n-vision

Virtual Binoculars User Guide

Jun-00

Table of Contents

n-vision, inc.

7915 Jones Branch Drive, Suite 1201

McLean, VA 22102

(703) 506-8808

1 Introduction

1.1 Overview

This document describes installation, operation, and maintenance procedures for the n-vision VGA Virtual Binoculars, a full color, hand-held immersive display. Users should familiarize themselves fully with the contents of this manual before handling the unit.

1.2 Safety Precautions

Danger

Do not put any object into the video control unit (VCU).
Do not put any solid objects or liquids such as water into the video control unit or CRT/Optical Assembly. In case of an accident, unplug the VCU immediately and contact n-vision. Using the VCU unit with any object inside can cause fire or damage.

Do not disconnect the Virtual Binocular connector while the unit is on.
The cable leading to the CRT/Optical assembly contains a high-voltage wire and should not be disconnected while the unit is on. This can damage the display and/or cause electric shock.

Warning

Operate under the specified power.
Be sure to operate the VCU only with the specified power. The unit is designed for 110-220V 50/60 Hz input.

Do not overload the power source.
Do not overload power outlets beyond their rated loads.

Protect the cables.
Do not pull or bend the power cable or signal cable. Do not place the VCU or any heavy objects on these cables. If damaged, the cable can cause fire, electric shock, or damage.

Hold the plug for disconnection.
To disconnect the power cable or signal cable, always pull from the plug, not the cable itself.

Maintain good ventilation.
Ventilation slots are provided to keep the VCU from overheating. Covering the slots may cause failure from overheating.

Use screen savers.
Similar to a desktop monitor, the CRTs used in the Virtual Binoculars are susceptible to phosphor burn-in if not cared for properly. When not in use for extended periods, be sure to have a screen saver protecting the display screen, or turn off the power.

2 System Overview

The n-vision Virtual Binocular is a 640x480 non-interlaced, full color, hand-held immersive display. The system employs advanced optical, electronic, and display components designed to deliver razor sharp visual acuity in a package that is functional and easy to use. The system is comprised of two main components: the Video Control Unit (VCU) and the Binocular display device.

2.1 The Display Device

The display combines one-inch CRT image sources housed in aluminum barrels with precision eyepieces to form a binocular display device. Mechanical features include focus adjustment, interpupillary distance adjustment, and mouse-compatible buttons on the top of the unit. The buttons can be programmed using any software tool kit that supports mouse gestures. Uses for the buttons include toggling reticules and indicators, zoom control, and motion control in virtual environments. See figure 2.1.

