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Video Adapter Assembly

(VAA)

Operation Manual

Revision -



Westar Corporation
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St. Charles, MO 63304-5685

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1. OVERVIEW

The Video Adapter Assembly (VAA) Operation Manual provides information on how to effectively use the VAA.

1.1 References

1. PS 14-11196, Appendix IV, Procurement Specification for the Display Processor / Multipurpose Display Digital Video Interface, dated 17 December 1999
2. CD 14-11112B, Section 3.5.1.13, Control Document for the Apache Longbow System, dated 02 March 1999
3. PS 90-410062, Procurement Specification for the Apache Longbow Crew Trainer Video Adapter Assembly, dated 26 October 2001

1.2 Introduction

The VAA converts four (4) channels of MDU Hotlink packet video information into industry standard video formats.

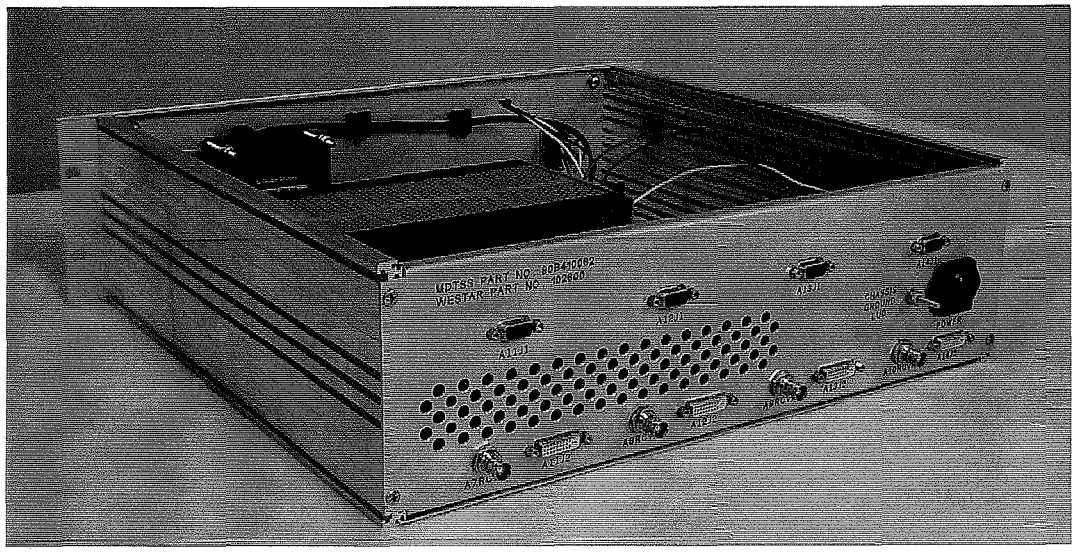


Figure 1 Video Adapter Assembly

The assembly, shown in Figure 1, is a 4U 19" rack unit, complete with video conversion electronics, fused AC power Inlet, DC power supply, cooling fan, and internal cabling.

Section 2 describes the VAA assembly.
Section 3 defines the signal interfaces.
Section 4 describes the VAA Theory of Operation.
Section 5 provides troubleshooting guidance.
Section 1) provides information on associated equipment to aid in troubleshooting VAA operation.

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1.3 Electro-Static Discharge (ESD) Warning



When handling circuit cards, please keep the following in mind:

Electronic components on printed circuit boards are extremely sensitive to static electricity. Static electricity is generated by clothing or by the rubbing (or separation) of items such as transparent tape or styrofoam. The static electricity can generate a field potential strong enough to cause damage to electronic components. It is recommended that when handling the VP5 module that you observe the ESD precautions by utilizing an anti-static grounding strap and selecting and ESD-safe work area.

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2. VAA ASSEMBLY DESCRIPTION

2.1 Key Components

Key components in the VAA assembly are depicted below in Figure 2

Please see the VAA Assembly Drawings for complete details.

