided a total of 64 different intensity levels for red, green and blue, resulting in 262,144 possible colors, any 256 of which could be assigned to the palette (and in turn out of those 256, any 16 of them could be displayed in CGA video modes).

This method allowed new VGA colors to be used in EGA and CGA graphics modes, providing one remembered how the different palette systems are laid together. To set the text color to very dark red in text mode, for instance, it will need to be set to one of the CGA colors (for example, the default color, #7: light grey.) This color then maps to one in the EGA palette — in the case of CGA color 7, it maps to EGA palette entry 42. The VGA DAC must then be configured to change color 42 to dark red, and then immediately anything displayed on the screen in light-grey (CGA color 7) will become dark red. This feature was often used in 256-color VGA DOS games when they first loaded, by smoothly fading out the text screen to black.

While CGA and EGA-compatible modes only allowed 16 colors to be displayed at any one time, other VGA modes, such as the widely used mode 13h, allowed all 256 palette entries to be displayed on the screen at the same time, and so in these modes any 256 colors could be shown out of the 262,144 colors available.

Programming tricks

An undocumented but popular technique nicknamed Mode X (first coined by Michael Abrash) or "tweaked VGA" was used to make programming techniques and graphics resolutions available that were not otherwise possible in the standard Mode 13h. This was done by "unchaining" the 256 KB VGA memory into four separate "planes", which would make all of VGA's 256 KB of RAM available in 256-color modes. There was a trade-off for extra complexity and performance loss in some types of graphics operations, but this was mitigated by other operations becoming faster in certain situations:

- Single-color polygon filling could be accelerated due to the ability to set four pixels with a single write to the hardware.
- The video adapter could assist in copying video RAM regions, which was sometimes faster than doing this with the relatively slow CPU-to-VGA interface.
- Several higher-resolution display modes were possible: at 16 colors, 704×528, 736×552, 768×576, and even 800×600 were possible. Software such as Xlib (a VGA graphics library for C in the early 1990s) and ColoRIX (a 256-color graphics program), also supported tweaked 256-color modes using many combinations of columns of 256, 320, and 360 pixels, and rows of 200, 240, 256, 400, and 480 lines (the upper limit being 640×400 which used 250 KB of VGA's 256 KB video ram). However, 320×240 was the best known and most-frequently used since it was a typical 4:3 aspect ratio resolution with square pixels.
- The use of multiple video pages in hardware allowed the programmer to perform double buffering or triple buffering, which, while available in VGA's 320×200 16-color mode, was not possible using stock Mode 13h.

Sometimes the monitor refresh rate had to be reduced to accommodate these modes, increasing eye strain. They were also incompatible with some older monitors, producing display problems such as picture detail disappearing into overscan, flickering, vertical roll, and lack of horizontal sync depending on the mode being attempted. Because of this, most VGA tweaks used in commercial products were limited to "monitor-safe" combinations, such as 320×240 (square pixels, three video pages), 320×400 (double resolution, two video pages), and 360×480 (highest resolution compatible with standard VGA monitors, one video page). Currently, the highest known tweaked VGA resolution is 400×600×256 (400×600 pixel × 256 colors). It is used in Fractint - a famous fractal generator.