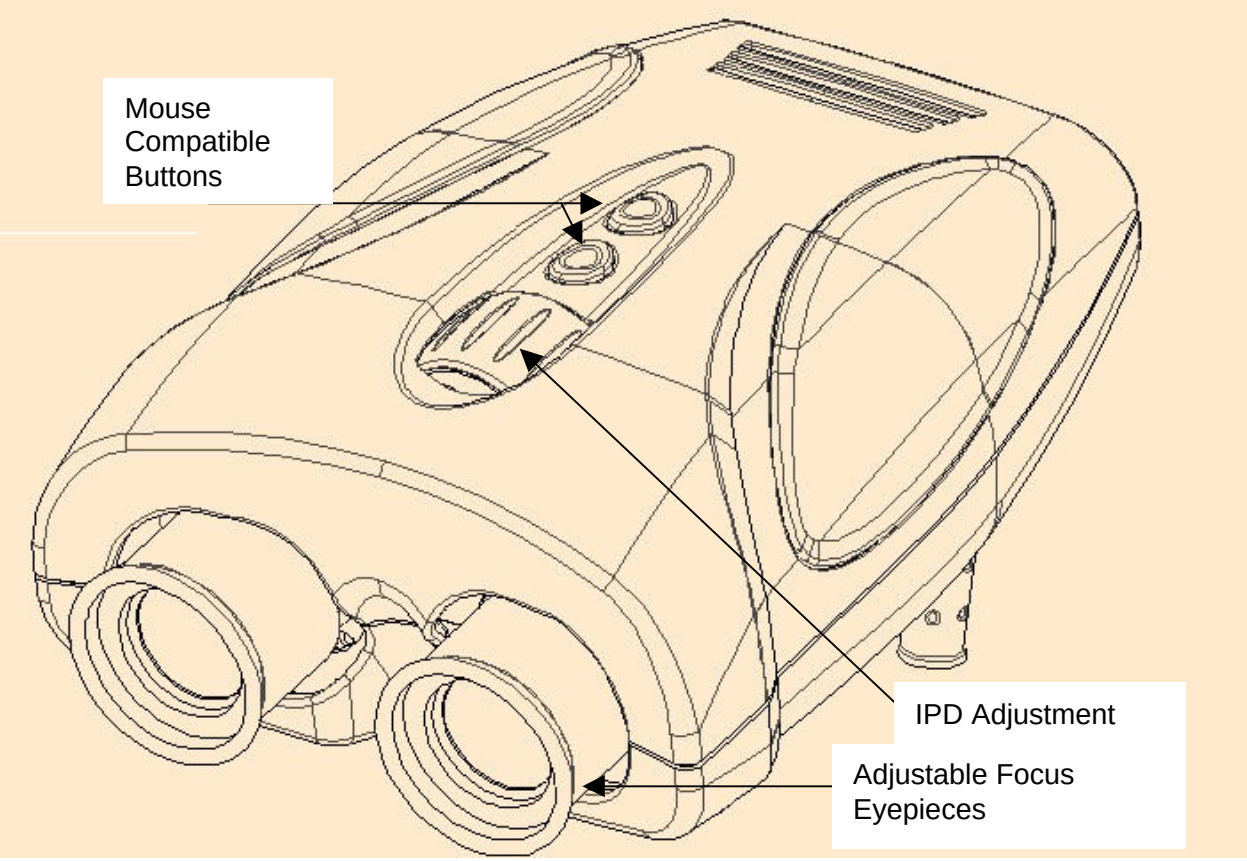

Figure 2-1

The Virtual Binoculars are housed in a rugged plastic clamshell housing with sides cushioned by ergonomic rubber grips. A rubber heel in the top center of the shell adjusts interpupillary distance. Underneath is a standard-threaded tripod mount for statically mounting the binoculars using off-the-shelf fixtures.

The binocular display system is designed for easy and unobtrusive mounting of tracking sensors internally or externally. Magnetic, mechanical, optical, ultrasonic, or inertial schemes can be used. Internal mounting points can be used for magnetic or radio sensors. External mounting points provide a platform for sensors that must be readily removed or require a line of sight to a source.

2.2 The Video Control Unit (VCU)

The VCU accepts the video input from the image generator (PC or graphics workstation) and processes the information to provide the correct drive voltages to the CRTs in the Binoculars.

The back of the VCU panel has (2) 15-pin standard VGA connectors which must both be connected to an input source. The VCU accepts standard VGA 640x480 60 Hz IBM five line video format as well as 640x480 180 Hz serial (one line) color field sequential video. See section 4, Configuring the Video Hardware, for more information. See figure 2.2.

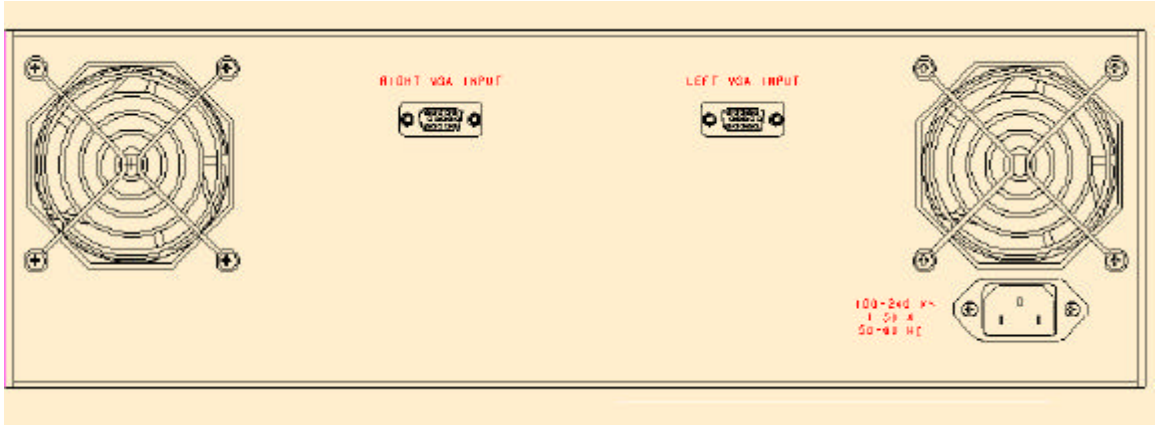

Figure 2-2

Connectors to the Binoculars are found on the front of the VCU along with the display parameter adjustments. The Binocular connectors are labeled **L** & **R** and must be plugged into the appropriate channel for the display to function properly. For information regarding display parameter adjustment, see section 3. See figure 2-3.