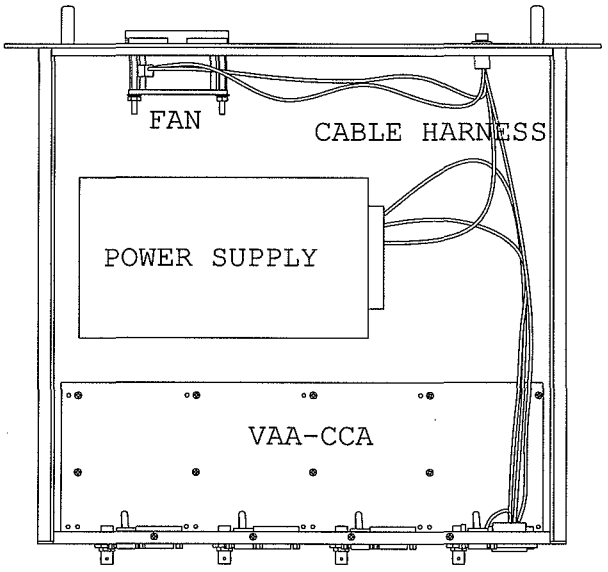


Figure 2 Key Components

The main components of the VAA are the VAA Circuit Card Assembly (VAA-CCA), the Power Supply, the Fan, and the cable harness.

- Full assembly information for the VAA-CCA is available in the VA Board Drawings section of the VAA Documentation Binder.
- System connectivity for the Cable Harness is available in the Power Cable Harness drawing and the VGA jumper cable harness drawing contained in the VAA Assembly Drawings tab within the VAA Documentation Binder.
- Mechanical detail on the power supply is available in the COTS section of the VAA Documentation Binder as well as from the manufacturer.

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2.2 VAA AC Power Requirements and Fuses

The VAA uses a standard, fused IEC 320 power inlet. The fuse is contained in the sliding mechanism within the AC Inlet. The unit is delivered with both an active fuse and a spare fuse in the spare fuse holder.

The fuse is rated at 250V and 1.6 A and is a 5 x 20 mm fast act fuse, Digi-Key stock number F947-ND (Littelfuse 21701.6).

The approximate power consumption is 0.6 Amps at 115 VAC.

2.3 VAA System Grounding

The AC Inlet safety ground is tied directly to:

- the ground lug on the back of the box
- the safety ground on the AC Power supply

via 16 AWG conductors, as described in the power cable harness assembly.

2.4 VAA System Cooling

Air is drawn into the VAA through the fan air inlet. Air circulates through the assembly and out the air vents located on the back of the VAA.

Fan assembly information is as follows:

Component	Allied Electronics Stock Number	Manufacturer Part Number
115 VAC fan assembly	965-0115	Globe Motors A31-B15A-15T2-000
fan guard	609-5602	Qualtek 09325-G
fan filter	609-5604	Qualtek 09325-M/30
fan retainer	609-5603	Qualtek 09325-R

Maintenance: Please check the fan filter periodically. If dust buildup is evident, replace the filter.

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3. SIGNAL INTERFACE DESCRIPTION

All signal cabling is connected at the back of the VAA, per Figure 3 below.

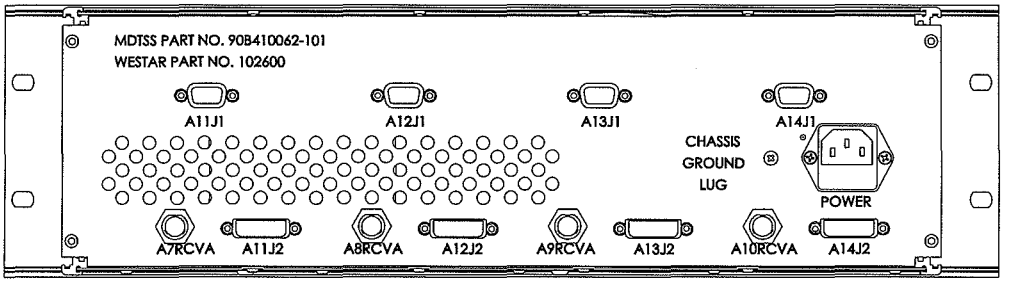


Figure 3 VAA Rear View

Connector naming connection is per Reference (4), and repeated here for convenience:

Channel	HotLink Input	VGA Output	DVI Output
1	A7RCVA	A11J1	A11J2
2	A8RCVA	A12J1	A12J2
3	A9RCVA	A13J1	A13J2
4	A10RCVA	A14J1	A14J2

3.1 Hotlink Input Channels

The various input and output signals from the VP5 module fall under one of the following categories:

Center Conductor	Inner Shield	Outer Shield
Signal	Signal Return	Chassis Ground

3.2 VGA Video Out

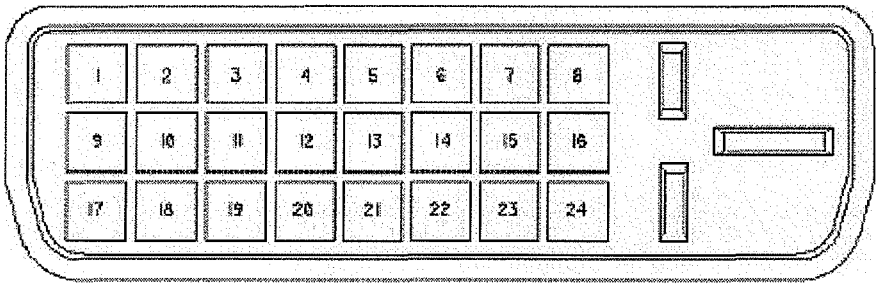
The four (4) VGA output connectors standard HD-15 female D-type connectors as follows:

Pin	Definition	Pin	Definition	Pin	Definition
1	Red Video	6	Red Ground	11	Ground
2	Green Video	7	Green Ground	12	Not Used
3	Blue Video	8	Blue Ground	13	Hsync
4	Ground	9	Not Used	14	Vsync
5	Ground	10	Ground	15	Not Used

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3.3 DVI Video Out

The four (4) DVI output connectors are DVI-D digital 24 pin connectors as follows:



Card end face of female DVI-D connector.

Pin	Function	Pin	Function
1	TMDS Data2-	13	Not used
2	TMDS Data2+	14	Not used
3	Ground	15	Not used
4	Not used	16	3.3 VDC
5	Not used	17	TMDS Data0-
6	Not used	18	TMDS Data0+
7	Not used	19	Ground
8	Not used	20	Not used
9	TMDS Data1-	21	Not used
10	TMDS Data1+	22	Ground
11	Ground	23	TMDS Clock+
12	Not used	24	TMDS Clock-

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4. THEORY OF OPERATION

4.1 Functional Description

The VAA accepts four (4) channels of HotLink video in a format as specified in references (1) and (2). The 512x512 pixels of Red, Green1, Green2, and Blue are received and reformatted to be the center 512x512 pixels (Red, Green1, Blue) in a 800x600 (SVGA) output per VESA 900602 timing. Both digital (DVI) and Analog outputs are available. Figure 4 below shows a functional block diagram of the VAA circuit card.

