

Two standard video inputs (up to 1080P) plus optional mezzanine card for 1-2 additional inputs. Automatic analog and digital input mode detection on each input port. Up to 4 windows can be placed in the output active area. Each window is assigned to an input. Automatic, prioritized input mode detection, with window size, location, input area-of-interest, and more determined by the detected input mode. Single, Dual, and Quad LVDS outputs for up to 2560x1600 panels. Parallel Digital output and Single link DVI output for up to 1080P panels.

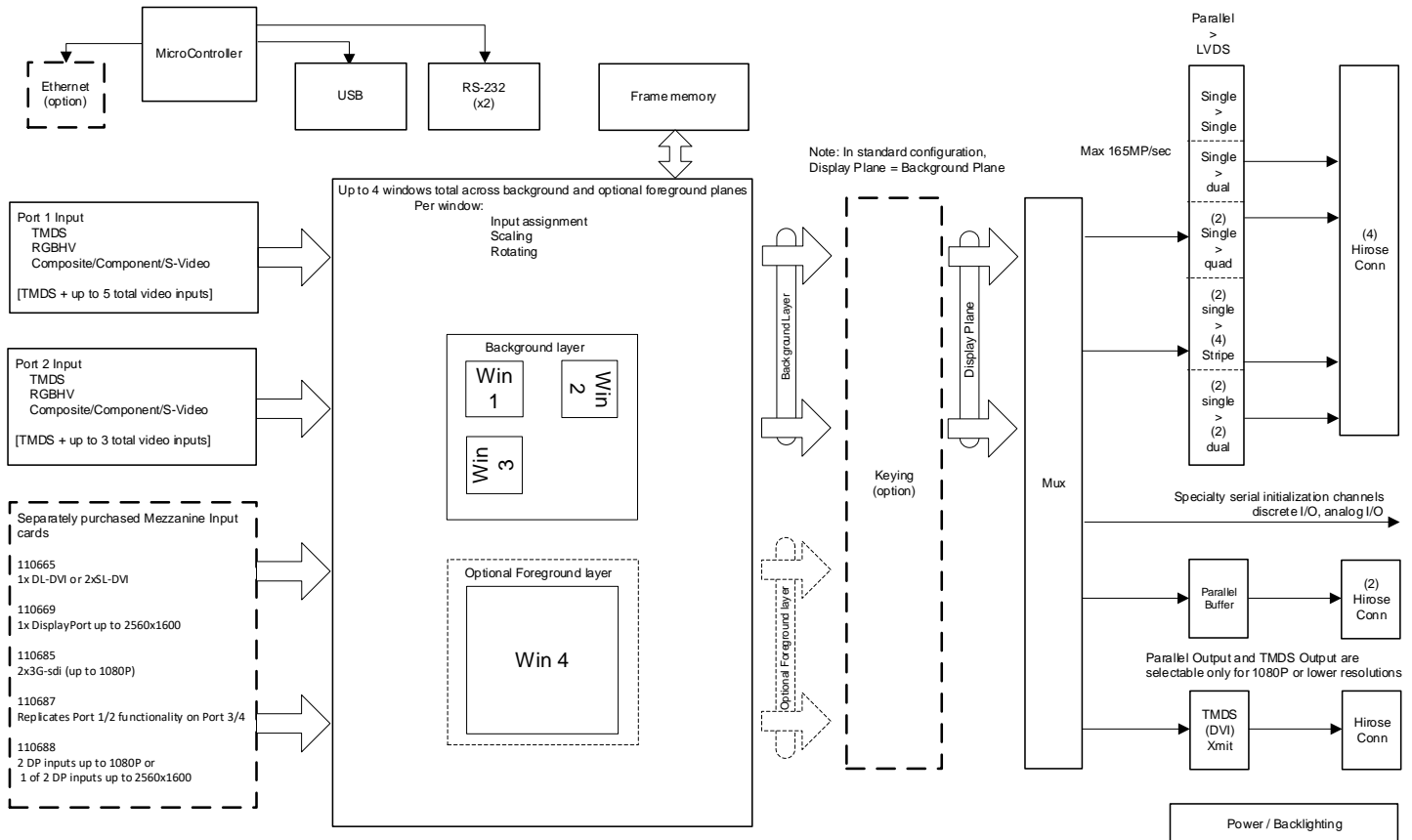


Figure 1 VP13 Block Diagram

VP13 LCD Controller

Standard Input Ports 1 and 2 can be used to populate up to 4 windows. Each input port has 1 or more input types (DVI, VGA, Composite, etc) and 1 or more sub-channels (VGA1). A Mode Control Handler detects pre-defined modes per Input Port, and content is mapped to Windows via both mode dependent and mode independent parameters, including window size, location, input area-of-interest, rotation, etc. Up to 2 additional input ports can be supported via an optional input mezzanine board.