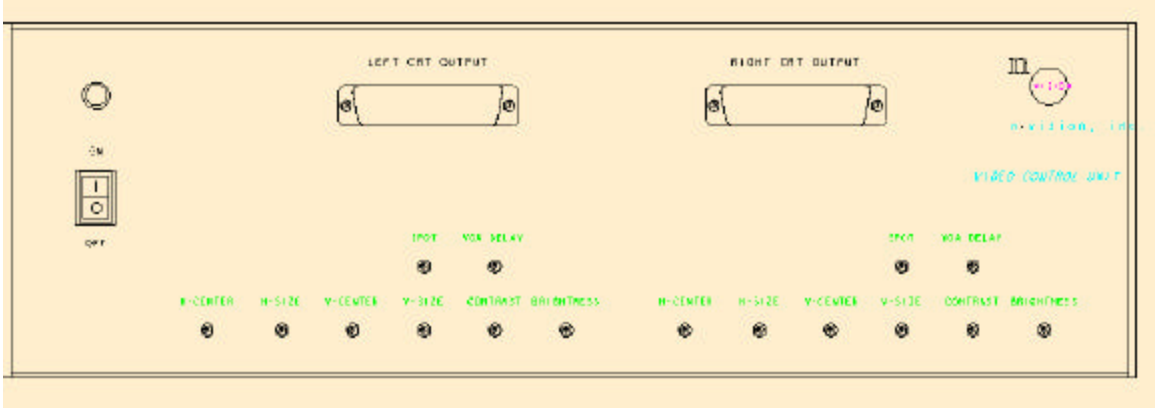

Figure 2-3

3 Using the Virtual Binoculars

3.1 Connecting the Binoculars

Be sure the unit is off before setup. Connect both left and right connectors from the Binoculars to the corresponding channel of the VCU. Tighten the connectors by turning locking screws. See the photo in figure 3-1.

Figure 3-1

3.2 Connecting Video

3.2.1 Standard PC Setup

If your image generator is based on a standard PC operating system such as Microsoft Windows, you will most likely be connecting the VCU to a standard 60 Hz VGA input. The video source must be capable of producing standard VGA output, i.e., 640x480, 60 Hz five line video. This format sends separate horizontal (**H**) and vertical (**V**) sync signals as well as red, green, and blue video (**RGB**). Most PC based video cards produce this video signal. Refer to the user manual of your video hardware for more information.

