



# NVAG

## Night Vision Aviator Goggle (NVAG)



# OPERATOR MANUAL

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## ***About This Manual***

This Operator's Manual is a guide for the use of the Nivisys, LLC model NVAG, Night Vision Aviator's Google.

Data herein has been reviewed and verified and is for the intended use of the equipment specified. Because failure to follow the recommendations set forth in this manual could result in equipment malfunction, personal injury or property damage, always follow recommendations set forth herein. Nivisys, LLC does not guarantee test results and assumes no obligation for performance of equipment or other products that are not used in accordance with the instructions provided herein. This publication is not a license to operate under, nor a recommendation to infringe upon, any process patents.

Nivisys, LLC model variations are identified by a suffix code. This manual specifically addresses all models in the NVAG family. Nivisys, LLC reserves the right to make changes to their products' design, availability, pricing, function, features, accessories, performance, specifications, claims, or documentation at any time without notice or obligation. Publications prior to the Issue Date of this manual may contain data in apparent conflict with that provided herein. Please consider data in this manual to be current at the time of issue.

NVAG FAMILY:

NVAG-6 Non-TSO – A, B, C Lens Coatings

NVAG-9 Non-TSO (A, B, C Lens Coating)

***WARNING, CAUTION, and NOTE*** are used within the text of these instructions to emphasize important and critical instructions as well as to highlight safety considerations.

***WARNING*** - informs the operator of a hazard or unsafe practice that could result in personal injury, affect the operator's health, or contaminate the environment.

***CAUTION*** - informs the operator of a hazard or unsafe practice that could result in damage of equipment.

***NOTE*** - highlights essential information.

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## ***Important Safety Information***

Certain potentially dangerous conditions may be possible when using, maintaining, transporting or storing the NVAG Goggle. To ensure safe operation, maintenance, transportation and storage, users should be aware of all safe practices and take all precautions listed below and throughout this manual.

***WARNING NVAG Goggles ARE NOT FAA TSO-C164 Approved. If your OP-SPEC requires the use of American FAA Approved Goggles, please contact Nivisys or your Flight Operations Director.***

***WARNING*** It is required to preflight the NVAG Night Vision Aviator Goggle in accordance with the preflight instructions outlined in Chapter 4 (page 29) of this manual. Failure to conduct preflight inspection of the goggle and verifying proper operational performance can jeopardize pilot operations and risk mission and/or crew safety. Consult your flight operations director for guidance.

Operators are required to document NVAG operational performance by logging preflight inspection results in the Operator's Log Book prior to each flight.

***WARNING*** There are no user-serviceable parts inside the NVAG Goggle. Disassembling any of the components, circuitry or sub-components, could result in operational malfunction, damage to equipment, and/or flight safety issues. *Servicing should only be attempted by qualified technicians who are familiar with and trained in the proper servicing of an NVAG night vision device.*

***CAUTION*** To reduce the possibility of corrosion damage due to battery leakage, remove batteries from the Battery Pack before extended storage or projected long periods of non-use, as well as after a set of batteries has lost its charge.

The NVAG Goggle has been designed, built, and tested to ensure optimal performance despite rugged handling or adverse conditions, and it comes complete with an integral water-resistant protective case. It is, however, a precision instrument, and should be handled and transported with care to ensure long life and trouble-free operation. Do not drop, throw, strike, or otherwise carelessly mishandle the NVAG Goggle.

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## ***Abbreviations List***

<b>Abbreviation</b>	<b>Meaning</b>
A	Amperes
ABAM	Auxiliary Battery Attachment Module
ABC	Automatic Brightness Control
AC	Alternating Current
ANVIS	Aviator Night Vision Imaging System
BSP	Bright Source Protection
°C	Degrees Celsius
DC	Direct Current
dia.	Diameter
DVM	Digital Volt Meter
°F	Degrees Fahrenheit
fL	Foot Lamberts
FOM	Figure of Merit
Hz	Hertz
IPD	Inter-Pupillary Distance
IR	Infrared
Kg	Kilograms
lb.	Pounds
LBI	Low Battery Indicator
LED	Light Emitting Diode
Lp	Line Pair
MCP	Micro-Channel Plate
m	Meters
mA	Milliamperes
mm	Millimeters
mR	Milliradians
mV	Millivolts
nm	Nanometers
NVD	Night Vision Device
NVIS	Night Vision Imaging System
NVG	Night Vision Goggle
Oz.	Ounce
PAS	Pivot Adjustment Shelf
V	Volts
VDC	Volts Direct Current

