PLUS

Digital Projector

[Handbook]

PICTURE BY DLP™ A TEXAS INSTRUMENTS TECHNOLOGY

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PLUS: The Number One Manufacturer of DLP™ Projectors in Japan*

* Study by Fuji Chimera Research Institute, Inc., 2004

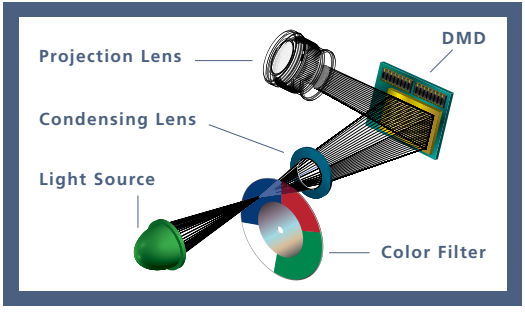
PICTURE BY DLP™ A TEXAS INSTRUMENTS TECHNOLOGY

Advantages of the DLP™ projection system:

- Designed for compact and lightweight projectors
- Superior image quality with superb color alignment and uniformity
- Superfine micromirror grid on the DMD chip produces seamless images
- Smooth reproduction of moving images
- Stable, long-lasting image quality
- Crisp, bright, high-contrast imaging

CONTENTS

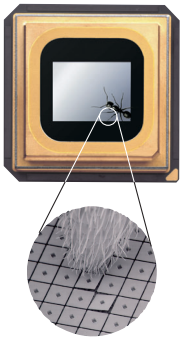
The DLP™ (Digital Light Processing) system is an all-digital image processing technology developed by Texas Instruments, Inc. The heart of a DLP™ projector is a semiconductor element called the DMD (Digital Micromirror Device).



Features of PLUS projectors

PLUS uses DLP™ technology in all its projectors. But how does this work, and what are its unique features?

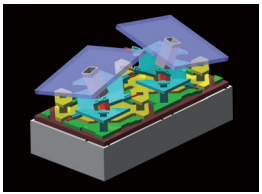
DMD chip and the leg of an ant



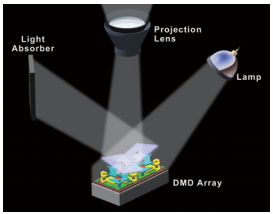
How a DLP™ projector works

Developed in 1987 by Texas Instruments, Inc., DMD consists of between 480,000 and 1.31 million individually tiltable mirror-pixels arrayed on a CMOS semiconductor chip. The digitally controlled angle of reflection of each of these mirrors is what switches the light on and off.

The single-chip DMD projection system used in PLUS projectors passes the light from a projection lamp through a rotating color filter (color wheel) and onto the DMD mirror array. The reflected light is then sent through the projection lens and onto the screen.



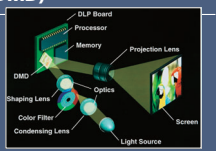
Movement of the mirrors



DLP™ projection system (1-chip DMD)

A single DMD chip switches between R, G, and B signals and projects the resulting images.

Because the DMD executes thousands of on/off commands a second, motion pictures can reproduced smoothly and naturally.

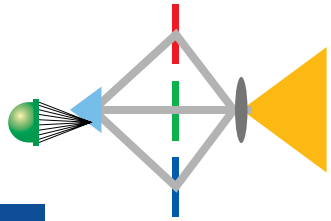


The difference between DLP™ and LCD systems

There are two main types of projection system: DLP™ and liquid crystal displays (LCD).

The LCD system breaks the light from the projection lamp into the RGB (red, green. blue) primary colors, passes each through a separate liquid crystal panel, and then uses a prism to reintegrate them for projection onto the screen.

Drawbacks inherent to this system are the weakening of the light source as it is passed through the liquid crystal panels, and the fact that three of these panels are required, making it difficult to reduce the size of the projector. Liquid crystals have another weakness as well: the quality of the image degrades over extended periods of use.



Did You Know?

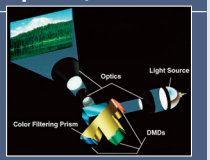
DLP™ Fun Facts

PLUS projectors use a single-chip DMD configuration, but large-scale DLP™ projectors for cinematic and other applications use three DMD chips.

