

VDA-3100 (VIDEO DISTRIBUTION AMPLIFIER)

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About This Manual

This manual provides detailed instructions for the installation, operation, and maintenance of the PESA VDA-3100 Video Distribution Amplifier.

Warnings, Cautions, and Notes



Warning statements identify conditions or practices that can result in personal injury or loss of life.



Caution statements identify conditions or practices that can result in damage to equipment.



Notes contain information important to the correct installation, operation, or maintenance of the equipment.

Contents

CHAPTER 1 – INTRODUCTION	1
1.1 General Description	1
1.2 VDA-3100 Video Mainframe Specifications	3
1.3 Board Specifications	3
1.3.1 ADA3102 Specifications	3
1.3.2 ADA3103	4
1.3.3 ADA3124	4
1.3.4 HDVDA3101-R	5
1.3.5 SDVDA3101	5
1.3.6 SDVDA3101-R	6
1.3.7 VDA3101GP	6
1.3.8 VDA3102	7
1.3.9 VDA3103	7
1.3.10 VDA3105	8
1.3.11 VDAC3101	8
1.3.12 ADA3118	9
1.3.13 ADAC3102	9
1.3.14 VADD3101-10	9
1.3.15 AADC3102	10
1.3.16 VDAE3101-10	10
CHAPTER 2 – INSTALLATION	11
2.1 Introduction	11
2.2 Receipt Inspection	11
2.3 Unpacking	11
2.4 Location	12
2.5 Mounting	12
2.6 Cabling	12
2.7 Plug-In Card Installation	14
2.8 Power Supply Installation	15
2.9 Front Panel Installation	17
2.10 Rear Panel Connectors	18
2.10.1 Alarm Connector	18
2.10.2 DC Power Connector	18
2.10.3 Video Input and Output Connectors	19
2.11 VDA-3100 Video Mainframe System Connections	19
2.11.1 Connection Guide	19
CHAPTER 3 – MAINTENANCE	20
3.1 Maintenance	20
3.2 Preventive Maintenance	20
3.3 Test Equipment	20
3.4 Corrective Maintenance	21
3.4.1 Factory Repair Service	21
3.4.2 Troubleshooting	21
3.4.3 Replacement Parts	21

List of Figures

Figure 1. VDA-3100 Front View 2

Figure 2. VDA-3100 Rear View 2

Figure 3. Chassis Installation..... 12

Figure 4. Cabling..... 13

Figure 5. Card Installation..... 14

Figure 6. Isolation Diode Installation..... 15

Figure 7. Power Supply Installation 16

Figure 8. Front Panel Installation..... 17

Figure 9. Alarm Connector..... 18

Figure 10. DC Power Connector..... 18

Figure 11. Connection Guide..... 19

Chapter 1 – Introduction

This manual provides detailed instructions for installing and operating the PESA VDA-3100 Video Mainframe.

1.1 General Description

The VDA-3100 Video Mainframe is the heart of PESA's new line of low cost video distribution amplifiers. Housed in a 2RU chassis with ten video card slots, video, equalized video, and serial digital video signals can be distributed by selecting the appropriate plug-in cards. Up to two power supply modules can be installed in the VDA-3100 Video Mainframe to allow single frame power redundancy. There is also one audio card which is used in the VDA-3100 frame, the 75 ohm AES serial digital audio distribution amplifier.

There are two versions of the VDA-3100 frame (both have ten card slots). In the VDA3100T (the non-looping version with terminating inputs), each card slot has a single terminated input and eight outputs. This VDA3100T frame is required for use with all digital DAs, but can also be used with all analog video cards. The VDA3100L (the looping version) has two input BNCs connected in parallel and eight outputs. The looping version cannot support the digital video cards since the digital cards require a terminated input.

Developed as a low cost modular frame, the VDA-3100 Video Mainframe is easily upgraded as requirements in the field change. All plug-in modules and power supplies are installed and removed from the front.

There are a wide variety of cards compatible with the VDA-3100, both analog and digital, as listed below:

Available Models	Description
VDA3101GP	Analog Video General Purpose DA up to 150MHz, 1x8
VDA3102	Analog Video DA with EQ, 1x8
VDA3103	Analog Video DA for wideband applications to 250MHz, 1x8
VDA3105	Analog Video DA with Auto EQ, non-reclocking, 1x8
SVDA3101	SDI Video DA with Auto EQ, non-reclocking, 1x8
SVDA3101R	SDI Video DA with Auto EQ, reclocking, 1x8
HDVDA3101R	HD Video DA with Auto EQ, reclocking, 1x8
VDAC3101	Video D to A analog output monitoring card, (NTSC/PAL/RGB out)
VADD3101-10	Video A to D for NTSC/PAL to SDI, 10 bit (SMPTE 259M out)
VDAE3101-10	Video D to A for SDI to NTSC/PAL, 10 bit (NTSC/PAL/YC/RGB/YpbPr out)
ADA3102	Analog Audio Distribution Amplifier – Dual 1x4

Available Models	Description
ADA3103	Analog Audio Distribution Amplifier – Single 1x8
ADA3124	Digital Audio Distribution Amplifier – Dual 1x4 or Single 1x8 (110 ohm)
ADA3118	Digital Audio Distribution Amplifier – Single 1x8 (75 ohm unbalanced)
ADAC3102	Audio D to A Conversion, 24 bit/96 KHz
AADC3102	Audio A to D Conversion, 24 bit/96 KHz (3 AES/EBU per input channel)

The VDA-3100 is capable of accepting a 1V p-p video input or a 2V p-p subcarrier input. The VDA3002 is capable of equalizing up to 1000 feet of Belden 8281 coaxial cable when used for post-equalization and up to 650 feet of Belden 8281 coaxial cable when used for pre-equalization. The SDVDA3001 is capable of distributing a wide of range serial digital video signals.