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**The warranty period for newly-manufactured items shall be extended** 12 months from the date of shipment by Seller unless a different warranty period is agreed in writing to by the Seller. The warranty period for repaired/refurbished electronic components shall extend for the unexpired warranty period or 90 days, whichever is longer, of the item repaired or replaced. The warranty period for intensifier repair/replacement shall extend six (6) months from the date of shipment by the seller or the balance of original warranty, whichever is longer.

This warranty shall not extend to any item that upon examination by Seller is found to have been subject to:

- a) Mishandling misuse, negligence or accident
- b) Installation, operation or maintenance that either was not in accordance with Seller’s specifications and instructions, or otherwise improper.
- c) Tampering, as evidenced, for example, by broken seals, damaged packaging containers, etc.
- d) Repair or alteration by anyone other than Seller without Seller’s express advance written approval.

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Failure to promptly notify Seller in writing upon discovery of any non-conforming item during the warranty period shall void the warranty as to such item. Buyer shall describe any such non-conformity in detail, expressing its position as to return of any article under the remedy provided herein. No returns shall be accepted without prior approval by Seller.

**Return Material Authorization Number (RMA#):**

Warranty and non-warranty items returned to Nivisys for repair or replacement require a RMA#. Email [services@nivisys.com](mailto:services@nivisys.com), call 1-915-633-8354 X-1002 or fax 1-915-633-8529 with a serial number and detailed information to obtain a RMA#.

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# Chapter 1 Introduction

This Section provides general descriptive information about the NVAG Night Vision Goggle.

## 1.1 Scope

This manual provides instructions for the operator to use and maintain the Aviator’s Night Vision Imaging System (ANVIS) Model NVAG (see Figures 1-1). The NVAG is a self-contained night vision device that enables improved night vision using ambient light from the night sky (moon, stars, sky glow, etc.). The NVAG is a helmet-mounted passive binocular that provides the capability for pilots to fly in terrain flight modes at night. The system amplifies ambient light from sources such as the moon, stars and sky glow so the viewed scene becomes clearly visible to the operator.

The NVAG has the following important features:

- Powered by 2 “AA” Alkaline batteries
- A low battery indicator (LBI) on the visor mount comes on or blinks if the battery voltage drops below safe limits.
- Adjusts for eye-span (IPD), vertical distance, tilt, eye relief, diopter setting and focus.
- Binocular may be flipped up and stored away from the eyes in an emergency.