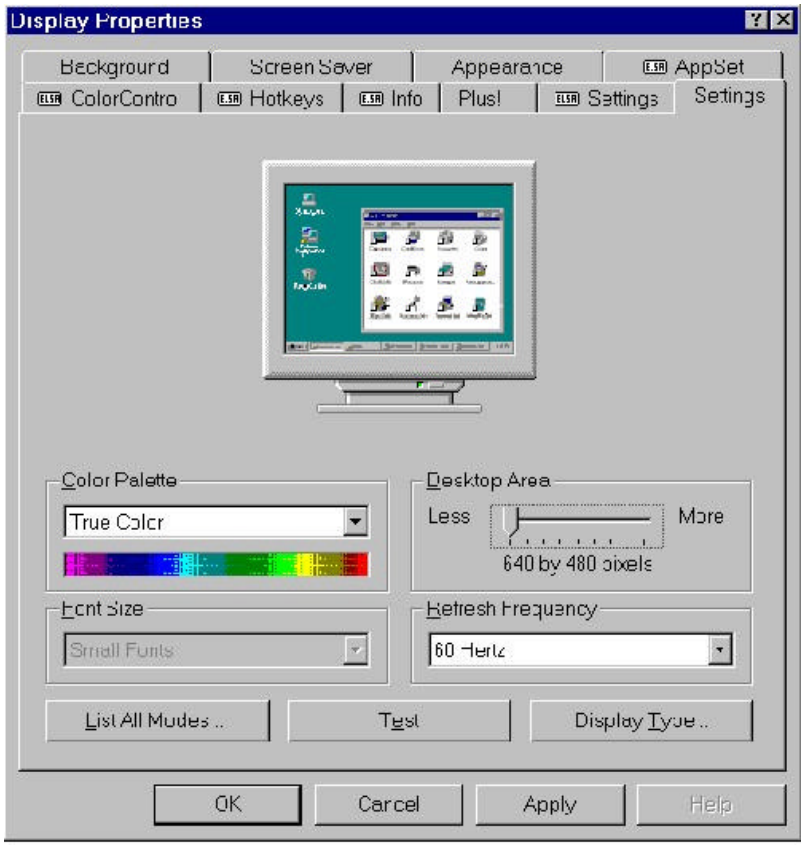

Figure 3-2

3.2.2 Color Serial Field Sequential Setup

The VCU will also accept 180 Hz color field sequential video as input. If you are working with SGI graphics hardware, particularly the Onyx or Octane class workstations, you can use this format. This is useful if you are already using an n-vision high performance display such as the Datavisor® HiRes Head Mounted Display. These high-resolution displays require FS video. In this case, you may use the same cabling, but you must be sure that the video format is set to 640x480 and have the sync format configured to separate **H** and **V** lines. See the *ircombine* screen shot in figure 3-3.

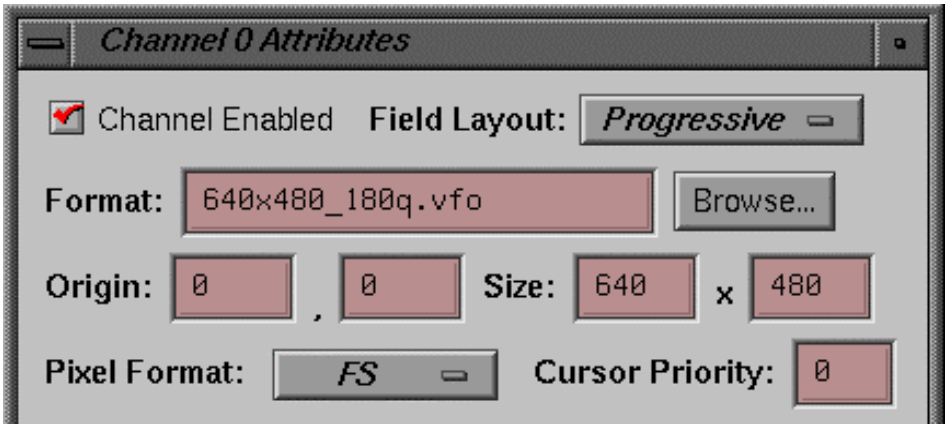

Figure 3-3

3.3 Adjusting the Binoculars

3.3.1 Mechanical Adjustments

Mechanical adjustments for the Virtual Binoculars include focus and IPD. The focus adjustments can be found on each eyepiece. The focus range is adjustable from 0±4 diopters. The IPD adjustment is on the topside of the unit and has a range of 58-73 mm.

3.3.2 Electronic Adjustments

The VCU for the Virtual Binoculars is carefully calibrated at the factory and should not require frequent adjustments. Over time, the characteristics of the CRT may change causing the image to shift or brightness to change. Depending on specific applications, the users may wish to adjust the size of the image as well. In general, it is not advised to make changes to these parameters frequently. Poorly aligned units can cause fatigue and/or headaches. If the unit ever becomes severely out of alignment, the entire system, both the display and the VCU, must be returned to n-vision for re-calibration. See table 3-1 for a list of the parameters and their properties.

Spot Size	Also known as focus voltage, this adjustment changes the voltage of the focus electrode in the CRT electron gun. Increasing or decreasing this voltage affects the sharpness of the image.
Horizontal Center	Controls the horizontal position of the image. Turning this adjustment clockwise moves the image to the right.
Horizontal Size	Controls the width of the image. Turning clockwise increases the width.
Vertical Center	Controls the vertical position of the image. Turning clockwise moves the image to the top of the CRT.
Vertical Size	Controls the height of the image. Turning clockwise increases the height.
Contrast	Adjusts the difference between white and black portions of the image. Turning this adjustment clockwise increases contrast. Too much contrast can cause "bleeding" of brighter areas into darker areas.
Brightness	Adjusts the overall light output of the CRT without changing contrast ratio. Turning clockwise will increase the brightness.
VGA Delay	This adjustment is used to compensate for variations in video timing from one system to another. It is a rotary switch with discrete positions corresponding to different variations in frequency. Consult n-vision before adjusting VGA Delay.