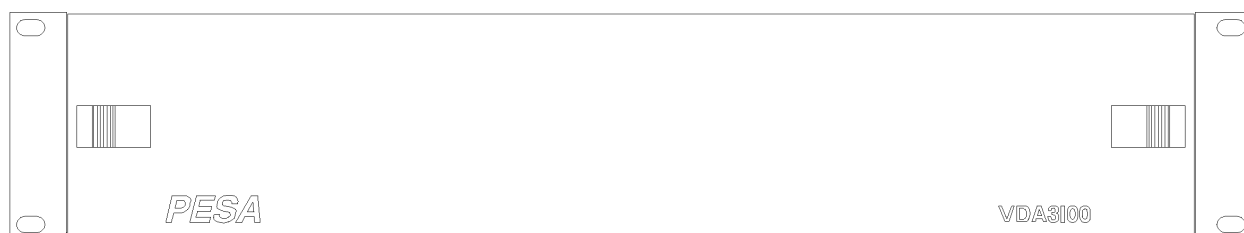


Figure 1. VDA-3100 Front View

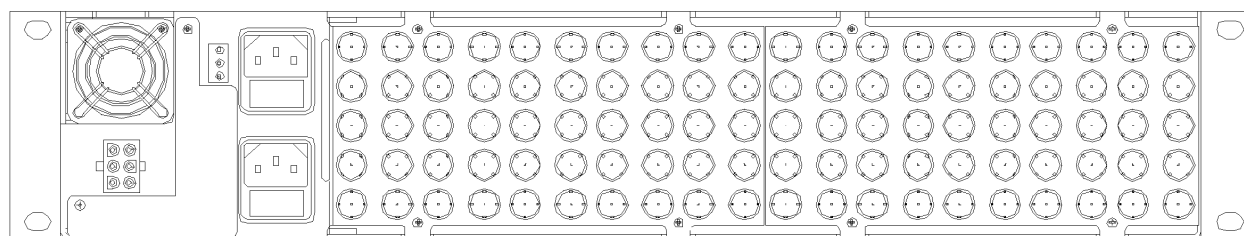


Figure 2. VDA-3100 Rear View

1.2 VDA-3100 Video Mainframe Specifications

INPUT CHARACTERISTICS

VDA3100L:

Input Type Looping Inputs

VDA3100T:

Input Type Terminating Inputs

OUTPUT CHARACTERISTICS

Number 8 Per Channel

Connector Type BNC

CARD SLOTS

Number 10 Per Chassis

ENVIRONMENTAL - Operational

Temperature 0°C to 40°C

Humidity 10-90% Non-Condensing

POWER SUPPLIES

Number 1 (Standard)

2 (Optional)

MECHANICAL

Dimensions 2RU

19" W X 10" D 3.5" H

(482.6mm X 254.1mm X 89mm)

POWER

AC Voltages 100-130V, $\pm 10\%$, 47-63Hz (US)

200-250V, $\pm 10\%$, 47-63Hz (OUS)

Power Apx. 45VA

1.3 Board Specifications

1.3.1 ADA3102 Specifications

Features:

- HiZ or 600 Ohm input impedance
- 66 Ohm/600 ohm output impedance
- 8 outputs (ADA-3101)
- 4 outputs (ADA-3102)

Input Characteristics

- Level +30dBm Max
- Coupling DC
- Type Balanced
- Common mode level $\pm 20V$
- Connector type 3-pin, 2-part detachable

- Impedance jumper on card HiZ or 600 ohms
- Common mode rejection >90dB @ 60 Hz; >60dB to 20KHz

Output Characteristics

- Level +30dBm @ 66 ohms
- Impedance jumper on card 66 ohms balanced
- Coupling DC
- DC on outputs <±20mV max
- Connector type 3-pin, 2-part detachable
- Output isolation – module to module > 1000dB 20 Hz to 20 KHz

1.3.2 ADA3103**Features**

- HiZ or 600 ohm input impedance
- 66 ohm/600 ohm output impedance
- 8 outputs (ADA-3101)
- 4 outputs (ADA-3102)

Input Characteristics

- Level +30dBm max
- Impedance jumper on card
- Coupling DC
- Type Balanced HiZ or 600 ohms
- Connector type 3-pin, 2-part detachable
- Common mode level +20V
- Common mode rejection >90dB @ 60 Hz; >60dB to 20KHz

Output Characteristics

- Level +30dBm @ 66 ohms
- Impedance jumper on card 66 ohms balanced
- Coupling DC
- DC on outputs <±20mV max
- Connector type 3-pin, 2-part detachable
- Output isolation – module to module > 1000dB 20 Hz to 20 KHz

1.3.3 ADA3124**Features**

- Reclocked and equalized
- Dual 1x4 or 1x8 configuration
- Analog headphone monitoring

Digital Input Characteristics

- Input level 2-7V p-p
- Impedance 75 ohm unbalanced or 110 ohm balanced, selectable

Digital Output Characteristics

- Impedance 75 ohm unbalanced or 110 ohm balanced, selectable
- Jitter <20ns
- Standard AES-3

1.3.4 HDVDA3101-R

Features

- Conforms to SMPTE 259M
- Automatic input EQ
- 8 outputs/card

Input Characteristics

- Standard SMPTE 259M
- Impedance Coax version: 75 ohms internally terminated
- Return loss >15dB to 1.5 GHz
- Signal amplitude 800mV $\pm 10\%$
- DC offset $\pm 0.5V$
- Rise and fall times <270pS

Output Characteristics

- Standard SMPTE 292M
- Impedance Coax version: 75 ohms internally terminated
- Return Loss >15dB to 1.5 GHz
- Signal amplitude 800mV $\pm 10\%$
- DC offset $\pm 0.5V$
- Rise and fall times <270pS