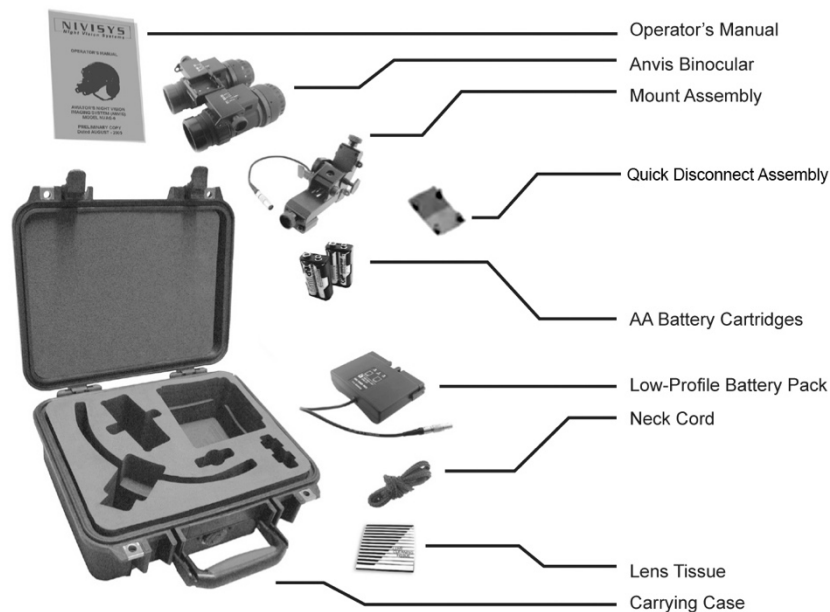


Figure 1-1. Aviator’s Night Vision Imaging System Model NVAG

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## 1.2 Location and Description of Major Components

### 1.21 Binocular Assembly.

This component (see Figure 1-2) consists of two identical monoculars mounted under the pivot adjustment shelf (PAS). The monoculars may be moved sideways (eye span or IPD). Each monocular is comprised of three primary subassemblies: objective lens assembly, monocular housing with image intensifier assembly, and an eyepiece lens assembly.

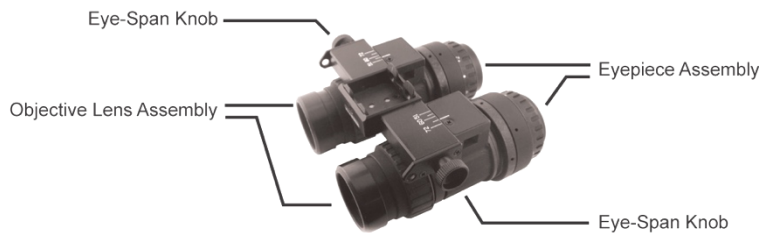


Figure 1-2. Binocular Assembly

### 1.2.2 Mount:

This component (see Figure 1-3) mounts on a standard Night Vision Visor or Quick disconnect mount. It contains a vertical adjustment for moving the binocular up or down, a fore-and-aft adjustment for optimal viewing of the field of view and tilt adjustment for optimal line-of-sight viewing. It also allows the binocular to be stowed in the up position away from the eyes and to be pulled off or to break away during a crash load of 10g force or more. The bottom of the mount incorporates a low-battery indicator (a LED) that either comes on or blinks to alert the pilot when remaining battery life is approximately 30 minutes. The mount also provides the electrical contacts for the binocular.

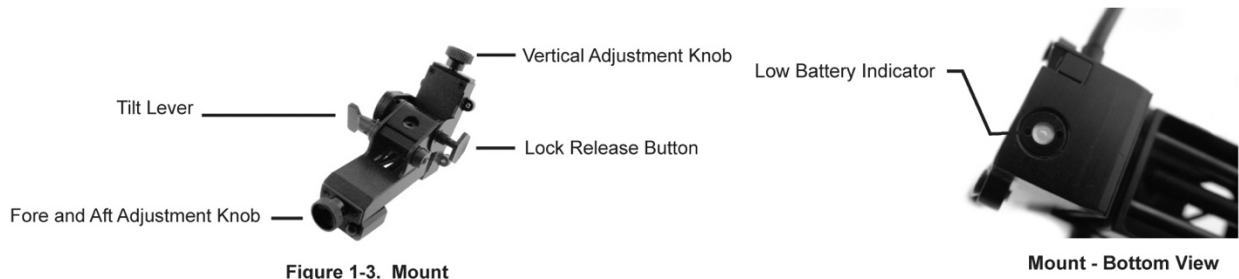


Figure 1-3 Mount & Mount Bottom View

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### 1.2.3 Power Pack:

The Low Profile Battery Pack (see figure 1-4) contains the batteries used to power the system as well as the power selector switch and low battery indicator circuit. Power is routed via cable from the battery pack to the power connector located on the helmet mount assembly. The battery pack utilizes AA cartridges for easy loading and unloading.



Figure 1-4. Low Profile Battery Pack

### 1.2.4 Low-Battery Indicator:

The NVAG incorporates a red LED at base of the mount (Figure 1-5) that comes on when the active battery voltage drops to 2.2 vdc, signaling the user to switch the ON-OFF-ON switch, on the power pack, to the reserve battery compartment. The low-battery indicator LED will blink. This is a normal function and does not indicate of a malfunctioning of the system.