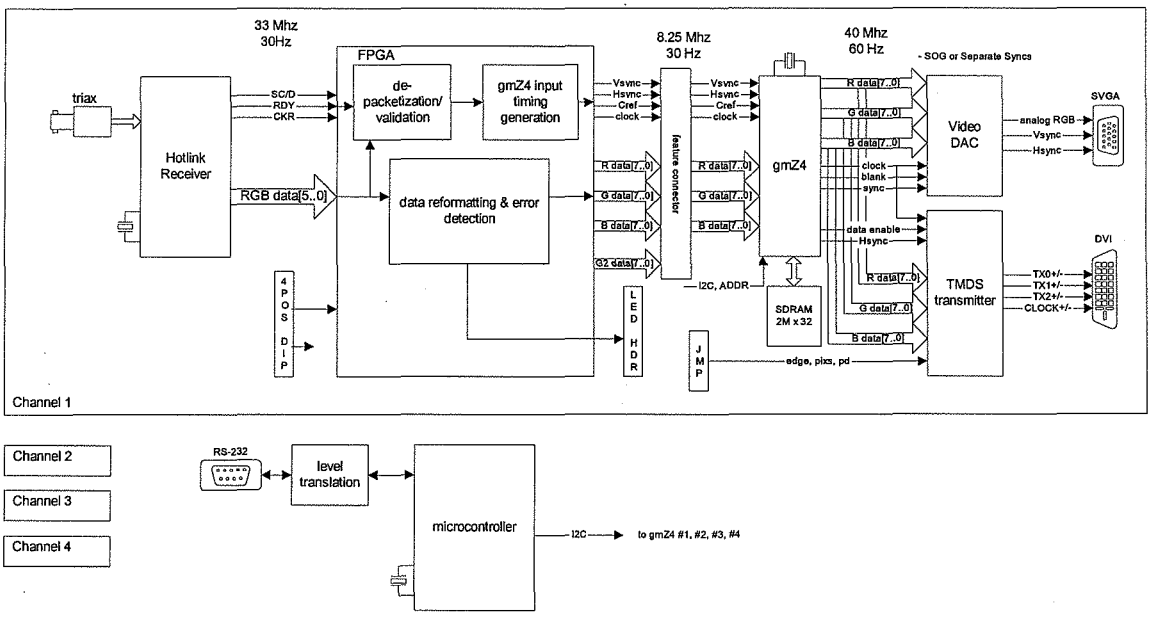


Figure 4 VAA Block Diagram

4.2 Switch Settings

Each of the 4 channels has 8 dipswitch settings as defined below:
The default setting at delivery is highlighted.

Dip Switch #	On Position	Off Position	Notes
1	**Sync is on Green channel**	Sync is not on Green channel	Separate Vertical and Horizontal syncs remain active regardless of switch setting
2	On	**Off**	Toggle to "on" then "off" position to clear latched error conditions **(Engineering debug only)**
3	Green #2 is selected	**Green #1 is selected**	Select Green 2
4	Auto Clear Active	**Auto Clear Off**	Logic automatically resets error flags after ~3 seconds. **(Engineering debug only)**
5	On	**Off**	Spare 1
6	On	**Off**	Spare 2
7	On	**Off**	Spare 3
8	On	**Off**	Spare 4

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4.3 HotLink Packet Processing

The VAA state machine processes incoming packets to create a raster digital video signal.

If the VAA NEVER receives valid packets, the output will be inactive.
If valid packets were being received and then are suspended, the VAA will output the most recently received frame.

Incoming packets are decoded to create vertical syncs, horizontal syncs, red data, green data, blue data, data enable signals, etc. Either Green 1 or Green 2 data may be processed, based on Dip Switch #3.

If an unexpected packet is detected, an error is flagged on the internal error status bus, and the state machine awaits the next vertical sync packet. **Information on the internal error status bus is available for Boeing Engineering.**

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4.4 Video Transfer

The Hotlink protocol delivers exactly 512Hx512V Red, Green 1, Green 2, and Blue pixels. The output format is SVGA, 800H x 600V Red, Green, and Blue pixels. Figure 5 shows the key output timing parameters.