1.3.5 SDVDA3101

Features

- Conforms to SMPTE 259M
- Automatic input EQ
- 8 outputs/card

Input Characteristics

- Standard SMPTE 259M
- Impedance 75 ohms
- Return loss >15dB to clock frequency
- Signal level 800mV $\pm 10\%$
- DC offset $\pm 0.5V$
- Equalization automatic

Output Characteristics

- Standard SMPTE 292M
- Impedance 75 ohms
- Return loss >25dB to clock frequency
- Signal level 800mV $\pm 10\%$
- DC offset 0V $\pm 0.5V$
- Rise and fall times 400-700pS (20 to 80% amplitude)
- Overshoot <10% of amplitude (all outputs terminated)

1.3.6 SDVDA3101-R

Features

- Conforms to SMPTE 259M
- Automatic input EQ
- Reclocking
- 8 outputs/card

Input Characteristics

- Standard SMPTE 259M
- Impedance 75 ohms
- Return loss >15dB to clock frequency
- Signal level 800mV $\pm$ 10%
- Equalization automatic

Output Characteristics

- Standard SMPTE 292M
- Impedance 75 ohms
- Return loss >25dB to clock frequency
- Signal level 800mV $\pm$ 10%
- DC offset 0V $\pm$ 0.5V
- Rise and fall times 400-700pS (20 to 80% amplitude)
- Overshoot <10% of amplitude (all outputs terminated)

1.3.7 VDA3101GP

Features

- Bandwidth up to 1280X1024 @75Hz (about 150MHz)
- Handles inputs over 2V p-p to over 40 MHz
- 8 outputs

Input Characteristics

- Level 1V p-p nominal
- Type Differential
- Return loss >50dB to 10 MHz, >30dB to 150 MHz
- Impedance 75 ohms or High-Z
- Coupling DC or AC
- Common mode rejection > 55dB to 10 khz @ 4V p-p

Output Characteristics

- Level 1V p-p nominal
- Impedance 75 ohms
- Return Loss >50dB to 10 MHz, >25dB to 150 MHz

1.3.8 VDA3102

Features

- 1500' EQ min., 1700' EQ typ. (Approx. -1dB to 25 MHz)
- 3000' EQ min. (VDA 3102E), 3400' typ. (Approx. -1dB to 20 MHz)
- 8 outputs/card plus front panel BNC
- 650' pre-EQ

Input Characteristics

- Level 1V p-p nominal; 2V p-p max (w/o obvious distortion)
- Common mode rejection >70dB @ 60 Hz; >40dB to 5 MHz
- Return Loss >-55dB to 5 MHz
- Coupling AC, DC, Selectable
- Type Differential
- Impedance HiZ or 75 ohms looping

Output Characteristics

- Impedance 75 ohms
- Return Loss >55dB to 5 MHz
- Coupling Direct DC
- Level 1V p-p nominal; 2V p-p max (w/o obvious distortion)
- DC on outputs <±20mV max (w/o clamp); <±10mV (with clamp)

1.3.9 VDA3103

Features

- 250 MHz bandwidth with EQ
- 275 MHz bandwidth without EQ
- 8 outputs/card with front panel BNC

Input Characteristics

- Level 1V p-p nominal
- Impedance 75 ohms looping
- Return Loss >45dB to 5 MHz
- Coupling DC (Direct)
- Type Balanced (Differential)
- Common mode rejection >65dB @ 60 Hz

Output Characteristics

- Level 1V p-p nominal
- Impedance 75 ohms
- Return Loss >50dB to 5 MHz
- Coupling DC (Direct)
- DC on outputs <±20mV max
- Isolation >50dB to 20 MHz
- Equalization 0 to 100 meters Belden 8281 or equivalent to 250 MHz

1.3.10 VDA3105

Features

- High level DA (0 to $\pm 5V$)
- H&V sync DA
- 8 outputs/card with front panel BNC

Input Characteristics

- Level 10V p-p centered at 0V
- Impedance 75 ohms looping
- Coupling DC (Direct)
- Type balanced (differential)
- Common mode rejection 60dB
- Return loss >40dB to 5 MHz

Output Characteristics

- Level $\pm 5.0V$ p-p centered at 0V
- Impedance 75 ohms
- Coupling direct DC
- DC on outputs $< \pm 20mV$ max
- Isolation >40dB to 5 MHz
- Equalization 0 to 200 ft. Belden 8281

1.3.11 VDAC3101

Features

- Converts 270 MB/s component SDI input into analog outputs
- Front card edge provides additional composite analog output
- Four rear panel analog outputs, configurable as all NTSC/PAL-B composite, two composite and one Y/C, or one composite and one component
- Built-in color bar generator for set-up
- Provides 4 re-clocked, buffered SDI outputs
- 10 bit D-A, 8 bit encoding

Performance

- Signal-to-noise >56dB (weighted luminance to 10 MHz)
- Luminance frequency response 12 bits at 27 MHz
- Differential Gain <1.5%
- Differential phase <1.5 degrees
- K factor (2T) <1.0%
- Output level adjustment (internal) $\pm 20\%$

1.3.12 ADA3118

Features

- Reclock and equalized
- 8 output
- Analog headphone monitoring

Digital Input Characteristics

- Input level 2-7V p-p
- Impedance 75 ohm unbalanced

Digital Output Characteristics

- Impedance 75 ohm unbalanced
- Jitter $<\pm 20$ ns
- Standard AES-3

1.3.13 ADAC3102

Features

- Two AES/EBU transformer coupled inputs
- Two stereo analog outputs per AES/EBU input
- 24 bit/96 KHz D-A converters for superior performance
- Supports LR swap, invert, sum, and difference modes via jumper selection
- Selectable 66 or 600 ohm output impedance dual analog headphones