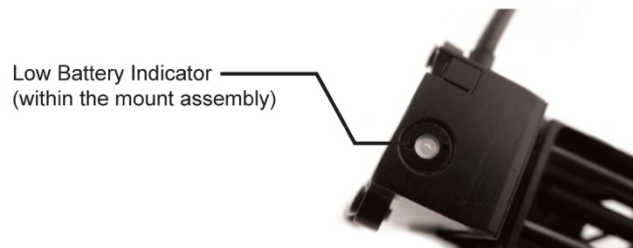


Figure 1-5 Low Battery Indicator

### 1.3 Equipment Data

The following tables provide information pertaining to the operational, electrical, mechanical, optical and environmental characteristic of the NVAG.

ITEMS	LIMITS
Vertical Adjust	16mm Total Travel
Fore and Aft Adjust	27mm Total Travel
Eye Span (IPD)	51mm to 72mm
Tilt	10 Deg. Total Travel
Diopter	+2 / -6
Objective Focus	25cm to Infinity

**Table 1-1 Operator Adjustment Limits**

ITEMS	DATA
Voltage Requirement	3.0 VDC nominal
Current Drawn by Binocular	80mA Max., 60mA Nom.
Battery, Alkaline (AA)	<i>Contact Nivisys For Replacement Batteries</i>
Voltage	1.5 VDC each
Cell Life	> 50 hours (at 20 °C)

**Table 1-2 Electrical Data**

ITEMS	DATA
Binocular Breakaway Force	10 G
Binocular Weight	500 grams

**Table 1-3 Mechanical Data**

ITEMS	DATA
Magnification	Unity (1X)
Field of View	40 Degrees

**Table 1-4 Optical Data**

ITEMS	DATA
Operating Temperature	-32 °C to 52 °C
Storage Temperature	-35 °C to +71 °C
Illumination Required	Overcast Starlight to Moonlight

**Table 1-5 Environmental Data**

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## 1.4 Mechanical Functions

The NVAG is mechanically fully adjustable, to fit each individual. These functions include: on-off power, adjustment for eye-span distance, vertical travel, and tilt angle, for-and-aft adjustment for eye relief, eyepiece focus and objective lens focus. The mechanical controls are identified in Figure 2-1.

## 1.5 Optical Functions

The Binocular is an electro-optical system consisting of two monoculars with identical optical terrains and functions (Figure 1-6). Each monocular has an objective lens, an image intensifier assembly and an eyepiece lens. The objective lens collects the ambient light reflected from the scene by the moon, stars, or night sky glow, inverts the image and then focuses the image on the image intensifier. Inside the image intensifier, a photocathode converts the light into electrons; a micro channel plate amplifies the electron's image resulting in the electron striking a phosphor screen. The phosphor screen creates a visible image, which in turn is re-inverted by fiber optics and transmits to the eyepiece, where the operator can see the intensified image in its proper 1:1 perspective (unity magnification).