As of the fourth quarter of 2004, DLP™ projectors accounted for 47% of the world market for front projectors.

DLP™ Cinematic Projectors (3-chip DMD)

Each of the three primary colors—R, G, and B—is assigned to a specific chip. With an independent DMD processing each color, the projector can deliver even more superb and powerful large-screen images.



The superiority of DLP™ technology

The DLP™ system offers the following advantages:

❶ Simple design facilitates reduced size and weight

The DMD that is the key device in the DLP™ system has a simplicity of design that makes possible significant reductions in the size and weight of the projector itself. From the time DLP™ projectors made their debut, they have been rewriting the records for the world's smallest and lightest projectors. PLUS is currently ranked as the number one manufacturer of mobile projectors in Japan.*

* For projectors weighing 1.5 kg or less. Study by Fuji Chimera Research Institute, Inc., 2004

❷ Reflective system reduces light loss

The DLP™ system is a reflective system. Light from the light source is bounced off the tiny mirrors on the chip, so there is almost no light loss, unlike LCD systems in which the light must pass through the liquid crystal. Because of this, even ultra-compact projectors deliver superior brightness, projecting a clear image even in a fully-lit room.

❸ Superior image reliability

Performance of liquid-crystal displays inherently degrades over time, but with the reflective system utilized in the DMD there is no adverse effect of heat or light to cause image degradation. Stable and reliable image quality is maintained, even with extended use.

See opposite page

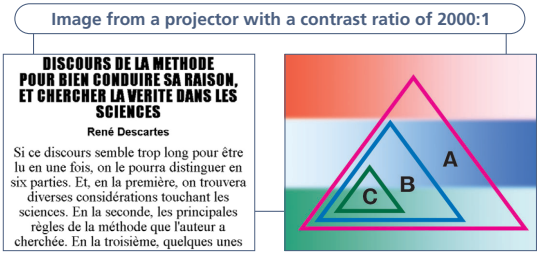
Changes in Image Quality over Time

* From an evaluation published by the Munsell Color Science Laboratory, Rochester Institute of Technology (January 2004)

❹ High contrast ratio delivers vivid images

The contrast ratio is the difference in brightness between the lightest and darkest parts of the image. The higher the contrast ratio, the crisper and sharper the image and the easier it is to see text and lines. A low contrast ratio gives a washed-out, poorly-defined image.

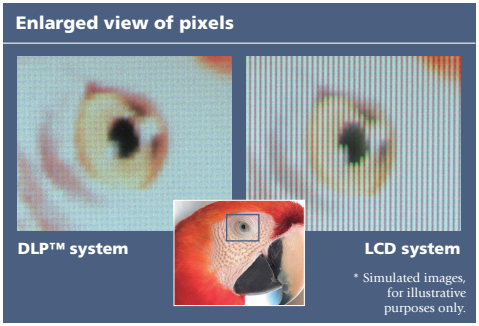
Brightness alone (measured in lumens, lm) is not enough. The contrast ratio plays a huge part in determining image quality. All PLUS projectors feature a high contrast ratio of 2000:1 (full on/off).



* Simulated images, for explanatory purposes only.

❺ Seamless high-resolution images

In the DLP™ system the thousands of micromirrors on the DMD are the equivalent of pixels. Since each of them is individually controlled from their back surface, the gap between them is drastically reduced. On the other hand, liquid-crystal displays are configured in such a way that the control mechanism must use the space between pixels, making it very difficult to hide this gap. The micromirrors on the DMD are spaced less than a micron apart, allowing it to project a more seamless high-resolution image than is possible with LCD systems.



❻ Superior moving image reproduction

The reflective mirrors on the DMD switch on and off at ultra-high speeds of thousands of cycles a second. This amazingly fast response time delivers a superior capability for the reproduction of even very rapidly moving images.

❼ Superb color alignment and uniformity

LCD projectors break light into the three RGB colors and then reassemble it to reproduce the image. This means that they are susceptible to misaligned and patchy color, as well as blurring of text. PLUS projectors use a single color wheel to reproduce all three colors, giving crisp, uniform color without blurring, so that even detailed graphics are rendered with clarity.