Table 3-1

3.4 Tracker Installation

The Virtual Binoculars support most commonly used commercial motion tracking hardware including those products from Ascension®, Intersense®, and Polhemus®. The tracker may be mounted internally or externally at the base of the display. See figure 3-4 and 3-5.

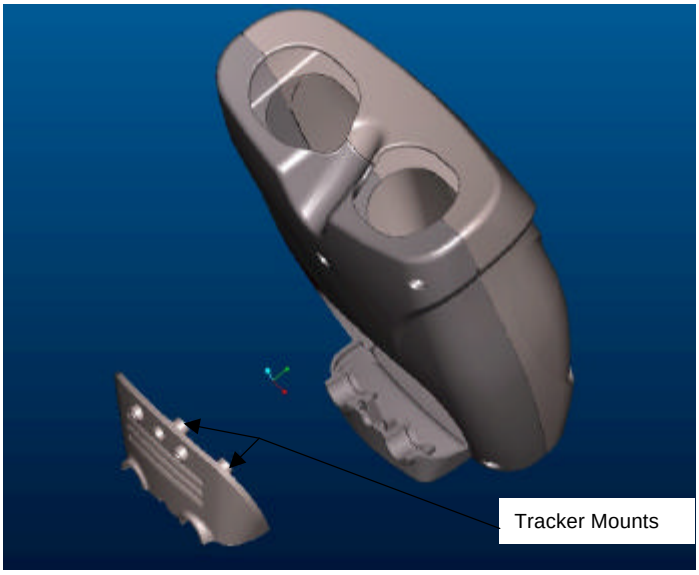

Figure 3-4

Figure 3-5

When mounting the tracker internally, be sure to carefully route the wires through the exit hole without damaging the other cables. The CRT cables are fitted with rubber boots and should be properly aligned when the unit is closed such that the cables are protected and adequately strain relieved. If you prefer to have our engineers install the tracker for you, please contact us directly or go through one of our authorized distributors to send the unit to our facilities.

n-vision, inc.

7915 Jones Branch Drive, Suite 1201

McLean, VA 22102

(703) 506-8808

4 Configuring the Video Hardware

The Video Control Unit (VCU) for the Virtual Binoculars can accept both standard VGA video and 180 Hz Serial Color Field Sequential video formats. For most users, the standard VGA setup is preferred because common PC hardware and many graphics workstations can support only one video format at a time. Since all desktop monitors are compatible with standard VGA video, this allows the user to setup a "repeater" monitor, allowing continuous use of the computer and allowing others to watch the virtual environment as it appears to the user of the Virtual Binoculars.

Field sequential video may be advantageous because it requires less cabling since all video information is carried on a single BNC cable for each eye. This option is recommended for users with Onyx Infinite Reality hardware, which allows for multiple video output configurations simultaneously. A field sequential signal could drive the Virtual Binocular while the desktop monitor is connected to a standard 60-85 Hz video output.

For configuring the video on your particular hardware, refer to the following table. For specific questions concerning your graphics hardware, consult the user manual with your system.

4.1 SGI ONYX RE/RE2, VGA

This section covers the standard VGA setup on SGI Onyx RE/RE2 systems

4.1.1 MCO, Stereoscopic, VGA

When connecting the Datavisor for MCO, Stereoscopic, Color VGA operation, perform the following steps:

Step	Action
1	For the left eye, connect the RGBHV outputs of the corresponding MCO channel to the 15-pin input labeled **L** on the VCU. Use the provided 15-pin to BNC break out cable.
2	For the right eye, connect the RGBHV outputs of the corresponding MCO channel to the 15-pin input labeled **R** on the VCU. Use the provided 15-pin to BNC break out cable.

3	Type the following command sequence to start the correct video mode
	
	`%/usr/gfx/setmon -x -S < mode>`
	`%/usr/gfx/stopgfx; /usr/gfx/startgfx &`
	
	The mode must be one of the following:
	`2@640x480_60`
	`4@640x480_60`
	`6@640x480_60`

NOTE For Monoscopic VGA setup on the RE/RE2 system, contact n-Vision technical support (`sales@nvis.com`) or call 703-506-8808.

4.2 SGI ONYX IR Systems, VGA

This section covers the standard VGA setup on the SGI Onyx Infinite Reality workstations.