VAA	Definition	900602
801	Active Horizontal Pixels	800
601	Active Vertical Pixels	600
37.879 KHz/ 26.4 usec	Horizontal Freq/Time	37.879 KHz/ 26.4 usec
60.317 Hz/ 16.6 msec	Vertical Freq/Time	60.317 Hz/ 16.6 msec
40.000 MHz/ 25 nsec	Pixel Clock/ Period	40.000 MHz/ 25 nsec
NONINTERLACED	Scan Type	NONINTERLACED
POSITIVE	Horizontal Sync Polarity	POSITIVE
POSITIVE	Vertical Sync Polarity	POSITIVE
1056 Pixels	Horizontal Total Time	1056 Pixels
801 Pixels	Horizontal Active Time	800 Pixels
255 Pixels	Horizontal Blank Time	256 Pixels
143 Pixels	Horizontal Right Border	0 Pixels
39 Pixels	Horizontal Front Porch	40 Pixels
128 Pixels	Horizontal Sync Time	128 Pixels
88 Pixels	Horizontal Back Porch	88 Pixels
146 Pixels	Horizontal Left Border	0 Pixels
628 Lines	Vertical Total Time	628 Lines
601 Lines	Vertical Active Time	600 Lines
27 Lines	Vertical Blank Time	28 Lines
37 Lines	Vertical Bottom Border	0 Lines
0 Lines	Vertical Front Porch	1 Line
4 Lines	Vertical Sync Time	4 Lines
23 Lines	Vertical Back Porch	23 Lines
52 Lines	Vertical Top Border	0 Lines

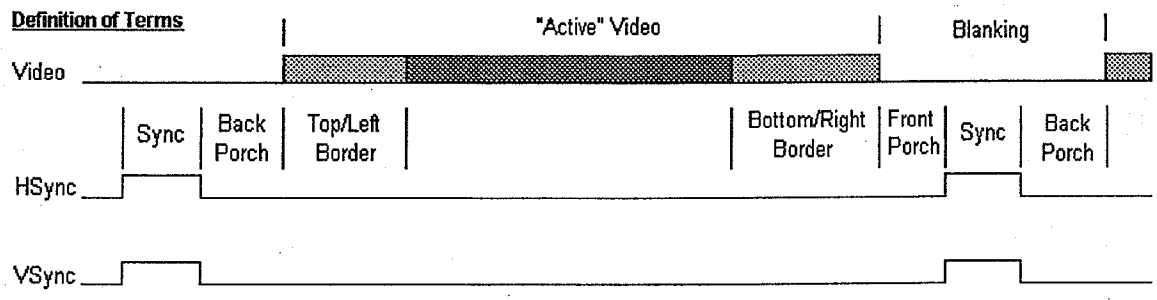


Figure 5 VAA Output Timing Parameters

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Figure 6 shows the location of the active video window.