Analog Output Characteristics

- Level +30dBm @66 ohms; +24dBm @600 ohms
- Impedance selectable 66 or 600 ohms

Digital Input Characteristics

- Input level 2-7V p-p
- Impedance 75 ohm unbalanced or 110 balanced, selectable
- Type transformer coupled
- Supported sample rates 28 to 96 KH

1.3.14 VADD3101-10

Features

- Excellent quality 10-bit NTSC/PAL to SDI decoder
- Automatic NTSC/PAL selection
- Composite, and Y/C inputs

Input Characteristics

- NTSC/PAL composite BNC
- Y/C, 2X BNC
- RGB. 3X BNC

Output Characteristics

- 4 SDI, SMPTE 259M BNCs
- A/D Converters: 10-bit, 2X oversampling

- Frequency: Resp. ± 25 dB to 5 MHz
- Size: Fits PESA VDA3100T frames
- Power: 7W

1.3.15 AADC3102

Features

- Two stereo analog input channels
- Three AES/EBU outputs per input channel
- 24 bit/96 KHz A-D converters for superior performance
- Dual analog headphone
- Selectable 75 or 110 ohm output impedance
- Supports LR swap, invert, sum and different modes via jumper selection

Analog Input Characteristics

- Input level +30dBm max.
- Impedance 600 or 30k ohm, selectable
- Return loss >35dB to 5.75 MHz

Digital Output Characteristics

- Impedance 75 ohm unbalanced or 110 ohm balanced, selectable
- Standard AES-3
- Supported sample rates 28 to 96 KHz

1.3.16 VDAE3101-10

Features

- Excellent quality 10-bit Serial Digital to Analog conversion
- Full 10-bit data path, 4X oversampling
- Simultaneous component and composite analog outputs
- Digital noise reduction

Input Characteristics

- SDI (SMPTE 259M), BNC

Output Characteristics

- YpbPr, Betacam, RGB (all with 3 BNCs) YC with 2 BNCs and NTSC/PAL with 1 BNC
- Size: Fits PESA VDA3100T frames
- Power: 7W

Chapter 2 - Installation

2.1 Introduction

This section details VDA-3100 Video Mainframe installation procedures. The following topics are discussed:

- Receipt Inspection
- Unpacking
- Location
- Mounting
- Cabling
- Plug-In Video Card Installation
- Video Power Supply Installation
- Front Panel Installation
- Rear Panel Connectors
- VDA-3100 Video Mainframe System Connections



The VDA-3100 contains static sensitive devices. Care should be used when it is necessary to handle the internal circuit cards. It is recommended that a ground wrist strap and grounding mat be used before attempting any equipment installations.

2.2 Receipt Inspection

The VDA-3100 Video Mainframe was tested and inspected prior to leaving the factory. Upon receipt, inspect the equipment for shipping damage. If any damage is found, contact the carrier immediately and save all packing material.

2.3 Unpacking

The VDA-3100 Video Mainframe is comprised of a frame, a backplane, up to two video power supplies, and up to ten video distribution boards. Prior to discarding packing material, compare the parts received against the packing list. Carefully inspect the layers of packing material for any components which may have been overlooked during the initial unpacking.

2.4 Location

The VDA-3100 Video Mainframe may be located anywhere power is available. However, units should be mounted as close as possible to their associated equipment to minimize cable runs. Installation should be in an area where the ambient temperature does not exceed 40°C (104°F) inside the equipment rack.

2.5 Mounting

The VDA-3100 Video Mainframe is rack mounted in a standard 19" equipment rack. Sufficient space must be provided behind the rack to allow for the video and power cables. All mounting holes should be utilized and mounting hardware tightened securely. As with all equipment installed in a rack, the bottom screw on each side should be installed before proceeding with the remainder of the screws. Then all screws should be securely tightened. Support the VDA-3100 Video Mainframe's bottom while installing it in the rack. Figure 3 illustrates chassis installation in the equipment rack.

To install a VDA-3100 Video Mainframe in an equipment rack follow these steps:

1. Align the chassis with the slotted opening in the rack.
2. Install the bottom screws first.
3. Install the two top screws
4. Tighten all four screws securely.

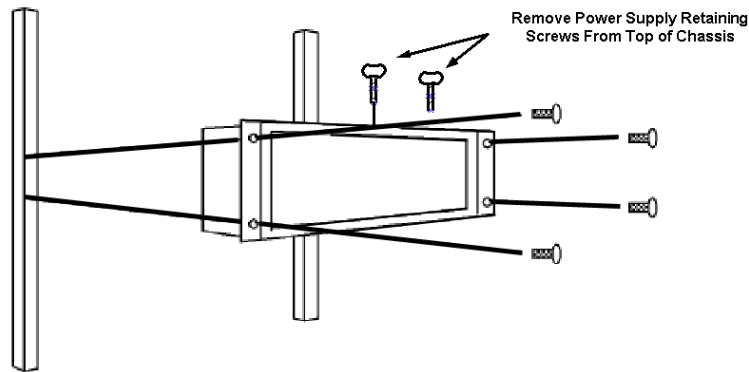


Figure 3. Chassis Installation

2.6 Cabling

Considerable weight will be added to the rear panel of the VDA-3100 Video Mainframe by the video cables and power cables. Therefore, all cables should be strained relieved and secured to racks or other supporting structures. Failure to provide adequate cable support can result in cables separating from connectors. If cable runs are to be stored under an elevated floor, they should be tied to the racks as a guide. If cables are run along the floor, do not allow them to lay in the work area behind the racks. Stepping or tripping on the cables may result in connections being pulled free or wire breakage inside the insulation. The VDA-3100 Video Mainframe should be installed in the equipment rack prior to attaching cables.



It is **strongly** recommended that you utilize Belden 8281 (or equal) 75 ohm cable for all video cabling.