4.2.1 Single channel, Monoscopic, VGA

When connecting the Datavisor for Single channel, Monoscopic, VGA operation, perform the following steps:

Step	Action
1	Connect a 13w3 to BNC cable to the 13w3 output labeled ***channel x*** on the IR system. *X* is the number of the output channel.
2	Connect the **Red**, **Green**, **Blue** outputs to the corresponding inputs on a distribution amplifier.
3	Connect the H & V outputs of the IR to the corresponding inputs on the distribution amplifier.
4	Using the provided BNC to 15-pin cables, connect the outputs of the distribution amplifier to the 15-pin inputs on the VCU.
5	Use the IRCOMBINE tool to select the following video format file: `640x480_60.vfo` sync: TTL level, separate H & V, no sync on video lines

4.2.2 Dual Channel, Stereoscopic, VGA

When connecting the Datavisor for Dual Channel, Stereoscopic, VGA operation, perform the following steps:

Step	Action
1	Connect a 13w3 to BNC cable to the 13w3 output on each channel.
2	Connect the **Red**, **Green**, **Blue** outputs of each channel to the corresponding **Red**, **Green**, **Blue** on the provided BNC to 15-pin cables.
3	Connect the H & V outputs of each channel to the corresponding H & V inputs on the provided BNC to 15-pin cables.
4	Connect the correct 15-pin cables to the corresponding **L** & **R** inputs on the VCU.
5	Use the IRCOMBINE tool to select the following video format file: `640x480_60.vfo` for each channel. sync: TTL level, separate H & V, no sync on video lines

4.3 SGI Impact with ICO, VGA

This section covers the standard VGA setup on SGI Impact with ICO systems

4.3.1 ICO, Monoscopic, VGA

Perform the following steps to connect the Datavisor to an ICO running Monoscopic, Color, and VGA.

Step	Action
1	Connect the RGBHV outputs of channel 1 to the corresponding inputs of a distribution amplifier.
2	For left and right VCU channels, connect the outputs of the distribution amplifier to the 15-pin inputs on the VCU, using the provided BNC to 15-pin cables.
3	Type the following command sequence to start the correct video mode: `% /usr/gfx/setmon -x  -S 4@640x480_60_ext`

4.3.2 ICO, Stereoscopic, VGA

Perform the following steps to connect the Datavisor to an ICO running Stereoscopic, and VGA:

Step	Action
1	For the left eye, connect the RGBHV outputs of the corresponding ICO channel to the 15-pin input labeled **L** of the VCU. Use the provided BNC to 15-pin cables.
2	For the right eye, connect the RGBHV outputs of the corresponding ICO channel to the 15-pin input labeled **R** of the VCU. Use the provided BNC to 15-pin cables.
3	Type the following command sequence to start the correct video mode `% /usr/gfx/setmon -S 4@640x480_60_ext`

4.4 Standard PC Systems, VGA

4.4.1 Single Channel, Monoscopic, VGA

Perform the following to connect the Datavisor for single channel, monoscopic, VGA on a standard PC:

Step	Action
1	Set the PC's current video mode to Standard VGA (640x480 @ 60hz).
2	Connect the VGA output of the PC to the VGA input of the distribution amplifier.
3	Connect the left and right channels of the VCU to the outputs of the distribution amplifier.

4.4.2 Dual Channel, Stereoscopic, VGA

Perform the following to connect the Datavisor for dual channel, stereoscopic, VGA on a standard PC:

Step	Action
1	Consult the manual for your graphics hardware to properly output two independent channels of 640x480 pixels per eye with a 60 Hz vertical refresh rate. Make sure that the output is standard five-line (RGBHV) VGA.
2	Connect the corresponding VGA outputs from each graphics card into the correct 15-pin input labeled **L** & **R** on the back of the VCU.

4.5 SGI ONYX IR Systems, Field Sequential

This section covers the field sequential setup for SGI IR Systems. For field sequential support on other systems, please contact n-vision.