Single, dual, or quad pixel LVDS panels are supported at up to 330 Mpixels/sec, while TMDS and parallel RGB outputs are supported up to 1080P. Various Serial command interfaces are also supported for display initialization and other display-specific communication.

VP13 Highlights

The VP13 includes many advanced features, including:

- Input resolutions up to WUXGA (for DVI and analog RGB) and WQXGA (for optional Dual DVI input),
- Supports NTSC/PAL (composite and S-Video) and component inputs,
- Up to 4 windows, each window may be flipped and/or rotated 90/180/270,
- Single/dual/quad LVDS output up to 2560x1600
- Parallel digital (up to 165 MPixel, single pixel), and DVI (single link) outputs,
- (2) RS-232, USB, or Ethernet (optional) controls
- Video combining via Windows, PIP, side-by-side
- Optional RGB/Luma/HSV Keying

User Programmable Input Modes

Modes define the video type (RGB, DVI, etc) and timing of a video input. With fully customizable input mode definitions for each video input port (standard 1 and 2, optional 3 and 4), programmable panel output timing and power sequences, and full control of window size and location within the output active area, you can configure the VP13 for your unique application.

Supports Standard and Custom Video

Port 1 accepts both TMDS (SL-DVI) and analog video. Possible analog video configurations include:

- 1x RGBHV input and 4x NTSC/PAL composite (CVBS) inputs
- 5x NTSC/PAL CVBS inputs
- 4x S-Video (Y/C) inputs, or
- 3x component (YPbPr) inputs.

Figure 2 below shows possible Port 1 configurations. The number after the designation defines the sub-channel. For example, R1 is the Red component of RGB sub-channel #1. Automatic mode detection is possible among the Orange sub-channels, and the TMDS input.

VP14 pin	VGA (RGB)	YPbPr	s-video (YC)	Composite (CVBS)
J17- 1	R1	Pr3		
J17- 3	G1	Y3	Y4	CVBS5
J17- 5	B1	Pb3	C4	
J17- 7	VS1			
J17- 9	HS1			
J24- 1	R2	Pr1	C2	
J24- 5	G2	Y1	Y2	CVBS3
J24- 3	B2	Pb1	C3	
J24- 13			Y3	CVBS2
J24- 7	G3	Y2	Y1	CVBS4
J24- 9	B3	Pb2	C1	
J24- 11	R3	Pr2		CVBS1

Figure 2 Port 1 Analog Video Input Possibilities

Similarly, Port 2 accepts (1) TMDS input and either:

- (2) RGB inputs, or (3) composite inputs, or
- (2) component inputs, or (2) S-Video inputs

Other combinations are possible. Ports 1 and 2 also support specialty formats such as RS-343, RS-170, and STANAG. The VP13 can also be programmed to support custom video formats.

VP13 Mezzanines – 110669

Mezzanine 110669 allows an additional DisplayPort input, with resolutions up to 2560x1600/60Hz.

VP13 Mezzanines – 110688

Using the VP13 Configuration application, a user may configure Mezzanine 110688 in 1 of 2 modes:

1. Simultaneous processing of 2 DisplayPort streams up to 1080P, or
2. Selection of 1 of 2 DisplayPort streams for processing at up to 2560x1600/60Hz

VP13 Mezzanines – 110665

Using the VP13 Configuration application, a user may configure Mezzanine 110665 in 1 of 2 modes:

1. Simultaneous processing of (2) SL-DVI (single link DVI) inputs at up to 1080P, or
2. Processing of (1) DL-DVI input at up to 2560x1600/60Hz

VP13 Mezzanines – 110685

Processes (2) 3G-SDI inputs up to 1080P.