Digital Projector [Sales Handbook]

Unique PLUS Technology

New Advanced Color Wheel (ACW)

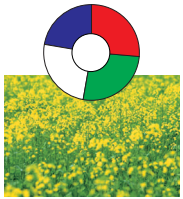
PLUS optics technology has always assisted in demonstrating the superiority of the DLP™ system.

The latest product born from this pursuit of excellence is the Advanced Color Wheel. With its introduction, color reproduction takes a major step forward.

[Specific modifications:]

①Improved positioning (angle) of the RGB (red, green, blue) colors on the wheel

②Enhanced coating on the G (green) portion of the filter.



The color reproduction has been improved further by optimizing the combination of the two modifications.

High-quality design of projector bodies, emphasizing ease of use

From the retractable lens on the V3-131, created with slimness in mind, to the iris lens cover on the V-332, developed from the standpoint of the user, uniquely refined and user-friendly design has won the support of a huge customer base and helped make PLUS the number one choice in mobile projectors in Japan.

V3-131

V-332

The History of PLUS Projectors

The history of PLUS is the history of the mobile projector.
From the time that PLUS announced the world's smallest projector in 1998, it has continued as the pacesetter in this field.

1998 Japan's first DLP™ projector (1-chip), the UP-800 introduced.
The ultra-portable size and weighing 4.5 kg, it was an epochal reduction in size, establishing the concept of the road warrior projector.
It was followed by the introduction of what was then the world's smallest true XGA projector, the UP-1100.

1999 Introduction of the U2 Series of ultra-compact, ultra-light (about 2.5 kg) projectors.

2001 Introduction of the world's smallest, lightest (1 kg) ultra-mobile projectors, the V Series
Introduction of the Piano projector for home theater use.

2003 Introduction of the U4 Series, the brightest projectors in the lightweight mobile class.
U5 Series of multipurpose projectors introduced.
World's thinnest (35 mm) projectors—the V3 Series—introduced.

2004 World's lightest wireless/PC-less mobile projectors (U4 Series) introduced.
New models featuring increased mobility introduced for the V Series

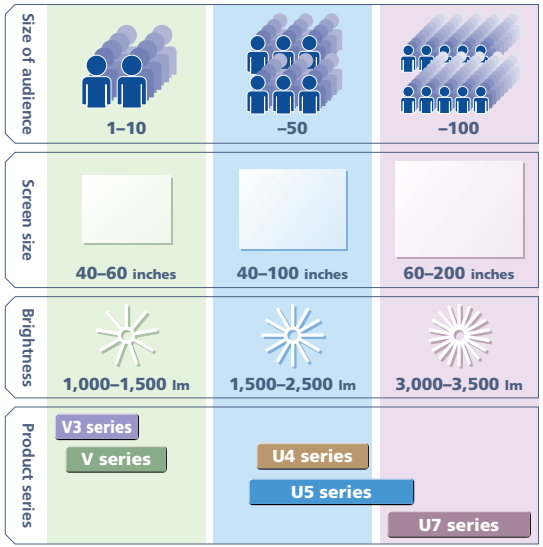
2005 U7 Series introduced—a high-powered multifunctional series featuring the world's highest brightness in their class (3500lm)

Choosing a Projector

Key points in choosing a projector

The rule of thumb for choosing a projector should be based on whether it has sufficient brightness to work well for the size of room it is to be used in (projection size) and the number of people in the anticipated audience. In addition, the PC graphic resolutions that it supports should be considered. For example, if it is to be used in a small conference room with an audience of no more than eight to ten people, a brightness of 1000–1500 lumens is probably sufficient, but would be inadequate in a larger room with more than fifty people in attendance. Of course, if it is to be used as a sales and marketing tool, portability will also be a key point.

Recommend a model of PLUS projector that best suits your client's sense of where and how it is to be used.



* Can vary with room lighting and other aspects of the use environment.

PLUS product lineup meets a variety of needs

PLUS has five different series of projectors based on different design concepts. Below is a comparison chart of the intended uses and special features for each series.

