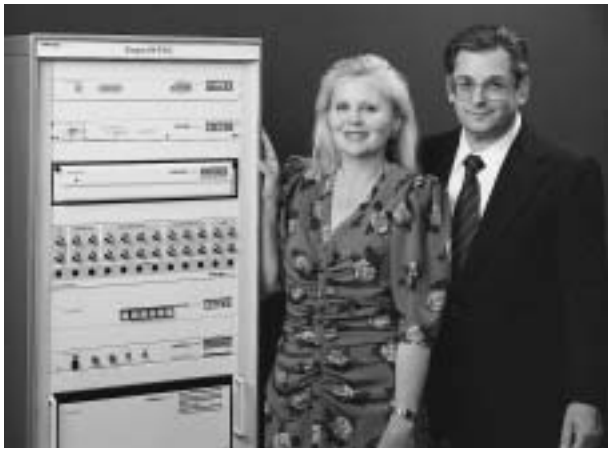
The Faroudja
VP400A/VP400AU Video Processor

A Technical Overview

CELEBRATING 25 YEARS
25
of video engineering excellence



Some Video History and the Faroudja Approach

Faroudja Laboratories, located in northern California's Silicon Valley, was founded in 1971 by Yves and Isabell Faroudja to develop state-of-the-art video processing technology. Over the last 20 years, Faroudja Laboratories and its companion R&D center, Faroudja Research, have indeed developed hundreds of advanced electronic processes to improve video enhancement, noise reduction and NTSC encoding/ decoding technologies. Many of these processes are used under license by the world's leading electronics companies in a wide range of high performance video products. Faroudja professional video equipment is also currently hard at work in hundreds of television studios. Thus Faroudja technology is utilized and enjoyed in millions of American homes every day.

Yves Faroudja has devoted his career and his company to the goal of enabling home video systems to achieve the image quality of 35mm motion pictures. In pursuit of this goal, Faroudja Labs has made use of techniques from Faroudja professional video equipment and incorporated these in the LD200, VP250 line doublers and VP400A/VP400AU Video Processors.

This booklet will provide the reader with a hands-on look at the VP400A, its operation and benefits. Also supplied is an overview of the proprietary technologies utilized in this extraordinary device and an explanation of the visual improvements it provides in home video playback systems.

First, before we discuss the VP400A, let's take a quick look at the history of the current television standard. Today's 525 line TV picture standard was actually developed in the 1940's when broadcasts were only in black and white. Keep in mind that back then, the transistor had not yet been invented! In 1953, the National Television Systems Committee (NTSC) adopted what is still the present method of color TV broadcasting. It was designed to be fully compatible with the older technology of black and white transmission. Unfortunately, this need to maintain compatibility with old technology led to unavoidable compromises in NTSC picture quality.

Today, thanks to the advent of new thinking and new technologies realized by industry pioneer Yves Faroudja, these compromises can be nearly eliminated. Faroudja's unique approach focuses on critical problem areas in the NTSC and PAL broadcast format. With patented engineering and design work, Yves and Faroudja Laboratories have created an exceptional product that brings new levels of visual reality to the enjoyment of discerning video enthusiasts around the world.

NOTE: For reasons of clairty, this overview has been written specifically for the VP400A. This description applies as well to the VP400AU.

Licensees Around the World

Faroudja's inventive approach to improving the quality of video imaging has caught the eye of some of the world's greatest high technology companies. The following list represents those that have recognized the value of Faroudja's solutions to imaging problems and pay for the opportunity to incorporate this technology in their advanced video products (as of April 1996):

Canon	Microtime
Conrac	Mitsubishi
General Instrument	NAC
Grass Valley	NEC
Hitachi	Sanyo
Ikegami	Sharp
JVC	Sony
Matsushita (Panasonic)	Toshiba

Awards and Achievements

Yves Faroudja and Faroudja Labs have garnered worldwide recognition and a number of industry awards. These honors are notable for several reasons. They are in response to the significant impact that Faroudja's technology has made on the serious improvement of video quality. They are also a reflection of his long term dedication to continually improving and optimizing the performance of the NTSC video format.

In chronological order, these awards and their specific focus are listed including an EMMY in 1991 for minimizing artifacts in the NTSC broadcast encoding process.