4.5.1 Single Channel, Monoscopic or Stereoscopic Field Sequential

When connecting the Datavisor for Single channel, Monoscopic or Stereoscopic Field Sequential operation, perform the following steps:

Step	Action
1	Connect a 13w3 to BNC cable to the 13w3 output labeled **channel *x*** on the IR system. *X* is the number of the output channel
2	Connect the **Green** output to the **Green** line of one of the provided BNC to 15-pin cables.
3	Connect the cable used in step 2 to the channel labeled **L** on the VCU.
4	Connect the **Red** output to the **Green** line of the other BNC to 15-pin cable.
5	Connect the cable used in step 4 to the channel labeled **R** on the VCU.
6	Use the IRCOMBINE tool to select the following video format: `640x480_180q` Composite Sync on Red and Green Pixel Format: FS

NOTE: The setup for both monoscopic and stereoscopic viewing on IR systems are very similar. However, stereoscopic viewing setup may require some extra steps to modify the software application that runs your HMD to generate the two separate images necessary for stereo viewing. For more information, consult the SGI technical documentation on the their Web-site, `http://www.sgi.com/virtual_reality/resource/developers.html#1`.

5 Maintenance and Service

Always switch the VCU off and disconnect the power before conducting any maintenance on the Virtual Binoculars.

5.1 Caring for the Virtual Binoculars

The optical element of the Binoculars may accumulate dust over time and require occasional cleaning. This should be done with commercial lens paper, compressed air, and 98% pure isopropyl alcohol.

Dust build-up around the cooling fan should be loosened with a soft brush and removed with a vacuum unit. Surface cleaning can be done with a damp cloth. Spray and excessive amounts of water should not be used to avoid any damage to electronic equipment.

5.2 Limited Warranty

5.2.1 Standard and Extended Warranty

The standard warranty covers electrical and mechanical parts and associated labor for one year from the date of receipt. Additional warranties can be purchased to extend the warranty on an annual basis. Contact n-vision for details.

5.2.2 Warranty Statement

Company does not warrant and specifically disclaims the warranty of merchantability of the product or the warranty of fitness of the product for any particular purpose. The company makes no representations or warranties, expressed or implied including warranties or merchantability and fitness for a particular purpose except as provided below.

Company makes no warranties, express or implied, that the product is free of error or is consistent with any particular standard of merchantability or that product will meet requirements for any particular application. The product should not be relied upon for solving a problem or fulfilling a function whose indirect solution or operation could result in injury to a person or loss of property. If the product is used in such manner, it is at the product users own risk.

The sole remedy for breach of warranty shall be repair or replacement, at the option of the Company, of the defective Product as provided below. In no event will the Company be liable for damages, including lost profits, lost savings or other incidental or consequential damages arising out of the use or inability to use the Product, even if the Company or an authorized dealer has been advised of the possibility of such damages, or for any claim by any other party.

The Company warrants to the original purchaser that it's Products are free of defects and will remain so for a period of one (1) year from the date of delivery of a new Product. The Company will replace any defective Product upon the return thereof to the Company together with proof of purchase and proof of purchase of date. This warranty shall not apply to any Product which, the sole judgment of the Company has been subjected to misuse, negligence, alternation, accident, improper maintenance, or damage by excessive physical or heat stress. This warranty is void if the serial number of the Product has been defaced, altered, or removed. All replaced products become the property of the Company.

This warranty is in lieu of all other warranties and condition expressed, implied or statutory and all other liabilities of the Company.

n-vision, inc.

7915 Jones Branch Drive, Suite 1201

McLean, VA 22102

(703) 506-8808

6 Troubleshooting

A number of factors can cause the Virtual Binoculars to malfunction or otherwise appear to need service. The following troubleshooting tips may help in avoiding unnecessary returns and costly delays.

Symptom	Possible Causes	Potential Solutions
No image in BOTH eyes	Possible causes include: • No power • Incorrect video format • Screen saver	• Check that power light is on. • Verify video format is correct. See section 4. • Turn off the screen saver.
No image in ONE eye	• Bad cable	• Swap inputs on back of VCU. • Replace cables.
Poor image in BOTH eyes	• Incorrect video format • Display needs adjustment	• Check the video format, see section 4. • Check brightness, contrast, etc. See section 3.
Poor image in ONE eye	• Display needs adjustment • Dirty lenses	• Check brightness, contrast, spot, etc. See section 3. • Clean lenses. See section 5.
Images do not align	• Display out of focus • Raster positions not aligned properly. • IPD needs adjustment	• Adjust focus w/ eyepiece. • Check horizontal and vertical size and center. See section 3. • Check IPD, see section 2.
Horizontal line appears across image.	• Poor focus adjustment causes color shutter to come into view.	• Turn focus adjustment clockwise to focus further away.