	Uses	Features
V3 series 	Road warrior presentations, desk-side meetings, small conference rooms. etc.	Brightness of 1,000 lm. World's thinnest at 35 mm. World's smallest and lightest class 1 kg). Short-focus model capable of projecting onto a 40-inch screen from 1.3 m distance.
V series 	Road warrior presentations, desk-side meetings, small conference rooms. etc.	Brightness of 1,200 lm. Light, compact, mobile (1.3 kg). "Unplug and Go" feature for immediate stowing after use
U4 series 	Road warrior presentations, small- and mid-sized conference rooms, etc.	Brightness of 2,000 lm. One of the models with wireless/PC-free operation, using a CF card to store presentation data.
U5 series 	Mid- to large-sized conference rooms, classrooms, seminars, etc.	Three models ranging in brightness from 1,800– 2,200 lm. In addition to a monochrome bright mode of 3000 lm, the U5-632 model is equipped with a short-focus zoom lens.
U7 series 	Mid- to large-sized conference rooms, classrooms, seminars, etc.	High brightness from 3,000 to 3,500 lm. Capable of projecting onto a 100-inch screen in daylight conditions without drawing the curtains. U7-137 features wireless/PC-free operation.

PLUS Projectors: Built-in Features

A wealth of convenient features

Introducing the variety of convenient features built into PLUS projectors.

For a comparison chart of features by projector model, see pp. 24–25.

Easy Set-Up

"Unplug and Go"

Even after you pull the plug, the cooling fan continues to rotate for the cool-down. When your presentation is over, you can pack it up immediately and take it somewhere else.

Auto-Source

Projector automatically distinguishes between RGB and video input sources.

Auto-adjustment

Automatically tunes the RGB phase, clock frequency, and resolution to achieve the optimal image.

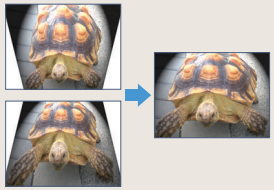
Did You Know?

What is keystoning?

When the projector is placed in proper orientation to the screen, you get an undistorted, rectangular image area. But if the positioning is off, the result is a skewed image. This is what is called "keystoning."

* Images are simulated for illustrative purposes.

Keystoning and its digital correction



Keystoning resulting from vertical misalignment can be corrected digitally

Digital keystone correction (vertical)

Keystoning resulting from vertical misalignment can be corrected digitally. The elevation of the angle of projection is set in advance on PLUS projectors, making keystoning unlikely.

One-touch height adjustment

Adjusts the height of the projector with a single button controlling the front foot.

Quick color adjustment

Enables you to switch easily between brightness mode, which places priority on brightness, color mode, which emphasizes color reproduction, and custom mode, which allows users to save their favorite color arrangements, to suit the nature of your image source.

Lens cover

A sliding or iris lens cover protects the lens during transit and storage.

Special Features for Presentations

Digital Zoom (2x)

Magnifies any portion of the projected image, making small characters and numbers easy to read.

Freeze Function

Halts the projected image. Useful when preparing the next file for presentation. Also functions as a video pause button.

Mute

Suppresses both image and sound. Useful when you want the audience to focus on what the presenter is saying, or on handouts and other materials.

Presentation Timer

Displays remaining time on screen in ten-minute increments, and can be set for anywhere from 10 to 60 minutes.

Bright Mode (monochrome)

This mode option, selected from the setup menu, is for high brightness monochrome projection. Useful for detailed text and projection onto blackboards.

Eco-mode

Projects at 70–80% of normal brightness. Conserves power, reduces cooling fan sound, and prolongs the life of the lamp.

Front ventilation

Keeps exhaust air away from audience members sitting beside the projector, providing a distraction-free viewing environment.

Low Noise

The fan has been suitably positioned within the projector to enhance noise reduction.

Remote Control Card

The projector's controls have been integrated into an ultra-portable card-type remote.

Remote Mouse and Laser Pointer

Connect the projector to your PC with a mouse cable, and you can use this remote to control the computer's cursor. Doubles as a laser pointer.

Remote Mouse

Control the computer cursor with the projector's remote. Separately sold VR-100 Remote Mouse Set required for some models.

High-Resolution Image Reproduction

Progressive DVD input (480p, 576p)

The component video cable enables progressive DVD input. Supports 16:9 widescreen aspect ratio.

HDTV broadcast input (1080i, 720p)

You can also project digital HDTV broadcasts. Supports 16:9 widescreen aspect ratio.