1987: SMPTE
DAVID SARNOFF GOLD MEDAL AWARD
for
"Contributing in Optimizing NTSC Performances"

1988: MONITOR AWARD
for
"Excellence in Engineering
NTSC Encoders and Decoders"

1989: BM/E AWARD
for
"Excellence in Engineering"

1991: Technology Executive of the Year from Cable TV Business

1991: EMMY
from The National Academy
of Television Arts and Sciences
for
"Techniques for Minimization of NTSC Artifacts
Through Advanced Encoding Techniques"

1992: VIDEO GRAND PRIX AWARD
Audio/Video International
LD100 Line Doubler "Advanced Technology Award"

1993: VIDEO MAGAZINE
Video Visionary
LD100 Line Doubler "10 Best Products"

1995: BROADCAST ENGINEERING AWARD
"Pick Hit" Award NAB Convention
VP400

1997: VISUAL GRAND PRIX AWARD
Audio Video Review Magazine (Japan)
LD200

SYSTEM DESCRIPTION

VP400A/400AU

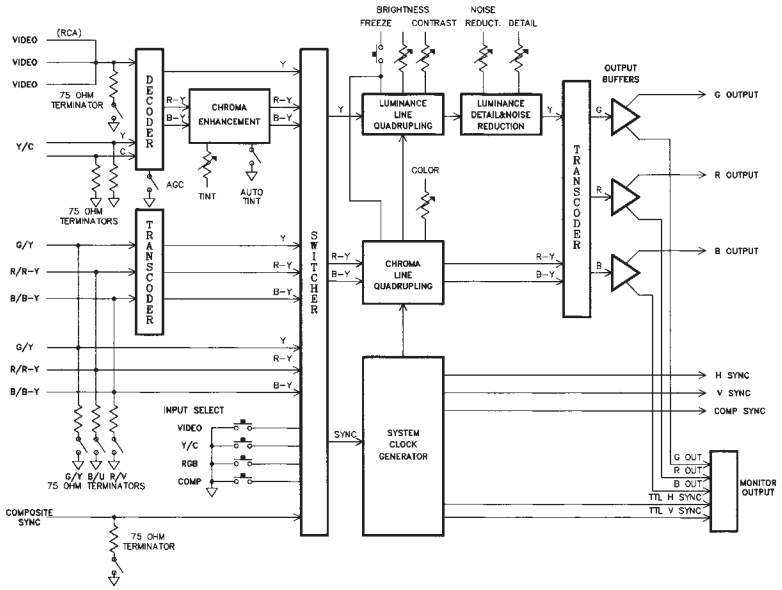
The Faroudja VP400A Video Processor is a precision video instrument used to convert NTSC Composite, Y/C, or 525 line RGB or Component interlaced signals into 1050 line progressive outputs. Using the VP400A Video Processor will produce pictures with more details, remove unwanted picture artifacts and, when used with projection systems, produce pictures of exceptional quality, giving a “cinema-like” feeling.

Front panel features include Power, Input Select (Video, Y/C, RGB and Component), Brightness, Contrast, Color, Auto-Tint, Noise Reduction, Detail, Digital Filter and Freeze. Input switch settings are memorized when the power is removed from the unit. This allows the VP400A to be interfaced into a system without the need to select the input when the system is powered up. The remaining controls may be left in factory preset or manually set by pulling out and rotating the control until the desired level is established.

Inputs to the VP400A include: Composite Video, Y/C (S-VHS), RGB and Component (Y,R-Y,B-Y). The Video input may be connected by either a BNC connection or a video RCA type connection. These inputs are looped internally so that the signal may be used by other devices. A selectable 75 Ohm terminator switch is provided and should be in the ON position if the input loop is not used. The Y/C input uses a standard 4 pin S-VHS connector. This input is not available for a looped operation and is terminated internally. The RGB and Component inputs use BNC connectors. As with the video input, these inputs are loopable to other devices. Selectable 75 Ohm terminations are provided. If the looped inputs are used, these cables should be kept short, (under 6' in length) or a video distribution amplifier should be used. This allows the VP400A to keep the highest signal bandwidth possible without having the high frequency being attenuated in a long cable.