VP13 Mezzanines – 110687

Mezzanine 110687 adds multiple video types to VP13's Port 3 and Port 4, in addition to the standard DisplayPort Input #1 (Ports 1/2) and the Low Latency DisplayPort input.

Both Port 3 and 4 support a TMDS (DVI/HDMI) input at up to 1080P, plus other switchable analog inputs such as RGB and composite. The analog inputs are switchable and provide a wide range of possible inputs, as shown in Figure 3 below for Port 3 configurations.

The number after the designation defines the sub-channel. For example, R1 is the Red component of RGB sub-channel #1. Automatic mode detection is possible among the Orange sub-channels, and the TMDS input.

VP14 pin	VGA (RGB)	YPbPr	s-video (YC)	Composite (CVBS)
J4- 1	R1	Pr3		
J4- 3	G1	Y3	Y4	CVBS5
J4- 5	B1	Pb3	C4	
J4- 7	VS1			
J4- 9	HS1			
J3- 1	R2	Pr1	C2	
J3- 5	G2	Y1	Y2	CVBS3
J3- 3	B2	Pb1	C3	
J3- 13			Y3	CVBS2
J3- 7	G3	Y2	Y1	CVBS4
J3- 9	B3	Pb2	C1	
J3- 11	R3	Pr2		CVBS1

Note: Table above shows Mezzanine J#s, not VP13 J#s

Figure 3 Port 3 Analog Video Input Possibilities

Similarly, Port 4 accepts (1) TMDS input and either:

- (2) RGB inputs, or (3) composite inputs, or
- (2) component inputs, or (2) S-Video inputs

Other combinations are possible. Ports 3 and 4 also support specialty formats such as RS-343, RS-170, and STANAG. These VP13 Ports 3 and 4 can also be programmed to support custom video formats.

VP13 Configuration Utility and Commands

The VP13 Configuration utility supports in-the-field firmware, FPGA and parameter (BIOS) updates. Commands are sent to the unit through the RS-232, USB, or optional Ethernet interface. Parameters are stored in non-volatile memory to retain desired settings. Westar also supplies a command line description document, so that customer software can send dynamic programming commands to the VP13.

Features

Based on state-of-the-art processing technology, the VP13 LCD Controller capabilities include:

Input mode detection and multiple windows

- Each video input port (1 and 2 and optional 3 and 4) can be pre-configured with multiple input modes defining input type, timing, resolution, etc.
- The built-in Mode Handler Control function is programmed to either:
 - a) monitor a particular input type and sub channel (eg RGB1), or
 - b) automatically cycle thru sub-channel 1 of each pre-configured input type (eg TMDS1 >> RGB1 >> CVBS1) until valid video is detected.
- Up to 4 windows can be defined within the output active area. **See additional window sections for limitations.** Each window is assigned to an input channel. Input modes defined for that input channel are mapped to the window according to the window's mode-dependent and mode-independent parameters.
- An optional mezzanine provides an additional input port(s) (Input Port #3 and #4). This option is often used for multi-window applications, or to support a different input type, such as DL-DVI.
- Each window has mode independent and mode dependent parameters such as window size, location, input area-of-interest, flip (vertical or horizontal), and rotate (90/180/270).
- If a pre-defined timing mode is not detected for an input port, then windows assigned to that input are programmed to either display a specific RGB color or disappear.

Video Conversion and Synchronization

- Digitization of computer-generated video sources with separate syncs or sync-on-green.
- Non-interlaced and interlaced RGB inputs with fine phase clock adjustment for pixel sampling.
- DVI (TMDS) inputs.

- Digitization and de-interlacing of consumer video formats, including NTSC and PAL Composite, S-Video, and Component Video.
- Frame rate conversion: free running or genlocked output. A Genlocked output provides the lowest possible latency.
- Incoming video gain and offset adjustments.

Programmable

- Remote interface for initial configuration and, if required, dynamic operational control.
- Commands defined in Command Line Description document.
- Programmable power and "loss of video" sequences with user-defined "On Screen Display" Messages and test patterns

Windows for display resolutions up to WUXGA

The VP13 offers robust windowing for display resolutions with pixel clock frequencies ≤ 165 MPixels/sec (eg 1080P and WUGA @ 60Hz). Up to 4 windows may be sized and placed anywhere in the output active area, as shown in Figure 3. Window techniques include PIP, side-by-side, and other window configurations.