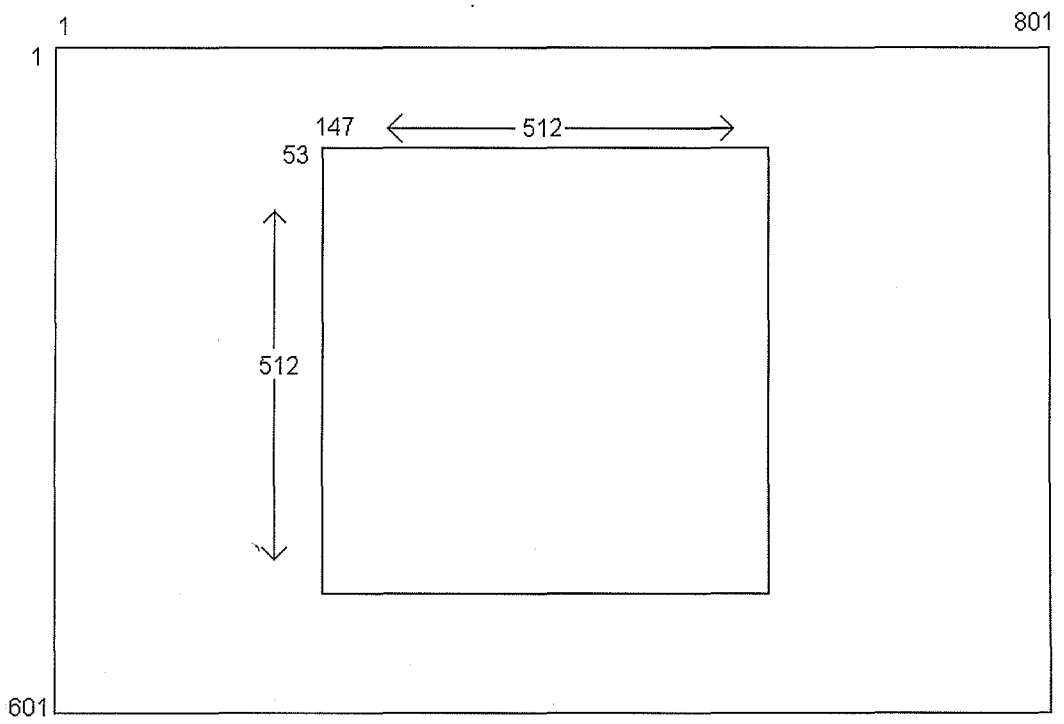


Figure 6 Active Video Window

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5. TROUBLESHOOTING GUIDE

The following steps are intended to determine if the VAA is operational or not. If the diagnosis conclusion is a suspect VAA. We recommend a spare VAA be installed to verify the original VAA is faulty. If the original VAA is faulty, contact Westar for support.

Warning! The VAA is a 115VAC device. Use extreme caution when handling powered devices. Consult a professional electronics technician.

Part A: No VAA channels are operating

1) Connect each VAA output to a computer monitor to isolate from downstream problems. If there is still no video out of any of the channels. Continue.
2) Is the VAA powered? (Switch light is ON)
   a) If so, are the VAA inputs active?
      i) Verify the Hotlink inputs are active.
      ii) If unsure, use HLR as an alternate source
      iii) Conclusion: If VAA is powered and inputs are good and no outputs are detected, the VAA is suspect. Swap out VAA boxes.
   b) If not (VAA not powered)
      i) Is the unit plugged in?
      ii) Is the power switch on?
      iii) Is the power switch lit?
      iv) If the power switch does not light
         (1) Check the AC source to make sure it is on
         (2) Check the fuse in the AC Inlet.
         (3) Conclusion: If the AC source is good and the fuse is good and the unit does not power on, the VAA is suspect. Swap out VAA boxes

Part B: At least one channel is operational, and at least one channel is not operational

1) Connect each VAA output to a computer monitor to isolate from downstream problems. If there is still no video (or faulty video) on at least one of the channels. Continue.
2) Swap a Hotlink input on a faulty channel with an input on a functional channel
   a) If the fault follows the input
      i) The source may be bad
      ii) Verify with the HLR
   b) If the fault stays with the same VAA channel
      i) The VAA channel may be bad
      ii) **Conclusion: The VAA is suspect. Swap out VAA boxes**

6. SUPPORT

If additional support is required beyond the information contained in the deliverable documentation, please contact Westar at 636-498-6004 x223.

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7. ASSOCIATED EQUIPMENT

7.1 Hot Link Replicator (HLR)

This device is available from Westar. The HLR is a 4 channel HotLink source. The HLR is a key tool in isolating system problems to either the VAA or the HotLink source.