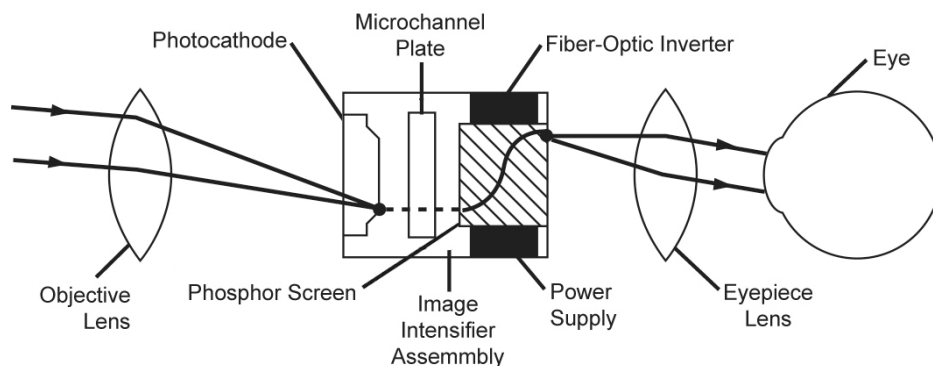


Figure 1-6. Optical Function Diagram

## 1.6 Electronic Circuit Function

The electronic circuit regulates the direct-current voltage from the batteries to the image intensifier assemblies, as required. It also monitors the output voltage of the batteries and turns on a low-battery indicator when the battery's voltage drops below 2.2VDC. Once below this threshold, remaining battery life is 30 minutes.

**A. Power Source:** The electronic circuit is powered by replaceable Alkaline "AA" batteries. The NVAG Power pack uses two 1.5V alkaline batteries.

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**B. Electrical Function:** Power from the batteries is supplied to the components through the power pack’s 3 positions, ON-OFF-ON, switch as follows:

<b>Primary ON Position</b>	Power is drawn from the primary battery compartment to energize the binocular. When the voltage drops to 2.2 VDC, a low battery indicator at the base of the mount assembly comes on indicating approximately 30 minutes of operating time left on that battery compartment.
<b>OFF Position</b>	With the switch in the OFF position, the circuit is not energized from either battery compartment.
<b>Alternate ON Position</b>	Power is drawn from the alternate battery compartment to energize the binocular. When the voltage drops to 2.2 VDC, a low battery indicator at the base of the mount assembly comes on indicating approximately 30 minutes of operating time left on that battery compartment.

With the switch in either of the ON positions, power from the battery compartment is applied through the power cable, through the matching contacts in the mount to the matching contacts inside the monocular onto the image intensifier assembly (see Figure 1-7).

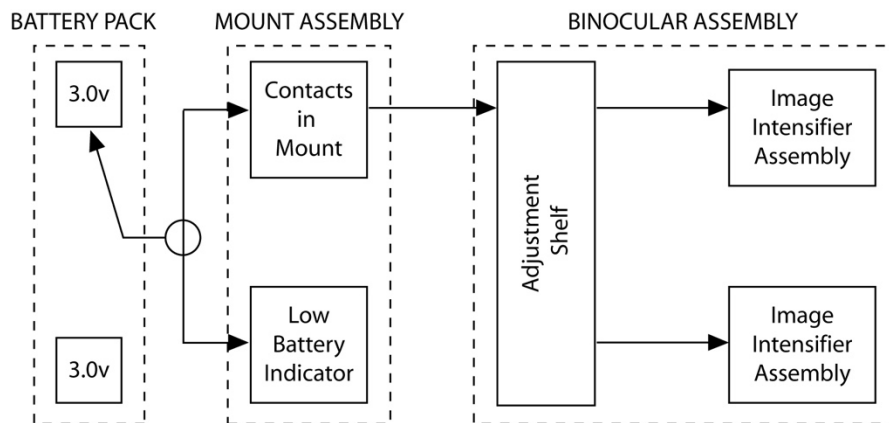


Figure 1-7 Electrical Diagram

**C. Image Intensifier Power Supply Function: (Non-Autogated)** The power supply inside the image intensifier assembly (refer to figure 1-6) converts the 3.0 volts from the power pack to the voltages required by the photocathode. The power supply also provides automatic brightness control (ABC) and bright source protection (BSP). Under high light conditions, the ABC automatically reduces the voltages to the Micro-channel Plate to keep the image intensifier’s brightness within a set limit. The effect of this function may be seen when rapidly changing from low-light to high-light conditions; the image gets brighter and then after a momentary delay, suddenly dims slightly to a constant level. The BSP function reduces the