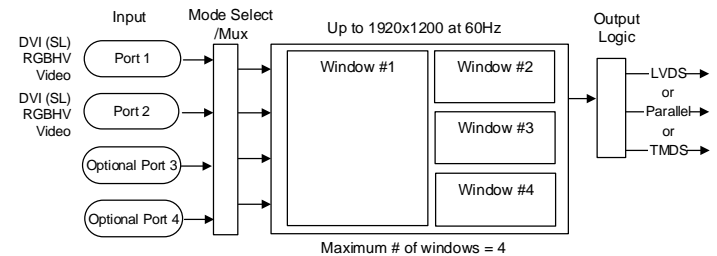


Figure 3: Window configurations for display resolutions of WUXGA or less

Windows for display resolutions beyond WUXGA

Many panels that require a pixel rate beyond 165 MPixels/sec utilize a quad LVDS interface. The VP13 supports these panels with some limitations. If the pixel rate exceeds 165 MPixels/sec, then the # of windows, and window sizes and locations are limited by a vertical segment boundary that splits the output area-of-interest. Specifically,

$$\sum_{n=1}^{\# \text{ of windows}} (\text{segments utilized by window } n) \leq 4$$

In Figure 4 below, an optional Dual DVI mezzanine is supplying 2560x1600 video for Window#3, while Windows 1 and 2 are assigned to Input Ports 1 and 2 respectively. Window #3 utilizes 2 segments, while Windows #1 and #2 utilize 1 segment each, for a total of 4 utilized segments. This is a valid configuration.

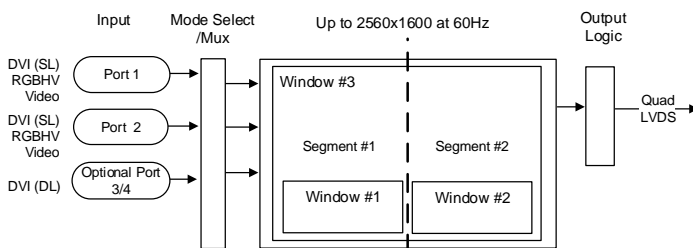


Figure 4: Window configurations for display resolutions > WUXGA

Special Features

- EDID prom on input ports 1 and 2 (for DVI or VGA type input), programmable via VP13 Configuration Utility,
- Backlight Power/Enable/PWM/Sync features,
- Video Contrast and Backlight PWM controllable via discrete input (pushbutton), rotary encoder input, analog input, or command
- Discrete I/O interfaces. A discrete input can trigger a VP13 action, such as a mode switch. Discrete outputs are typically used for parameter selection on a display, such as scan direction.

Video Combining (Standard)

- PIP is performed by assigning windows in a layer.
- Programmable alphas in a layer support z-order priority and alpha blending per window overlap area.

Keying (Standard)

- Alpha blending between foreground and background is standard on the VP13. This is also known as “area keying”.
- Keying requires both the foreground and background layer of equal resolution (typically 1080P), to form a display plane.
- A rectangular key area is defined in the active area.
- With standard “area keying”, programmable foreground and background alpha values are defined for outside the key area and inside the key area.
- An output pixel in the display plane is computed as:

$$\text{Output pixel} = (\text{Foreground alpha} * \text{foreground pixel}) + (\text{Background alpha} * \text{background pixel})$$

Keying (Optional)

- Optional keying (:Key) supports calculations on foreground pixels that are “inside” the key area. These calculations may be based on RGB, Luma, or HSV values. Foreground and background alpha values are applied based on the key calculation result (Key = True or Key = False)
- Option also includes a technique that “extracts” an alpha LUT index from the (2) LSB’s of the RGB foreground pixel, supporting a 64 entry table of Foreground/Background alpha values. This technique is “symbology-encoded alpha”.
- Option also includes using the blue content as a LUT pointer for both foreground and background alpha values. This technique is referred to as “blue alpha”.