Output from the VP400A is provided on six BNC connectors as well as one 15 pin ‘D’ connector. The BNC outputs provided are Red, Green, Blue, Horizontal Sync, Vertical Sync and Composite Sync. Interface to monitors/projectors can be of a 4 or 5 wire connection. Note: 4 wire, meaning Red, Green, Blue and Composite Sync or 5 wire, meaning Red, Green, Blue, Horizontal Sync and Vertical Sync. There is no sync present on the Green output. The VP400A is capable of driving a monitor/projector using the BNC outputs as well as a 15 pin ‘D’ connector, at the same time. The monitor and projector have to scan at 62.94KHz Horizontal scan rate.

The VP400A features a RS-232 remote control interface that will allow control of all line quadrupler functions. The remote control uses a 25 pin female ‘D’ connector located on the rear panel. See appendix A for further information.



Circuit Description

Figure 1 is a block diagram of the VP400A showing signal flow and the location of front panel controls and switches. Composite Video and Y/C (S-VHS) inputs are connected to the units decoder with AGC control and converted to Y, R-Y and B-Y signals. The Y, (Luminance) output from the decoder enters the input switcher while the R-Y and B-Y signal enter the Chroma Enhancement block where the Tint phase can be adjusted when selected in the manual mode. The RGB input signals are trans-coded to Y, R-Y, and B-Y signals and fed to the input switcher. Component signals are fed directly to the input switcher.

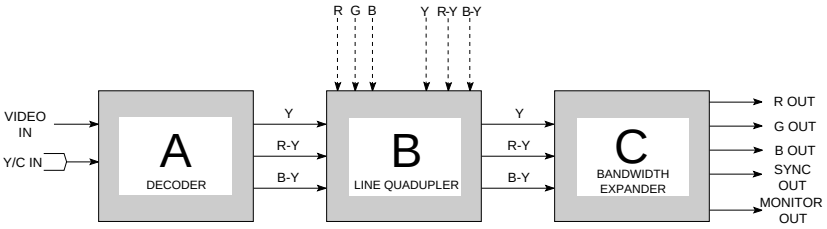
The input switcher then selects the correct function and outputs the Y signal to the Luminance Line Quadrupler block. The Luminance Line Quadrupler block contains the Brightness, Contrast and Freeze controls while the R-Y and B-Y signals enter the Chroma Line Quadrupler block where the color level can be controlled along with the Freeze controls. The Line Quadrupled Luminance signal now enters the Luminance Detail and Noise Reduction block where the functions of Noise Reduction and Detail Level are controlled.

The Luminance signal from the Luminance Detail and Noise Reduction block along with the R-Y and B-Y signals from the Chroma Line Quadrupling block feed the output transcoder and are converted to RGB signals. These RGB signals are buffered and then sent to the rear panel outputs to both the BNC and monitor interface connectors.

When using the RGB or Component inputs, Sync is derived from the G or Y input signals unless sync is provided to the Composite Sync input. The Composite Sync input will override the sync from the G or Y inputs. The sync signal then feeds the VP400A systems clock generator and is used as a reference to generate Horizontal Sync, Vertical Sync and Composite Sync.

TECHNICAL HIGHLIGHTS

VP400A TECHNICAL HIGHLIGHTS – The VP400A is a truly unique product in the world of high performance video. **The VP400A is actually a complex image processor that consists of three distinct components – all utilizing patented Faroudja technologies and engineered into one chassis; *the SuperNTSC decoder, the Faroudja proprietary line quadrupler, and Faroudja's innovative horizontal and verticle bandwidth expansion circuit that allows for the sharpening of image details.*** But simply quadrupling the lines of information is worse than doing nothing at all because the visual result is a picture of lesser quality. To achieve film-like quality, a great deal more is required than just quadrupling the lines. The block diagram below provides a simple view of Faroudja's multi-faceted solution for perfect pictures. The technical and visual benefits of each of these special circuits are explained more fully below.



VP400A BLOCK DIAGRAM

SECTION A – The VP400A SuperNTSC Decoder: Eliminates ***COLOR BLURRING*** – The engineers of the 1940's (and the 1950's, before and during the development of color broadcasting), had no idea that video images would one day be blown up as large as they are today. They therefore designed the color section of the NTSC standard with severe bandwidth restrictions. This causes colors in various video images to "blur" and "smear". These effects are further aggravated by storage media, such as VHS tapes, that further degrade the chroma or color signal. e.g. – note how deep reds smear on VHS tape images.