Component Signal compatible

This feature allows the projector to be connected to a variety of input devices such as DVD recorders and digital HDTV tuners, making it possible to enjoy high-resolution projections of movies, sports, and other entertainment in your own home.

Line-doubling function

I-P conversion makes possible even smoother reproduction of video images.

Built-in DVI terminal

The Digital Visual Interface (DVI) terminal enables direct digital transmission, maximizing the advantages offered by the DLP™ system based on the all-digital DMD device. Since there is no degradation of the digital source, the result is the highest image quality possible.

*Digital RGB input requires a third-party DVI-D cable.

Double Security

Security Password

Projectors can be set to require the input of password at startup. We recommend affixing a label to your projector indicating that it is password-protected to prevent tampering or theft.

Security slot

Accommodates use of third-party anti-theft cables. The cable attaches to a desk or other fixed object, and the lock fits snugly into the security slot.

Wireless / Wired Network / PC-Free Operation

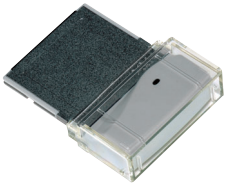
Here we'll focus on the features supporting wireless, wired network, and PC-free operation of the projector.

Wireless operation (U4-237/U7-137)

Wireless LAN technology* creates a smarter, more enjoyable presentation environment. *IEEE 802.11b standard

No need for RGB cable

A CF-type wireless LAN card comes with the projector as a standard feature. Inserted into the projector, it allows wireless transmission of images from a PC to the projector. Since there is no need to use an RGB cable to connect the two devices, the hassle of setup is greatly reduced.

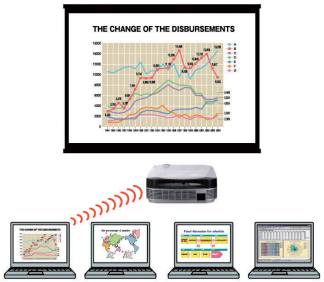


Wireless LAN card

*Requires a wireless LAN-enabled PC or a second wireless LAN card for the PC.
*Compatible with Microsoft Windows 2000/XP Professional/XP Home Edition/XP Tablet PC Edition
*Not compatible with Mac OS

Image transmission from multiple PCs

A single projector can receive image transmissions from more than one PC. Since transmission is wireless, switchover from one PC to another is easy, without any need to reattach RGB cables. Compatible with WEP, a standard wireless LAN security protocol, allowing encryption of graphic data for transmission.



"Wireless to Go" enables easy and friendly operation

Packed utility software "Wireless to Go" implement such wireless connection through easy and friendly operation.

Remote control of projector from a LAN-connected PC

From a PC connected to a LAN, a Web browser can be used to control and monitor the basic functions of the projector *(on/off, input mode change, etc.). Using TELNET protocol, an even higher level of control is possible.

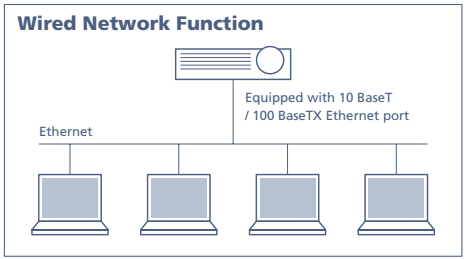
Wired network feature (U7-137)

This feature enables high-speed image transmission and remote control of the projector from a wired network.

The projector is equipped with a 10 BaseT/100 BaseTX Ethernet port. From a networked PC, a Web browser may be used to control and monitor the basic functions of the projector *(on/off, input mode change, etc.). Using TELNET protocol, an even higher level of control is possible.

A wired network permits much higher rates of image transmission and projection than a wireless LAN.

Moreover, there is no need to connect the projector to a PC with an RGB cable, thus eliminating any restrictions on positioning and distance between devices.



PC-free operation (U4-237/U7-137)

Enables PC-free presentations using an internal Image Viewer.

The CF card slot, built-in USB port (U7-137 only), and on-board Image Viewer enable PC-free presentation capability, allowing projection of image files stored in USB memory or CF card/CF card adapter-compatible media without the use of a computer.

In addition to image files, the Image Viewer is also able to project PowerPoint files incorporating animation effects (some effects not supported).