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voltage to the photocathode when the goggles are exposed to bright light sources. The BSP feature protects the image intensifier from damage and enhances its life; however, it also has the effect to lowering resolution. Therefore, under bright conditions, when you would not normally use the goggles, the image produced is not sharp. **(Autogated)** The power supply inside the image intensifier assembly (refer to figure 1-6) converts the 3.0 volts from the power pack to the voltages required by the photocathode. The power supply also provides automatic brightness control (ABC) and a Autogated feature that replaces the bright source protection (BSP). Under high light conditions, the ABC automatically reduces the voltages to the MCP to keep the image intensifier's brightness within a set limit. The effect of this function may be seen when rapidly changing from low-light to high-light conditions; the image gets brighter and then after a momentary delay, suddenly dims slightly to a constant level. The Autogated function turns off and on the voltage to the photocathode when the goggles are exposed to bright light sources. The Autogated feature protects the image intensifier from damage and enhances its life and maintains a better resolution than with BSP. Therefore, under bright conditions, the image produced is will be sharper than a Non-Autogated power supply.

**D. Low Battery Indicator:** Electrical power for the low-battery indicator is drawn from either compartment, which ever has the high voltage. When activated, the low-battery indicator light blinks ON and OFF.

## **1.7 Equipment Limitations**

To avoid personal injury and property damage when using the NVAG, carefully read and understand the following safety precautions.

- The equipment requires some night light (moonlight, star light) to operate. The performance level depends on the light level.
- Night light is reduced by such factors as passing cloud and objects that produce shadows.
- The equipment is less effective viewing into shadows and other darkened areas.
- The equipment is less effective through rain, fog, sleet, snow, smoke and other reflective materials.
- The equipment has a field of view limited to  $40^{\circ} \pm 2^{\circ}$ .

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- If eyeglasses are worn, the upper rims of the eyeglasses can obscure the low-battery indicator.

**WARNING**

*Do not use mercury or rechargeable Ni Cad batteries*

**CAUTION**

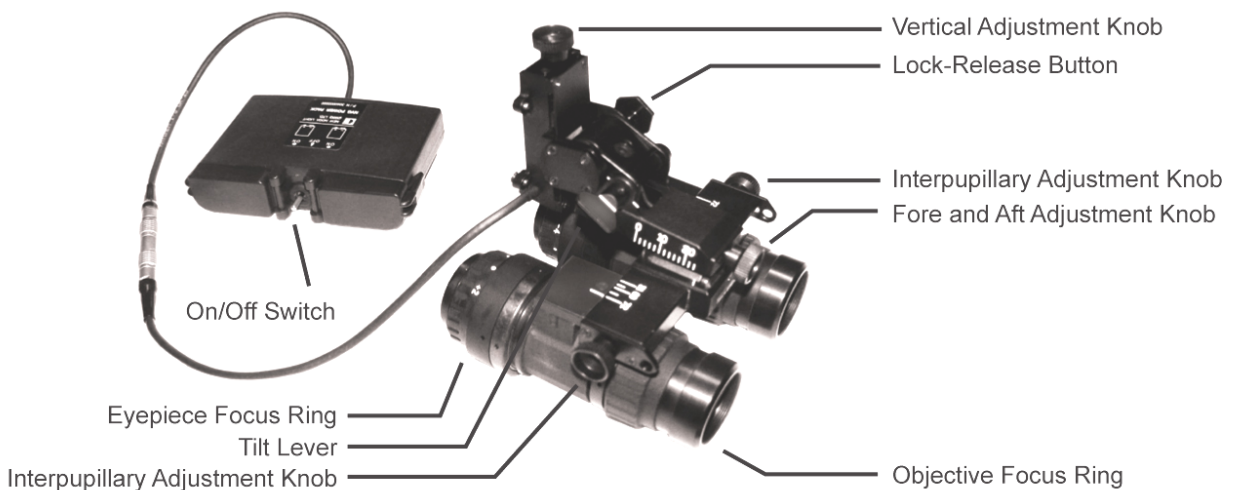
*Do not carry batteries in pockets containing metal objects such as coins, keys, etc. Metal objects can cause the batteries to short circuit and become very hot.*

## **Chapter 2 Operating Instructions**

The NVAG is a precision electro-optical instrument, so handle it carefully. If the equipment fails to operate, refer to the Troubleshooting Procedures in Chapter 3, Section II.