The Faroudja VP400A utilizes proprietary circuitry to recreate and further correct color details. Technically, this is accomplished by making use of the sharper black and white transitions to develop a correction signal that is then used to sharpen the color transitions. The result is colors that are restored with sharp details and video images that retain their original crisp look.

RAINBOW PATTERNS – When you notice the fine detail of a referee's striped shirt rippling with colored rainbows as the camera pans by, you've seen video cross-color interference.

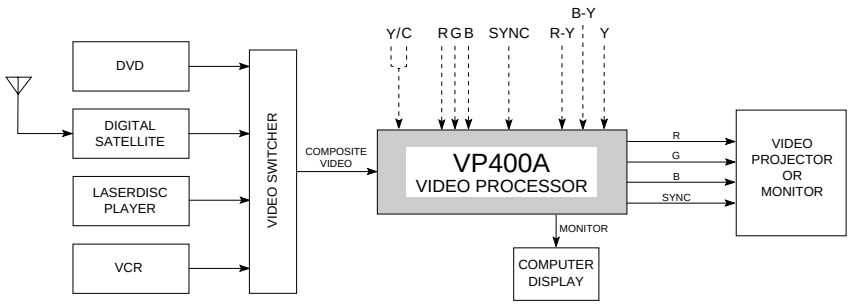
This annoying artifact is caused by imperfect separation of the color (chroma), and black and white (luminance) signals by the color decoder circuitry. Simple techniques used commonly to separate the two signals can be effective most of the time, but occasionally are fooled by finer pitch detail areas like the referees shirt. The decoder in the VP400A has patented digital adaptive comb filter circuitry that eliminates decoding errors of this type and enables the reproduction of sharper, cleaner color images.

DOT CRAWL and ***HANGING DOTS*** – This phenomena is easily seen with large, highly colored, stationary graphics like titles and credits. Dot crawl is a rapid upwards movement of colored dots on sharp vertical transitions. Hanging dots lie underneath all the colored horizontal transitions. Both of these color aberrations are artifacts that appear due to an imperfect color decoding process. The VP400A has two separate and patented correction circuits that work to eliminate both of these distortions. The impact is color transitions that are clear, sharp and natural.

SECTION B – THE VP400A Patented Line Quadrupler: eliminates ***VISIBLE SCAN LINES*** – The secret of the VP400A's uncanny ability to quadruple the lines of information without adding digital artifacts is in its unique ability to detect motion and interpolate correctly. The Faroudja VP400A does this well thanks to its proprietary, patented circuitry. It can detect the difference between a film image that has been transferred to video or video image that emanated from a video camera. After detecting the image type, the VP400A adjusts its algorithm to compensate accordingly.

This is critical because today's home theaters are primarily used to show films that were transferred to video whether on DVD tape, laserdisc or off the air (virtually all prime time programs are film transferred to video). The VP400A offers sharper, uniquely clean, artifact-free film-like images without visible scanning lines.

Historically speaking again, electrical engineers back in the 1940's knew the resolution of a picture tube depends on two different mechanisms. Horizontal resolution is a function of bandwidth (frequency response) of the circuitry



TYPICAL VP400A SYSTEM UTILIZATION

while vertical resolution is a function of the scanning frequency (the number of scan lines in each picture). Given these mechanisms and the average size picture tube being 8-10", they designed the 525 line broadcast standard so that viewers would not see the scan lines when watching TV. They had no idea that someday people would be projecting home theater video images with diagonal screen sizes of 10' and more.

Based on those NTSC parameters, using a 10 ft. diagonal screen, would require the viewer to be located more than 45 ft. from the screen to see the picture as it was intended, without scan lines! Unfortunately, today's large screen installations have scan lines that are quite visible, especially with some of the latest high resolution monitors and projection televisions. The VP400A eliminates this problem by scan quadrupling, or digitally quadrupling the 525 lines to become 2100 lines. The result is the elimination of visible scan lines. The image produced by the VP400A is clearer, continuous and virtually film-like.