Do not use 50 ohm cable, as this will produce standing waves and oscillations.

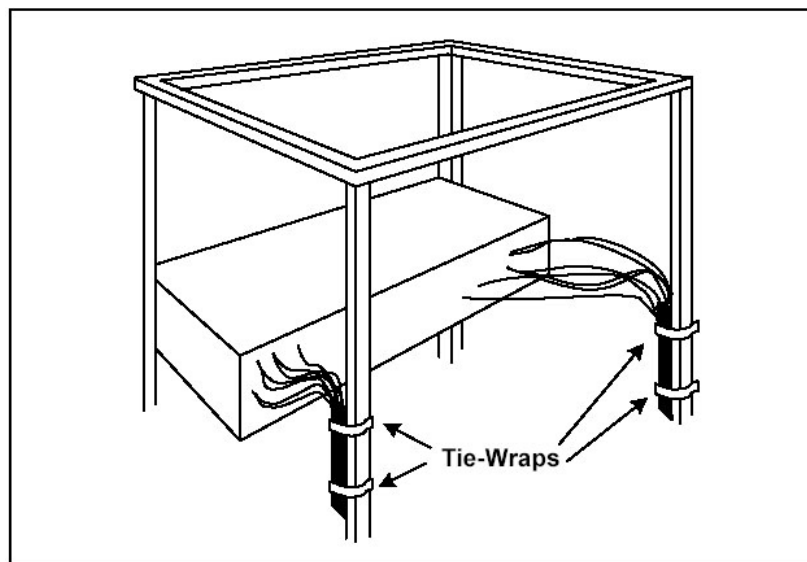


Figure 4. Cabling

Use the following rules when cabling the VDA-3100 Video Mainframe:

1. Lay all cables in their intended positions, separating video from power cables wherever possible.
2. Provide proper support for each cable during the cabling process. The use of tie-wraps is recommended, as in Figure 4.

2.7 Plug-In Card Installation

To install a card in the VDA-3100 Video Mainframe follow these steps while referring to Figure 5.

1. Align the card with a set of circuit card guides in either the center or left-hand compartment of the frame.
2. Carefully push the card into the frame until the circuit card connector makes initial contact with the backplane connector. At this point, firmly but carefully push the card into the frame while making sure the connectors are properly aligned. Continue pushing the card until it is in place and the connectors are firmly mated.
3. Repeat steps 1 and 2 for each card to be installed.

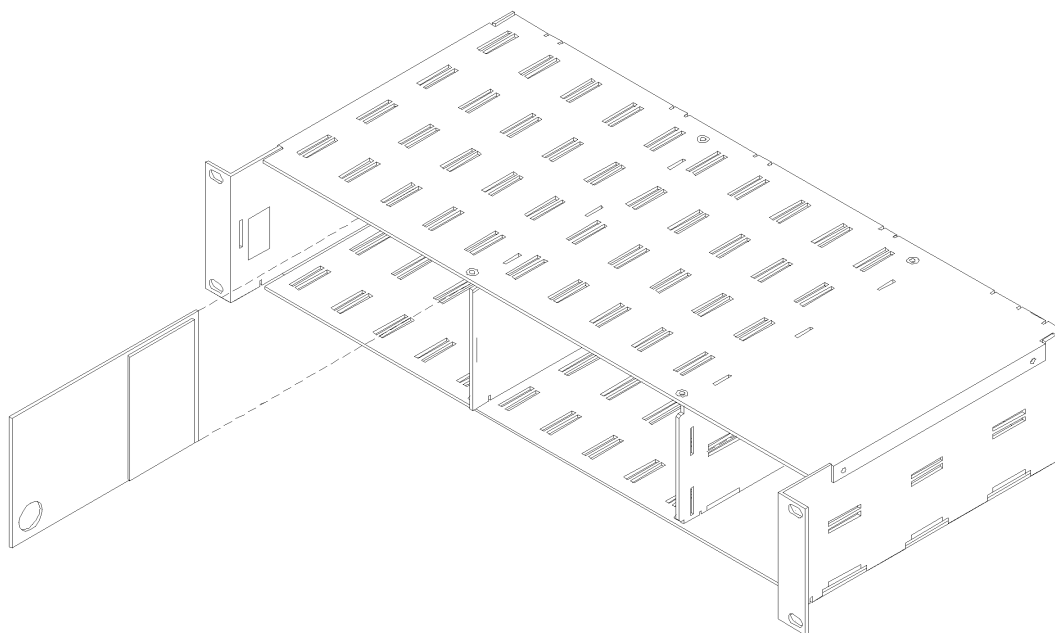


Figure 5. Card Installation

2.8 Power Supply Installation

Power is supplied to the VDA-3100 Mainframe through an internally mounted Power Supply. Power can also be supplied by an internally mounted secondary power supply or from an external power supply through the external power supply connector. External power supplies must be diode isolated from the internal power supplies. An 1N5821 or equivalent type diode may be used for this purpose. See Figure 6 for an illustration of the isolation diode installation. Each Power Supply provides $\pm 9-16$ volts unregulated DC.

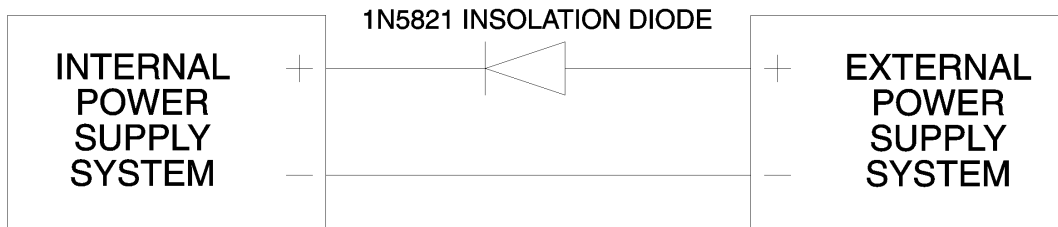


Figure 6. Isolation Diode Installation

In a redundant external power configuration, it should be noted that the VDA-3100 Video Mainframe does not differentiate between the supply intended as primary power and the supply intended as backup. Therefore, consideration should be given to avoid overloading the power supplies by having less than one supply per frame in multi-frame configurations.