USB port

CF card slot

Compatible media: CF cards, media using a CF-card adapter (SD Memory Card, Memory Stick, Multimedia Card), USB memory (U7-137 only)

Readable data formats: 3.5 MB or smaller JPEG, BMP, PNG, TIFF 6.0, PDB image formats; PPT- and PPS-formatted PowerPoint files (progressive JPEG and some other formats are not readable)

Supported PowerPoint versions: PowerPoint 2003, PowerPoint 2002, PowerPoint 2000, PowerPoint 97 (some animation formats not supported)

PLUS Projectors: Built-in Features

Quick search of image files

In List Review (Thumbnail) mode, the names of the image files are displayed in alphabetical order with thumbnails* of their images appearing to their right. When Slideshow is selected from List Review, the display switches over to Picture Review (Full-screen) mode, projecting the image files full-screen as either an automatic or manually controlled slideshow.

*In single icon display mode. Works only with JPEG files containing thumbnail data.

Sharing data from PLUS copyboards

This permits data transfer from the PLUS M Series of copyboards, which are equipped with an internal CF card slot. Minutes of meetings, ideas, any data written on the copyboard can be stored on a CF card, which can then be removed and inserted into the CF slot on the projector for large-screen display—a paperless way to share important information.

PC control

Many of the PLUS projectors can be controlled with a PC by using the RS-232C connection, Telnet or Web browser.

See pages 24-25 for supported models.

Digital Projector [Sales Handbook]

PLUS Projectors: Built-in Features

Features for each model

	Functions	V3-131	V-332	U4-237	U4-232h	U5-732	U5-632	U5-532	U5-512	U7-137	U7-132h	U7-132
Easy Set-Up	Unplug and Go		●									
	Auto-source	●	●	●	●	●	●	●	●	●	●	●
	Auto-adjustment	●	●	●	●	●	●	●	●	●	●	●
	Digital keystone correction (vertical)	●	●	●	●	●	●	●	●	●	●	●
	One-touch height adjustment	●	●	●	●	●	●	●	●	●	●	●
	Quick color adjustment	●	●	●	●	●	●	●	●	●	●	●
	Lens cover	● slide	● iris									
Special Features for Presentations	PC-less presentation			●*2						●*3		
	Wireless presentation			●						●		
	Wired network feature									●		
	Wired network control			●						●		
	Digital zoom	●	●	●	●	●	●	●	●	●	●	●
	Freeze function	●	●	●	●	●	●	●	●	●	●	●
	Mute function	●	●	●	●	●	●	●	●	●	●	●
	Presentation timer	●	●	●	●	●	●	●	●	●	●	●
	Bright mode (monochrome)						●					
	Eco-mode	●	●	●	●	●	●	●	●	●	●	●
	Front ventilation		●	●	●	●	●	●	●	●	●	●
	Low noise					●	●	●	●			
	Remote control card	●	●	●	●	●		●	●			
	Remote mouse and laser pointer						●			●	●	●
	Remote mouse	●*1	●*1	●*1	●*1	●*1	●	●*1	●*1	●	●	●
	PC control			★*4		RS232C	RS232C	RS232C		RS232C ★*4	RS232C	RS232C
High-Resolution Image Reproduction	Progressive DVD input (480p, 576p)	●	●	●	●	●	●	●	●	●	●	●
	HDTV broadcast input (1080i, 720p)	●	●	●	●	●	●	●	●	●	●	●
	Component signal compatible	●	●	●	●	●	●	●	●	●	●	●
	Line-doubling function	●	●	●	●	●	●	●	●	●	●	●
	Built-in DVI terminal			●	●					●	●	●
	ACW featured				●	●	●	●	●	●	●	●
Double Security	Security password	●	●	●	●	●	●	●	●	●	●	●
	Security slot	●	●	●	●	●	●	●	●	●	●	●

*1:Separately sold VR-100 Remote Mouse Set required *2:CF card slot *3:CF card slot, USB port
*4:Telnet/Web browser (through wireless (U4-237/U7-137) or wired (U7-137) LAN network)

A Glossary of Projector Terminology

Analog RGB
PC digital image data converted to analog on the basis of the RGB color mode.

Angle of view
Numeric value serving as an index of visibility from positions at an angle to the screen.
It may also be described as wide or narrow.