SECTION C – The VP400A Bandwidth Expansion Circuitry: ***SHARPENING OF THE IMAGE DETAILS*** – There is a major limitation with most contemporary NTSC program sources — lack of frequency response. The best video sources such as satellite dish reception and laserdiscs can provide acceptable resolution (400 plus lines of horizontal resolution). Other more common sources however, such as VHS tapes (230 lines), are clearly deficient. The problem is compounded when one doubles or quadruples the scan lines and performs other signal processing. The lack of high frequency detail becomes very obvious with almost all sources. The resultant picture is free of scan lines but dull, with a loss of definition. The solution is to expand the high frequencies without producing annoying and picture degrading artifacts.

The bandwith expansion circuitry in the VP400A is exceptionally sophisticated, using Faroudja's double differentiation techniques to sharpen the edges of both horizontal and vertical details. The VP400A uses a new patented bandwidth expansion circuit that is specifically applied to greatly increase the horizontal detail in the picture. The result is a sharply detailed line quadrupled image that appears crisp and three dimensional with no visible negative side-effects. This process can effectively double the bandwidth and therefore the resolution of the incoming signal.

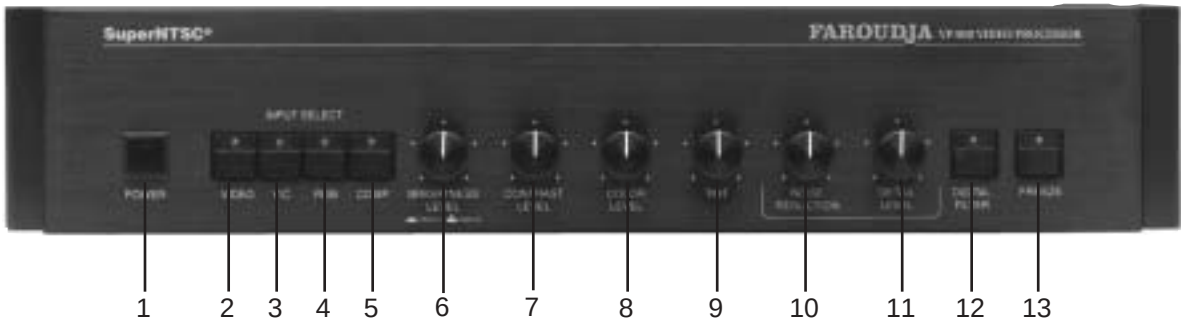
FAROUDJA VP400A APPLICATIONS – While the technical accomplishments of the VP400A represent years of intense research and development, its use is straightforward and direct. The block diagram (above), illustrates a typical home theater system configuration and shows how the VP400A would be inserted in the signal path. Many entertainment sources benefit greatly by the VP400A's unique attributes; DVD, laserdisc, VHS video, S-VHS video, cable TV, broadcast TV, etc. The VP400A has proven to be an invaluable tool in other presentation disciplines where image quality is important – computer data displays, professional installations in boardrooms and media rooms, film studios, military installations, government agencies and academic uses in schools and colleges. From the quality of its individual parts to its state-of-the-art patented circuitry, the VP400A is truly in a class by itself. There is simply no finer video processor available.

VIDEO PROCESSOR OPERATING INSTRUCTIONS

For reasons of clarity, this technical overview has been written specifically for the VP400A. This description applies as well to the VP400AU with the following exceptions:

1. The VP400AU accepts PAL and NTSC signals and switches automatically to the proper standard.

2. Tint control is not operational with PAL sources.



The VP400A Control panel

Selecting a push button control lights the adjacent LED to indicate activation or selection of that particular function.

1) **Power ON/OFF** – Press the button and the LED lights green to indicate POWER ON. When the VP400A powers up it is automatically set to operate just as it was when it was last turned off. The Detail Enhancement circuits are automatically engaged at turn on.

   Power ON/OFF - OFF – Another push on the switch and the power is cut off extinguishing the green LED. The Freeze Circuit is automatically disengaged, if in use, upon turn off.

INPUT SELECTION SWITCHES (4)

2) **Video** – refers to any composite NTSC video input - (e.g. VCR's, laserdisc players, cable boxes, etc.) Press to select the Video input.