### **2.1 Operator Controls and Indicators**

The NVAG is designed to adjust for differences in head shape and corrects for most differences in eyesight. Figure 2-1 and Table 2-1 describes the controls and indicators.



**Figure 2-1. Illustration of Operation Control and Indicators**

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Table 2-1

Controls & Indicators	Function
<b>Power Switch</b>	<b>ON</b> - binocular on, power drawn from battery compartment to switch points. <b>OFF</b> - binocular off. <b>ON</b> - binocular on, power drawn from battery compartment to switch points.
<b>Objective Focus Rings</b>	Focuses the objective lenses. Adjust for sharpest view of scene.
<b>Eyepiece Focus Rings</b>	Focuses the eyepiece lenses to adjust for differences in eyesight. Adjust for sharpest image. Travel for eyepiece focus ring varies among eyepieces.
<b>Eye Span Adjustment Knobs</b>	Adjusts for different spacing between operator's eyes. The NVAG has independent eye span adjustment, the left knob moves the left monocular and the right knob moves the right monocular. Turn the knob(s) to move the eyepieces together or apart for optimal spacing.
<b>Fore and Aft Adjustment Knob</b>	Adjusts for optimal viewing of the field of view. Turn the knob to obtain a full view of the image. Adjust the binocular as close as possible to your eyes to maximize the field of view and "look under" capability.
<b>Vertical Adjustment Knob</b>	Moves the binocular up or down in a vertical direction. Turn the knob to center the eyepieces in front of the eyes.
<b>Tilt Lever</b>	Allows the binocular to be tilted up or down. Move the lever to obtain the optimum line-of-sight viewing.
<b>Lock Release Button</b>	Press the lock release button to rotate the binocular up or down.
<b>Low-Battery Indicator</b>	When illuminated, indicates a low battery condition with less than 30 minutes of battery life remaining.

## 2.2 Operator Checks

- A. **General:** Table 2-2 has been provided so you can keep your equipment in good operating condition and ready for its primary mission.
  
- B. **Warnings and Cautions:** Always observe the WARNINGS and CAUTIONS appearing in the table. Warnings and Cautions appear before applicable procedures. You must observe the warnings and cautions to prevent serious injury to yourself and others, or to prevent your equipment from being damaged.
  
- C. **Explanation of Table Entries:**

**Step Number Column** - Step numbers are included to assist you with performing the checks.

**Location/Item to Check Column** - This column provides the location and the item to be checked.

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**Inspection Instructions** - This column gives the procedure you must use to check or service the item listed in the Location/Check column, to know if the equipment is ready or available for its intended mission or for operation.

**Service Criteria Column** - Information in this column tells you what faults will keep your equipment from being capable of performing its primary mission. If you make checks that show faults listed in this column, do not operate the equipment. Follow standard operating procedures for maintaining the equipment or reporting equipment failure.

Table 2-2

Step	Location/ Item to Check	Inspection Instruction	Service Criteria
<b>BEFORE OPERATION CHECK</b>			
1	Power Pack	Inspect the power pack for damage or missing components.	Power pack cracked.
2	Battery Compartment	Check for corrosion, damaged contacts, spring tension, caps damaged or tether cable frayed or broken.	Contacts corroded or damaged, cable broken.
3	Power Cable	Inspect the cable for damage, the connector for bent pins, quick release for proper function, protective shield frayed or broken.	Cable damaged, connector inoperable.
4	Function On/ Off Switch	Check the switch for operation (performed during the low-battery indicator check).	Switch inoperable.
5	Mount	Inspect the mount to make sure it securely attaches to the visor guard or helmet, sides of mount not cracked, vertical adjustment operates, lock release button for proper operation and channel contacts for cleanliness, corrosion	Side cracked, vertical adjustment inoperable, release button inoperable or missing, contacts corroded or worn.
6	Power Cable	Inspect to make sure cable is secure, free of visible damage, and female connector is free of debris.	Cable connector is damaged.
7	Binocular Assembly	Inspect contacts for dirt, corrosion, or wear. If dirty, clean with pencil eraser.	Contacts are worn, loose, or missing.