Aspect ratio
The horizontal to vertical ratio of dots and displays. The common display resolutions of 800 x 600 pixels or 1024 x 768 correspond to an aspect ratio of 4:3.

Component terminal
A terminal designed to transmit the video signal as three separate component signals: Y (luminance), and two forms of color signal, B-Y (blue minus luminance) and R-Y (red minus luminance). Unlike the composite mode, which treats luminance and color as a single mixed signal, and is thus subject to data loss and noise interference as a result of the process of mixing and separating the signals, the component mode is capable of comparatively pure transmission.

Composite (RCA) terminal
A terminal that transmits luminance and chrominance as a composite (mixed) signal. When hooking up a video deck or similar device, this is the terminal that takes the red-yellow-white three-headed cable (yellow = picture, red and white = sound). Standard transmission signals for this include NTSC and PAL.

Contrast ratio
The ratio of light to dark that the screen is capable of displaying. Higher contrast produces more highly defined color.

Full on/off measurement
A method for measuring contrast ratio that compares the luminance values of an all-white (on) and an all-black (off) signal.

I-P conversion
This refers to the conversion of an interlaced image (which reproduces a picture by weaving together alternate lines from two separate image fields) into a single progressive-scan image.

Interlacing
Process by which images are rendered on TV or other displays by alternating horizontal scan lines.

lm (lumen)
Unit of measure for intensity of light. White light is projected onto a screen divided into nine sectors, and the intensity of light at the center of each of the sectors is measured in units called lux. The average of these values is then multiplied by the total area of the projected image (in square meters) to arrive at the value in lumens.

Mini D-Sub 15-Pin
A connector configuration used for the transmission of analog RGB signals. It got its name from the fact that the connector is shaped like the letter D. "Subminiature-D" is its official designation.

NTSC signal
A video signal format commonly used in Japan and the U.S. It employs 525 vertical scan lines and displays 30 (interlaced) frames per second. Other formats are PAL and SECAM.

Peripheral brightness ratio
A comparison of the brightness of the edges of the screen to the center. A value approaching 100 indicates even distribution of brightness. Also referred to as "uniformity."

Digital Projector [Sales Handbook]

Progressive scanning

Unlike the every-other-line scanning of interlaced video, progressive scanning is a display mode that scans all the lines in one pass. This mode is the dominant one for computer monitors, where it displays its powerful ability to render detailed graphics.

Resolution

Value expressing the fineness of rendering on displays or in print. Displays are measured by the number of dots defining the horizontal and vertical dimensions of the screen, so we speak of a 640 x 480 dot resolution. SVGA (800 x 600) and XGA (1024 x 768) are common resolutions, but in addition there are SXGA (1280 x 1024), VGA (640 x 480), and others.

RS-232C

A standard interface for data transmission. Used for data transfer between PCs and modems, printers, and other peripherals. Mainly uses 25- or 9-pin D-sub connectors.

S-Video terminal

A terminal designed to transmit video as two separate signals for brightness, or luminance (Y) and color, or chrominance (C). Produces higher quality images than composite video signals.

Screen (beaded)

A screen made of fabric whose surface is covered with microbeads of optical glass. It has high reflectivity, and superb brightness and color reproduction. However, since the brightest light returns to the point of incidence (the angle of view is narrow), it is best suited to situations where the projector can be set up on a desk.

Screen (matte white)

The surface is matte, not glossy, and diffuses the reflected light from the projector in all directions. The wide angle of view makes it suitable for both desktop and ceiling-mounted projection.

Screen size

It is customary to describe screen size in inches as measured across the diagonal, from corner to corner.

NTSC-compatible screen sizes (aspect ratio 4:3) are as follows:

Size in inches	Width x Height in meters	Size in inches	Width x Height in meters
40	0.81 x 0.61	150	3.05 x 2.29
60	1.22 x 0.91	180	3.66 x 2.74
80	1.63 x 1.22	200	4.06 x 3.05
100	2.03 x 1.52	250	5.08 x 3.81
120	2.44 x 1.83	300	6.10 x 4.57

USB

Universal Serial Bus; a standard interface for computer peripherals. Its value is that it allows a variety of devices—keyboards, mouses, printers, modems, etc.—to be interfaced using the same connectors and cables.