3) **Y/C** – Y/C refers to any Super-VHS (S-VHS or Hi-8) inputs - (e.g. laserdisc players, S-VHS or Hi-8 video tape recorders, satellite receivers, etc.) Press to select the Y/C input. Using the Y/C input on the VP400A allows one to realize all the benefits of maintaining the separation of the luminance (picture) and chrominance (color) signal through the video signal processing chain, thus avoiding rainbow patterns due to cross color interference.

4) **RGB** – RGB refers to the incoming video signal being broken down to the individual red, green and blue format more typically found in the professional and broadcast area. The most common use of this input is direct video camera feeds. Press to select the RGB video input.

5) **Component Input** – Component Inputs are for DVD players and for use in the broadcast studio or post-production environment. The video signal in its component form (Y, R-Y, B-Y) is carried in a 3-wire cable with BNC type connectors (e.g. MII™, D1, Betacam™, Betacam SP™, etc.). Press to select the Component video input.

PICTURE CONTROLS (4)

The four rotary-style picture controls, **BRIGHTNESS, CONTRAST, COLOR** and **TINT**, are factory preset when pushed in. When pulled out they become active for manual adjustment. Pushing the knob back in after manual adjustment gives you the opportunity to compare your setting to the factory preset(s).

The rotary control format allows for a high degree of tactile feedback when one is adjusting the picture functions. Additionally, these controls provide a wider range of adjustment than those typically found on monitors and televisions.

In addition, automatic chroma level and phase controls (ACC and APC) are provided. As a consequence, all source-to-source variations in chroma phase and level are corrected.

When the signal is fed to the RGB inputs the monitor color and tint controls are typically bypassed. Incorporating the VP400A in such a system, with its broad range controls, restores and enhances this control flexibility.

Every VP400A is subjected to an intense battery of QC and environmental tests. Then each unit is re-tested and re-calibrated for optimum performance. The component parts used in the VP400A are built to professional broadcast studio standards, ensuring long term consistent performance and reliability. This unique, quality oriented "Faroudja touch" can also be seen in the design of many of the VP400A's controls and features.

6) **Brightness Level** – Known as "Set-up" in the broadcast industry, the BRIGHTNESS control is used to set up the background black level. Pull the knob out and turn fully counter clockwise until the picture goes dark. Then rotate the control clockwise until the black areas in the picture just begin to go gray. Turn the control back counter clockwise until the gray just goes to black. This is the optimum setting.

7) **Contrast Level** – As the BRIGHTNESS control sets the background black level, the CONTRAST control sets the foreground white level. First set the BRIGHTNESS level as above, then pull out and rotate the CONTRAST level clockwise, starting at the full counter clockwise position, until the white areas of the picture are clearly obvious.

8) **Color level** – With the Color control pressed in, the VP400A uses its internal AGC, (Automatic Gain Control) to set the color level. Pull the knob out and starting from the full counter-clockwise position, rotate clockwise for increased color saturation. This is a subjective setting, there is no right or wrong. Simply adjust for the most pleasing color level. The AGC continues to operate.

9) **Tint** – Also known as "Hue" or "Phase", pull the knob out to adjust to your personal taste, particularly in flesh tones. Adjusting the tint control shifts the picture towards the green or red areas of the color spectrum. Tint is only active in the video or Y/C input modes. With the control pressed in, the VP400A is in the Auto-Tint mode. The Auto-Tint mode is achieved by using internal phase comparison techniques to automatically display colors as intended.

IMAGE SHARPNESS CONTROLS (2)

The two rotary-style Image Sharpness controls, NOISE REDUCTION and DETAIL LEVEL, work together to sharpen edge transitions for a "punchier" picture. The proprietary bandwith expansion circuitry contained in the VP400A is critical to its spectacular performance. The VP400A's Image Sharpness circuitry improves both the horizontal and verticle sharp line and edge transitions making for clearer, more vivid video images. This is accomplished with the two controls working in tandem, without adding video noise or digital artifacts which could otherwise degrade the picture. In most installations, the factory preset position provides the best results.

10) **Noise Reduction** – After setting the detail level (11), the noise reduction control is then used to remove any residual noise that may be added during the Image Sharpness process.

11) **Detail Level** – To set the detail level start full counter clockwise and add detail until the edge transitions just begin to sharpen.

12) **Digital Filter** – The Digital Filter eliminates compression artifacts generated by video sources transmitted via a digital compressed path.Do not use with conventional video sources.