Test Pattern / Messaging

- Test Patterns include: flood fields, color wedges, checkerboards, and color wedges; each highly programmable
- Test pattern overlay capabilities include: outline, lines, and pixel.
- Up to 8 on-screen messages using built-in 8x10 pixel character generator based on ASCII character set. Each message has:
 - up to 64 characters
 - 1x, 2x, 4x, 8x character size multiplier
 - programmable location in x and y

VP13 Configuration utility

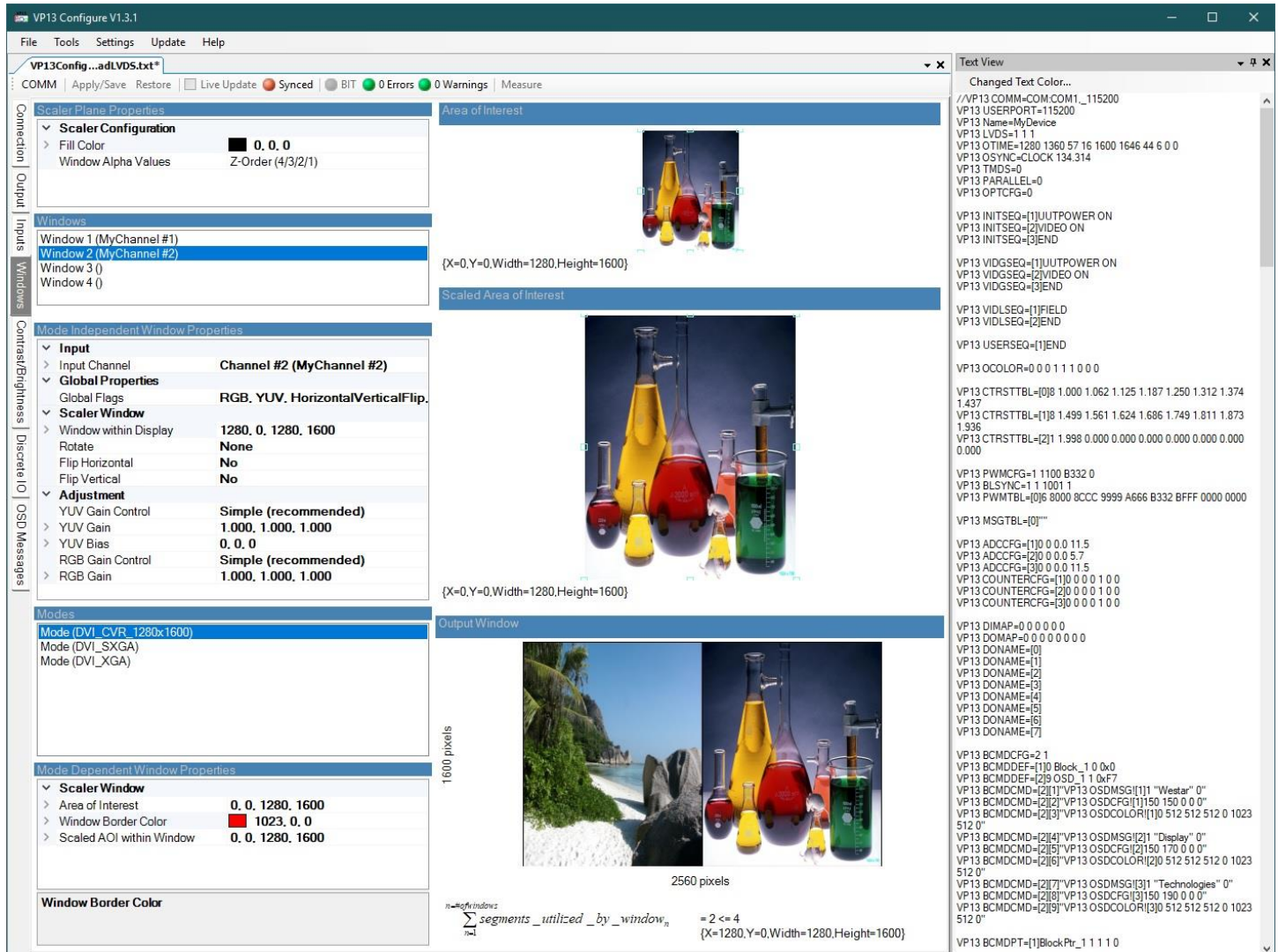


Figure 5 VP13 Configuration Utility

The VP13 Configuration utility provides a graphical method for setting up the VP13. The utility supports definition of the output, inputs, windows, and much more. Figure 5 above is a sample screenshot of the “Windows” tab, where Mode Independent and Mode Dependent parameters, such as sizing and rotation, can be defined. The executed text commands are shown in the right window.