Each of the 4 channels outputs one of 16 different test patterns. The HLR includes an AC/DC adapter for power. Installed test patterns are as follows:

TP#	Pattern	TP#	Pattern	TP#	Pattern	TP#	Pattern
0	reserved	4	Blue Wedge	8	50 pixel/50 pixel Checkerboard	12	White Wedge
1	White Wedge	5	Pixel off/Pixel on Checkerboard	9	White Wedge	13	White Wedge
2	Red Wedge	6	Horizontal stripes	10	White Wedge	14	White Wedge
3	Green Wedge	7	Vertical stripes	11	White Wedge	15	White Wedge

Figure 7 hows the HLR:

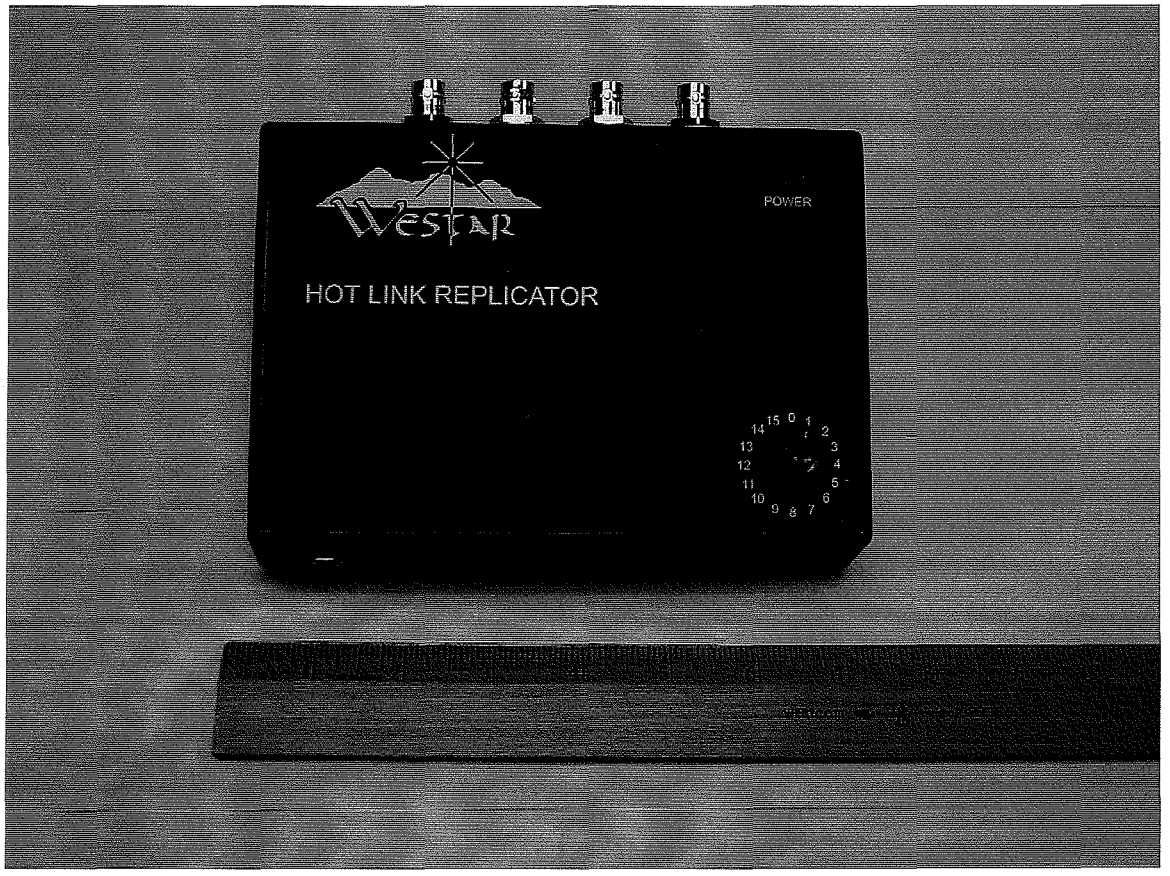


Figure 7 HLR Test Asset

Hotlink video cables are available separately. Because of the proximity of the Hotlink source to the VAA, the test technician may be able to simply disconnect the cable from the HotLink source and re-attach to the HLR during a debug session.

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7.2 DVI to RGB Converter

This device is available from Westar. It converts the DVI signal to a RGB analog signal ready to display on a CRT monitor.

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