13) **Freeze On/Off** – Press to capture the current picture displayed on the screen. Press again to return to normal, active video. The freeze mode digitally captures the incoming video signal and holds it for critical viewing and adjustment. This feature allows you to optimize the VP400A picture controls on a still, constant image of your choosing.

SPECIFICATIONS

VP400A Specifications

INPUT SIGNALS (NTSC)	525 Line 2:1 Interlace
Video	1Vp-p, Negative Sync 714mV Luminance
Y/C	Y/C (3.58) Non-Composite 700m/Vp-p Y 286mVp-p C (Burst)
RGB	700mVp-p Non-Composite, 1Vp-p Composite
Component	Y(1V w/Sync), R-Y(714mV), B-Y(714mV)
Composite Sync	Negative, > 4Vp-p Composite
OUTPUT SIGNALS (NTSC)	1050 Line Progressive Scan/2100 Line per Frame
R, G, B	Non-composite, Positive, 714mVp-p
Vertical Sync	59.94Hz, Negative, 4Vp-p, 75 Ohm
Horizontal Sync	62.94KHz, Negative, 4Vp-p, 75 Ohm
Composite Sync	62.94KHz/59.94Hz, Negative, 4Vp-p, 75 Ohm
Multi Sync Monitor	15 Pin 'D' Connector
LUMINANCE	
Input Conditions	Low-Pass Filter: -3db @ 11MHz
Output Conditions	Low-Pass Filter: -3db @ 44MHz
CHROMINANCE	
Input Conditions	Low-Pass Filter: -3db @ 6MHz
Output Conditions	Low-Pass Filter: -3db @ 24MHz
PROPAGATION DELAY	1 Field + 3 Lines
POWER CONSUMPTION	100-250 VAC, 50/60Hz, 60W, Auto Ranging
FUSE	2 Amp, Slo-Blow AGC-2A
DIMENSIONS	17"W* x 3.5"H x 21"D (43.1cm x 8.9cm x 53.3 cm)
WEIGHT	22 lbs. (9.8Kg)