In this case, Window 1 is assigned to Input 1 and placed in the left half of an output area-of-interest that is 2560x1024. Window 2 is assigned to Input 2 and placed in the right half of the output area-of-interest. (This specialty display requires quad LVDS output).

Figure 6 below shows the high level specifications for VP13. Figure 7 lists the VP13 connectors.

Physical Dimensions	5.3" x 4.6" x 1.4" (2 circuit boards are coupled as a single unit)
Temperature Range	Operating: 0°C to +70°C (additional data available) Storage: -40°C to +100°C
Video Inputs	Chan 1: RGB (up to WUXGA resolutions @ 60Hz), DVI (up to 165 MHz) NTSC/PAL (composite or S-Video), Component Chan 2: RGB (up to WUXGA resolutions @ 60Hz), DVI (up to 165 MHz) NTSC/PAL (composite or S-Video), Component Syncs (Digital Separate, Digital Composite, Analog Composite) Optional Input Mezzanines: 110665 Dual Link DVI (up to 2560x1600) or (2) Single link DVI (up to 1080P each) 110669 Single Channel DisplayPort (up to 2560x1600) 110685 (2) 3G-SDI inputs up to 1080P 110687 Replicates Ports 1/2 functionality on Ports 3/4 110688 Simultaneous processing of 2 DisplayPort streams up to 1080P, or Selection of 1 of 2 DisplayPort streams for processing at up to 2560x1600/60Hz Please contact the factory for additional mezzanines
Video Outputs	Single, Dual, or Quad LVDS Single Pixel Parallel, up to 165 MPixels/sec, with voltage level of 1.7V to 3.1V or 3.3V DVI (TMDS) up to WUXGA
Input Power	+12 VDC, 10 Watts
Control Interface	(2) RS-232, USB, Ethernet (via optional Ethernet interface assembly) Maintenance RS-232 interface fixed at 115kbps for Configuration Application User RS-232 interface has programmable baud rate

Conn	Type	Description	Conn	Type	Description
J1	DF11-06DP	USB Interface	J25	DF11-12DP	Channel 1 – TMDS Video Input
J2	1 position jumper	Inverter Voltage Select	J28	1 position jumper	Factory Use Only
J3	DF11-06DP	Ethernet Module Interface	J29	DF11-10DP	Factory Use Only
J4	0.1" Header x 10	Factory Use Only	J32	DF11-14DP	LVDS Video Out, 1
J5	DF11-10DP	Factory Use Only	J33	DF11-14DP	LVDS Video Out, 2
J6	DF11-10DP	RS-232 Interface	J34	DF11-04DP	Channel 1 – TMDS EDID
J7	DF11-08DP	LED Interface	J37	DF11-12DP	TMDS Output
J8	4 position jumper	Inverter Power Select	J42	DF11-30DP	Input Mezzanine Card Channel 3 Data
J9	4 position jumper	UUT Power Select	J43	DF11-06DP	Input Mezzanine Card Channel 3 Control
J10	DF11-24DP	Inverter Interface	J44	DF11-30DP	Input Mezzanine Card Channel 4 Data
J11	DF11-06DP	External Sync Input	J45	DF11-06DP	Input Mezzanine Card Channel 4 Control
J12	DF11-18DP	Input Mezzanine Card Power	J62	DF11-14DP	LVDS Video Out, 3
J13	DF11-22DP	Power Input	J63	DF11-14DP	LVDS Video Out, 4
J15	2 position jumper	Parallel Output voltage select	J67	DF11-10DP	Channel 2 - VGA Video Input
J17	DF11-10DP	Channel 1 - VGA Video Input	J74	DF11-06DP	Channel 2 –Composite Video Input
J18	DF11-16DP	Discrete I/O	J75	DF11-12DP	Channel 2– TMDS Video Input
J21	DF11-10DP	Parallel Video Control Output	J84	DF11-04DP	Channel 2 – TMDS EDID
J22	DF11-32DP	Parallel Video Data Output			
J24	DF11-14DP	Channel 1 – Component /Composite Video Input			

Figure 7 VP13 Connector definitions

Figure 8 below shows the VP13 connector locations and Figures 9 and 10 are pictures of the VP13.