To install a Power Supply in the VDA-3100 Video Mainframe follow these steps while referring to Figure 7:

1. Align the primary Power Supply with the upper set of circuit card guides in the right-hand side of the frame.
2. Carefully push the Power Supply into the frame until the power supply connector makes initial contact with backplane power connector. At this point, firmly but carefully continue pushing the Power Supply into the frame while making sure the connectors are properly aligned. Continue pushing the Power Supply until it is in place and the connectors are firmly mated.
3. If a redundant video power supply is to be installed, align it with the lower set of circuit card guides in the right-hand side of the frame and repeat step 2.

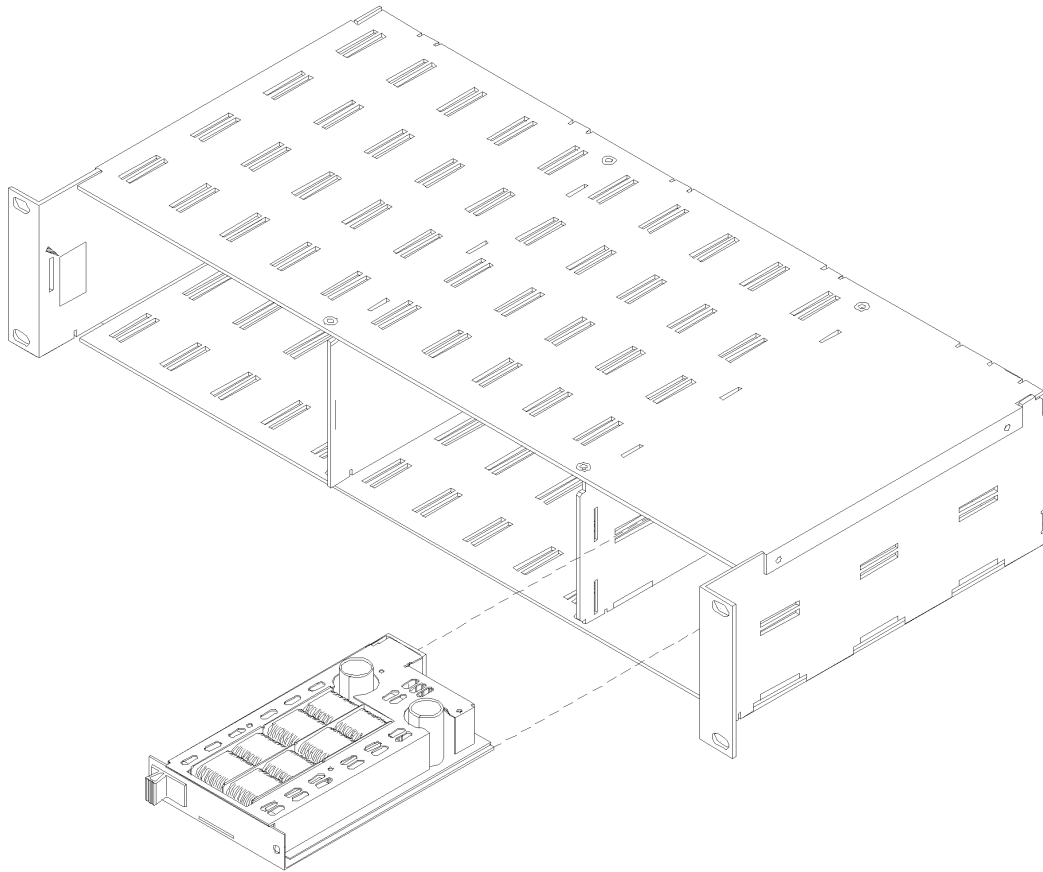


Figure 7. Power Supply Installation

2.9 Front Panel Installation

To install the access door (front panel) of the VDA-3100 Video Mainframe refer to Figure 8 and follow these steps:

1. Align the front panel to the front of the VDA-3100 Video Mainframe.
2. Now slide the front panel onto the mainframe assembly until the slide locks snap into place.