*19" (48.26cm) with rack mount ears

Design and specifications are subject to change without notice

VP400AU Specifications

INPUT SIGNALS (NTSC)	525 Line 2:1 Interlace
Video	1Vp-p, Negative Sync 714mV Luminance
Y/C	Y/C (3.58) Non-Composite 700m/Vp-p Y 286mVp-p C (Burst)
RGB	700mVp-p Non-Composite, 1Vp-p Composite
YUV	Y(1V w/Sync), R-Y(714mV), B-Y(714mV)
Composite Sync	Negative, > 4Vp-p Composite
INPUT SIGNALS (PAL)	625 Line 2:1 Interlace
Video	1Vp-p, Negative Sync 700mV Luminance
Y/C	Y/C (4.43) Non-Composite 700m/Vp-p Y 286mVp-p C (Burst)
RGB	700mVp-p Non-Composite, 1Vp-p Composite
YUV	Y(1V w/Sync), U(700mV), V(700mV)
Composite Sync	Negative, > 4Vp-p Composite
OUTPUT SIGNALS (NTSC)	1050 Line Progressive Scan/2100 Line per Frame
R, G, B	Non-composite, Positive, 714mVp-p
Vertical Sync	59.94Hz, Negative, 4Vp-p, 75 Ohm
Horizontal Sync	62.94KHz, Negative, 4Vp-p, 75 Ohm
Composite Sync	62.94KHz/59.94Hz, Negative, 4Vp-p, 75 Ohm
Multi Sync Monitor	15 Pin 'D' Connector
OUTPUT SIGNALS (PAL)	1250 Line Progressive Scan/2500 Line per Frame
R, G, B	Non-composite, Positive, 700mVp-p
Vertical Sync	50Hz, Negative, 4Vp-p, 75 Ohm
Horizontal Sync	62.5KHz, Negative, 4Vp-p, 75 Ohm
Composite Sync 4Vp-p, 75 Ohm	62.5KHz/50Hz, Negative,
Multi Sync Monitor	15 Pin 'D' Connector
LUMINANCE	
Input Conditions	Low-Pass Filter: -3db @ 11MHz
Output Conditions	Low-Pass Filter: -3db @ 44MHz
CHROMINANCE	
Input Conditions	Low-Pass Filter: -3db @ 6MHz
Output Conditions	Low-Pass Filter: -3db @ 24MHz
PROPAGATION DELAY	1 Field + 3 Lines (NTSC) 1 Field + 4 Lines (PAL)
POWER CONSUMPTION	100-250 VAC, 50/60Hz, 60W, Auto Ranging
FUSE	2 Amp, Slo-Blow AGC-2A
DIMENSIONS	17"W* x 3.5"H x 21"D (43.1cm x 8.9cm x 53.3 cm)
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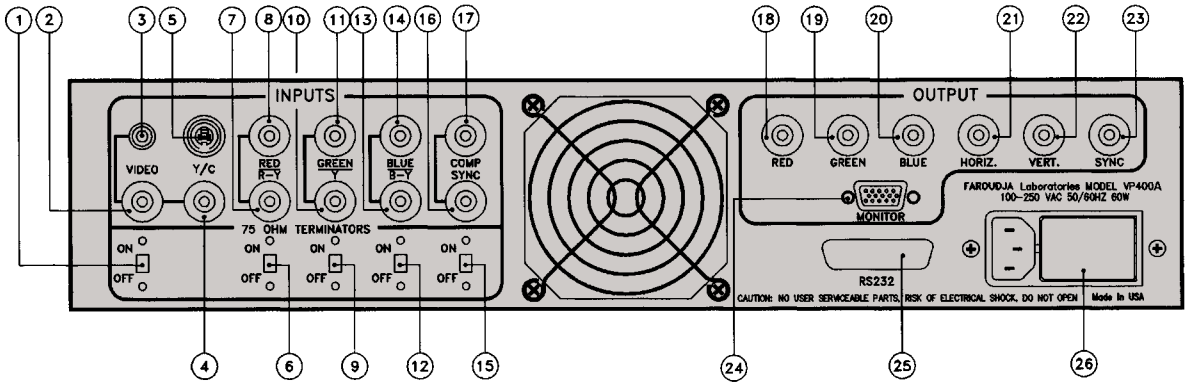

Rear Panel I/O

1. **Video Termination Switch** – Select ON when not looping the Video signal to other video devices, (75 Ohm).
2. **Video Input (BNC)** – Composite Video Input
3. **Video Input (RCA)** – Composite Video Input
4. **Video Input (BNC)** – Composite Video Input Loop
5. **Y/C Input (4 Pin)** – Y/C, input internally terminated.
6. **R/R-Y Termination Switch** – Select ON when not looping the R/V signal to other video devices, (75 Ohm).
7. **R/R-Y Input Loop (BNC)** – Red/R-Y Input
8. **R/R-Y Input (BNC)** – Red/R-Y Input
9. **G/Y Termination Switch** – Select ON when not looping the G/Y signal to other video devices, (75 Ohm).
10. **G/Y Input Loop (BNC)** – Green/Y Input
11. **G/Y Input (BNC)** – Green/Y Input
12. **B/B-Y Termination Switch** – Select ON when not looping the B/B-Y signal to other video devices, (75 Ohm).
13. **B/B-Y Input Loop (BzNC)** – Blue/B-Y Input
14. **B/B-Y Input (BNC)** – Blue/B-Y Input
15. **Sync Termination Switch** – Select ON when not looping the Composite Sync signal to other video devices, (75 Ohm).
16. **Sync Input Loop (BNC)** – Composite Sync Input Loop
17. **Sync Input (BNC)** – Composite Sync Input
18. **Red Output (BNC)** – Red Output 714mV
19. **Green Output (BNC)** – Green Output 714mV
20. **Blue Output (BNC)** – Blue Output 714mV
21. **Horiz. Sync Output (BNC)** – Horizontal Sync Output –4Vp-p, 62.94Hz
22. **Vert. Sync Output (BNC)** – Vertical Sync Output –4Vp-p, 59.49Hz/50Hz
23. **Sync Output (BNC)** – Composite Sync Output –4 Vpp
24. **Monitor Interface Output** – Positive TTL Sync Levels. (DB-15 mini)
25. **Remote Control Interface** – RS-232 (DB-25)
26. **Power Input** – 100-250 VAC, 50/60Hz, 60W

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