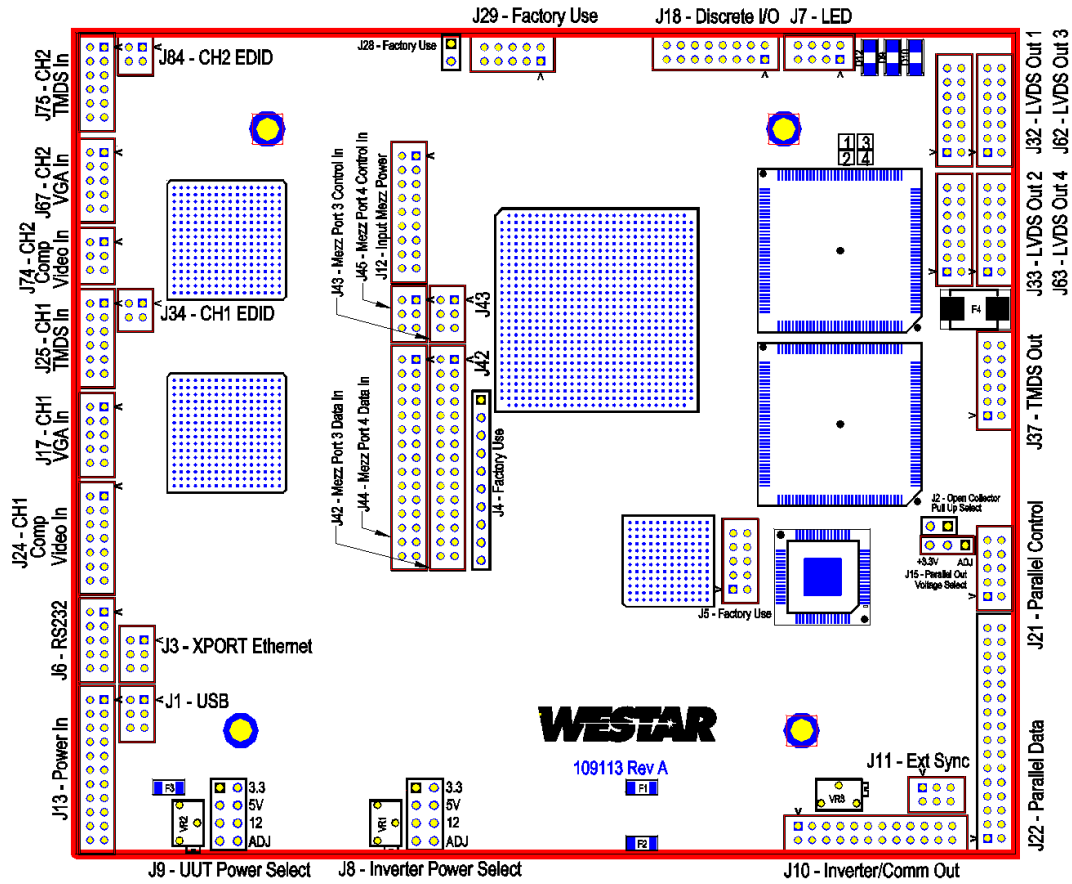


Figure 8 VP13 Connector layout



Figure 9 VP13 top perspective (2 board stack)



Figure 10 VP13 top-side

VP13 Operation

Typically, the VP13 operates as follows:

1. Upon power up, the VP13 configures itself based on its internal BIOS. The BIOS includes various input mode definitions per input channel, windowing definitions, and an output mode (timing, electrical format, video combining definition, etc.)
2. For each input channel, if a valid video mode is detected on an input channel, the VP13 drives windows associated with that input channel per the mode definition.

Ordering Configuration

VP13 standard VP13
 VP13 /Key VP13 with optional foreground keying

Available Input Mezzanine Boards:

110669	Single Channel DisplayPort
110665	Dual Link DVI or 2x Single Link DVI
110687	2x DVI/RGB/Composite

Other input mezzanines available. Optional Ethernet is available via a cable assembly with built-in Ethernet port.

Contact Us

Call us for additional product info and pricing.

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