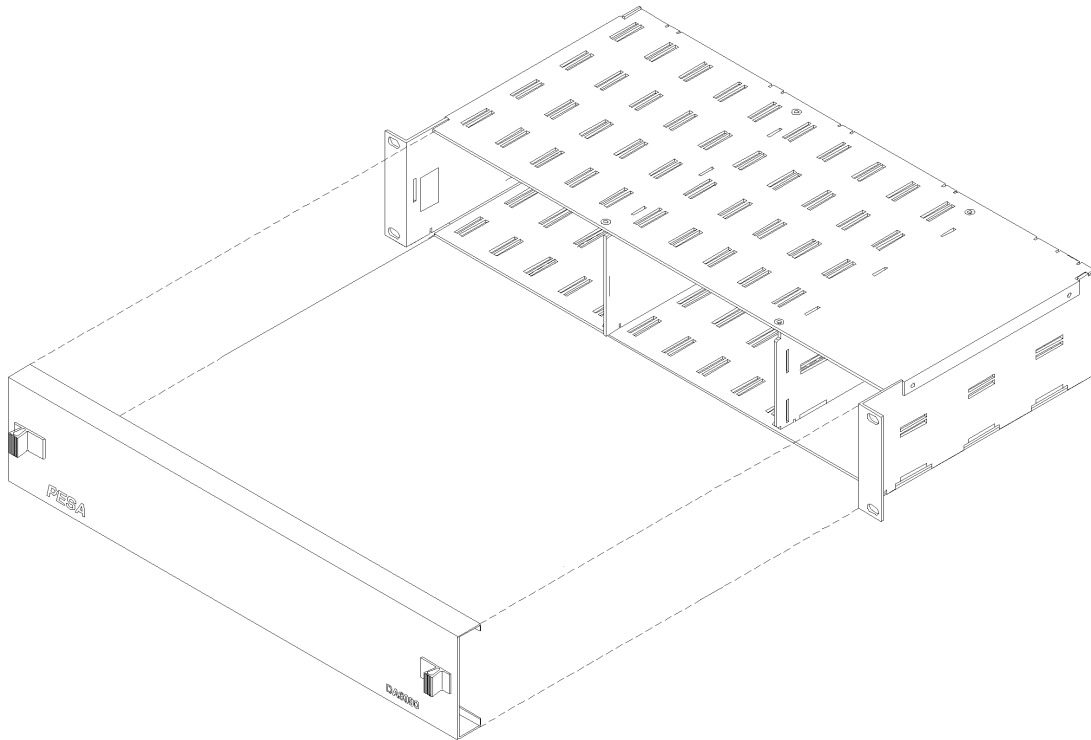


Figure 8. Front Panel Installation

2.10 Rear Panel Connectors

2.10.1 Alarm Connector

The alarm connector is disabled when Power Supplies are utilized to power the VDA-3100 Video Mainframe (standard configuration) except when SDVDA3101 Boards are installed. The fan circuit is also disabled. When power supplies are utilized to power the VDA-3100 Video Mainframe (optional configuration) the fan circuit is enabled and the alarm circuit, contained in power supply circuitry, acts as a switch to trigger an optional external alarm in the event of a failure in the power supply or of the external 110VAC (220VAC for the international version) source. The SDVDA3101 Board's alarm circuitry acts as a switch to trigger an optional external alarm in the event of an equalization loss. The alarm circuits supply a contact closure but do not provide an operational voltage for the external alarm. The alarm connector, located on the backplane, allows connection of the external alarm.

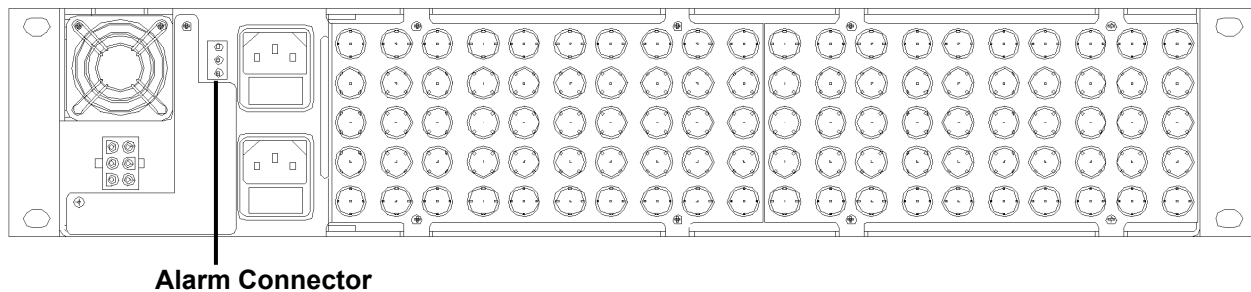


Figure 9. Alarm Connector

2.10.2 DC Power Connector

Power can be supplied to the VDA-3100 Video Mainframe through an externally mounted power supply or from internal power supplies. The DC Power Connector can be used as DC power input (external power supply) or as DC power output (internal power supplies) to allow the video mainframe to power additional equipment items.

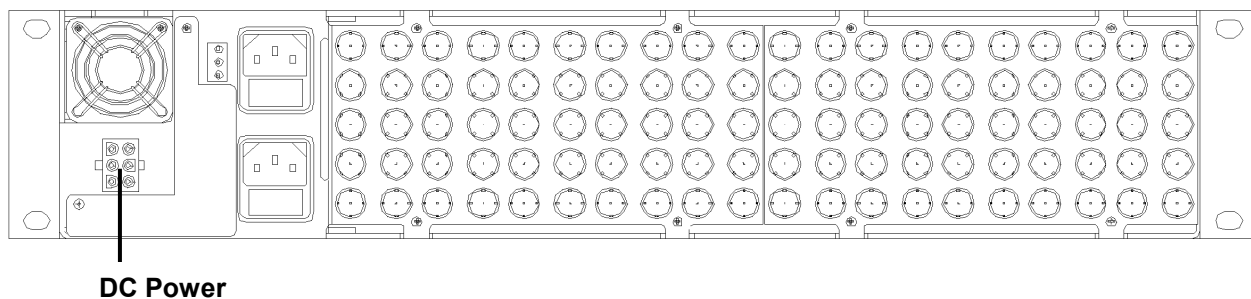


Figure 10. DC Power Connector

2.10.3 Video Input and Output Connectors

There are ten video loop-through connectors located on the rear panel of the VDA-3100 Video Mainframe. There are also ten groups of video output connectors located on the rear panel. Each of these groups contain eight video output connectors.

2.11 VDA-3100 Video Mainframe System Connections

Once the VDA-3100 Video Mainframes are installed in the equipment racks, system connections can be made. Use the following guide and the sample system connections illustration, Figure 11, to insure that the VDA-3100 Video Mainframe system connections are hooked up correctly.

2.11.1 Connection Guide

1. Connect the video sources to the video inputs. The video inputs are loop through connectors and can be daisy chained as shown in Figure 11. The end of each video input daisy chain must be terminated with a 75 ohm termination.
2. Connect the video outputs to the video destinations.
3. Connect the primary power supply to the AC line.
4. If a redundant internal AC power supply is utilized, connect it to the AC line.
5. If a backup power supply is to be included in the system configuration, connect it to the DC input/output connector and then connect it to the AC line.

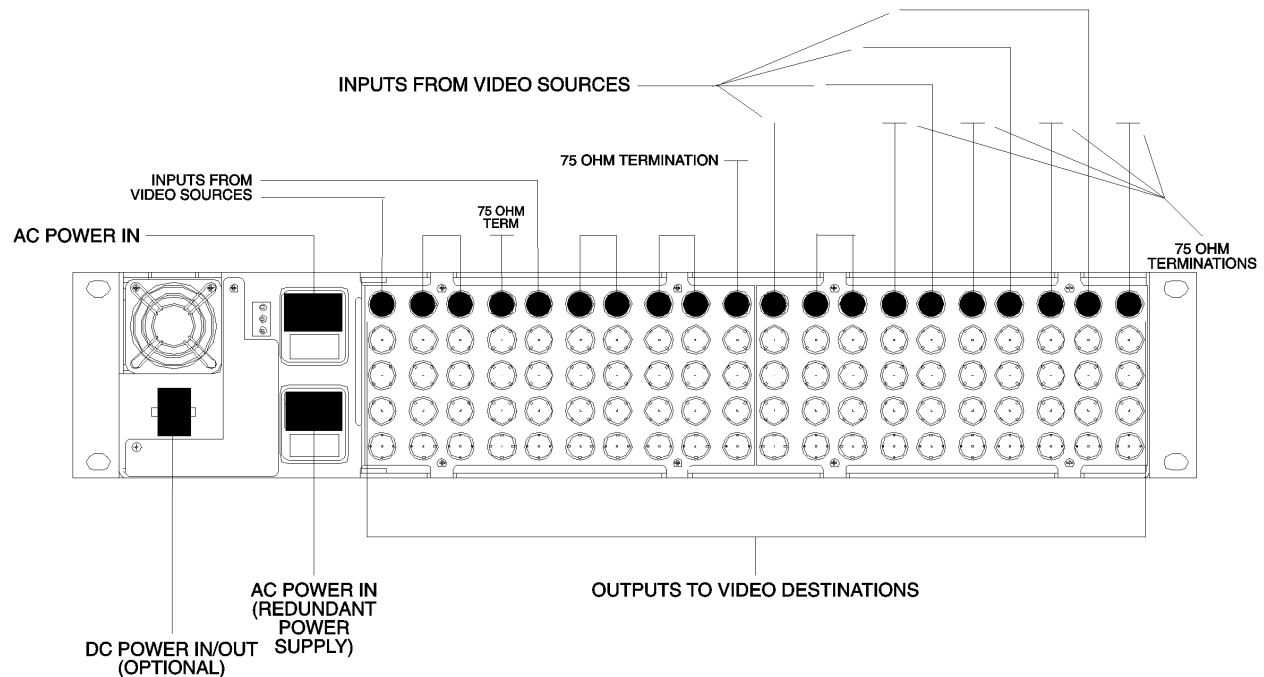


Figure 11. Connection Guide

The VDA-3100 Video Mainframe should now be powered up and ready for operation.

Chapter 3 – Maintenance

3.1 Maintenance

The VDA-3100 Video Mainframe, the boards, and the Power Supplies are designed and manufactured to give long, trouble free service with minimum maintenance requirements. If problems do occur, follow the troubleshooting procedure provided in this section. If additional technical assistance is required, refer to the General Assistance and Service information in the front of the manual.

3.2 Preventive Maintenance

Use the following guidelines for general preventive maintenance:

- Keep the inside of the frame clean, especially if your facility is subject to dust or dirt in the atmosphere. Use compressed air, an antistatic cloth, or an antistatic vacuum to clean the frame and internal components.
- Observe proper procedures for preventing electrostatic discharge when cleaning the unit, and when inserting and removing cards.
- Ensure that all tools and personnel handling individual components are properly grounded.
- If a problem is suspected with an individual Video Distribution Board, first swap out the board and recheck the system for the problem.

3.3 Test Equipment

The test equipment recommended for servicing the VDA-3100 Video Mainframe, the Video Distribution Boards, and the Power Supplies is listed below. Equivalent test equipment may be used.

- Digital Multimeter
- Audio Generator
- Video Generator
- Oscilloscope
- 75 Ohm Load
- 75 Ohm Termination
- Audio Distortion Analyzer
- Video Network Analyzer

3.4 Corrective Maintenance

The following paragraphs provide information to assist the servicing technician in maintenance of the VDA-3100 Video Mainframe, the Video Distribution Boards, and the Power Supplies.

3.4.1 Factory Repair Service

If desired, equipment or boards may be returned to the factory (transportation prepaid) for repair. Refer to the General Assistance and Service information on the front of this manual. Call the PESA Service Department for a RMA number before shipping an equipment item.

3.4.2 Troubleshooting

The best troubleshooting tool is a familiarity with the equipment and a through understanding of its operation. If all of the video outputs from a VDA-3100 Video Mainframe are missing, check the Power Supply System and the power supply line fuses. If some of the video outputs from a VDA-3100 Video Mainframe are missing, check the operation and adjustment of the individual Video Distribution Board whose outputs are missing.



Do not attempt to repair equipment that is in warranty. If the equipment is in warranty follow the procedures found under Factory Repair Service.

3.4.3 Replacement Parts

Only parts of the highest quality have been used in the design and manufacture of the VDA-3100 Video Mainframe, the Video Distribution Boards, and the Power Supplies. If the inherent stability and reliability are to be maintained, replacement parts must be of the same quality. When replacing parts, avoid using excessive solder on the printed circuit board. Always make sure that the solder does not short two circuits together. Be sure the replacement part is identical to the original, and is placed in exactly the same position with same lead lengths.