Contacts on Mount Assembly



Contacts on Anvis Binocular

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Step	Location/ Item to Check	Inspection Instruction	Service Criteria
8	Lenses	Inspect objectives and eyepieces for cleanliness, scratches, chips, or cracks. If necessary, clean and dry lenses using clean water and lens paper.	Chipped, cracked or if scratches hinder vision with NVAG turned on.
9	Eyepiece Focus Assembly (25mm eye relief)	<p>Check eyepiece to make sure the whole assembly is not loose, that there is free movement through full range of travel. Normally, the +2 mark on the eyepiece focus ring can turn counter clockwise past the reference dot up to the second hole in the indicator plate and the -6 mark clockwise past the reference dot.</p> <p>On some 25mm eyepieces, The -6 mark can turn clockwise well past the reference dot. As long as the eyepiece focus ring stops at each extreme of travel, this situation is OK. If the eyepiece focus ring continues to turn and the whole lens turns with it, the eyepiece is loose. The reference dot on the indicator plate may be at any point around the eyepiece.</p>	Eyepiece assembly loose, travel binds.



Step	Location/ Item to Check	Inspection Instruction	Service Criteria
10	Objective Focus Assembly	Check objective to make sure the whole assembly is not loose, that there is free movement through full range of travel.	Objective assembly loose, travel binds.
11	Pivot Adjustment Shelf (PAS)	<p>Check for cracks, broken electrical circuits and that spring-loaded ball bearings are clean and operating properly. Check full travel of eye span adjustment.</p> <p>Hold binocular at eye level, turn eye-span knob(s) to move monoculars to inside and outside extremes. Watch to make sure the monoculars move evenly. A small amount of wobble is acceptable. If you think the wobble is excessive, return the NVAG to the maintainer.</p> <p><b>CAUTION:</b> <i>Do not attempt to adjust the eye-span distance by trying to pull the monoculars away from each other or push them together. Using force on the monocular to make this adjustment will damage the adjusting mechanism inside the adjustment shelf. Use only the eye-span knob(s) to adjust the eye span distance.</i></p>	<p>Cracks, broken circuit or ball bearing inoperable.</p> <p>Monoculars wobble excessively or bind</p>
12	Monocular Housing	Inspect exterior and purge ports for cracks or damage.	Cracks, damage, or purge valve missing.

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Step	Location/ Item to Check	Inspection Point	Service Criteria
13	Mount	Hold the binocular with eyepiece facing you and slide the spring-loaded ball bearings of the binocular into the channels of the mount until they lock in place. Make sure the fit is secure and snug. Press the lock release button (see figure 2-1) and rotate the binocular to the up and down positions. Make sure it engages properly. Check all adjustments: vertical, fore-and-aft and tilt for proper operation.	Binocular not held securely.  Binocular will not stay locked in up or down position. Lock-release button is missing. Movement binds or does not adjust.
14	Power Pack ON-OFF- ON Switch	Place switch in either ON position. Look for green glow in both eyepieces. Check the other ON position.	Green glow absent in one or both eyepieces in either position.
15	Low-Battery Indicator	<b>CAUTION:</b> <b>Indicator must be checked without the binocular attached to the mount or in the flipped -up position.</b>  Attach the power pack to the mount cable. Install appropriate batteries in primary and alternate compartments, place switch in either ON position and remove battery cap for that side thereby breaking electrical contact (if using the AA battery cartridge, make sure to pull it part away out to break contact). The low battery indicator should come on or blink. Check the other side.	Indicator will not come on.
<b>AFTER OPERATION CHECKS</b>			
16	Binocular Assembly	Replace the lens covers on all lenses, use eye span knob(s) to adjust the eye-span distance to allow the binocular to fit into the case. Insert the binocular into the carrying case. Do not force the binocular into the case.	
17	Low Profile Power Pack	Place the switch in the OFF position, remove the batteries and stow the power pack into the carrying case so the power cable faces up	

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## 2.3 Assembly And Preparation For Use (Pre-Flight)

**CAUTION**

*The NVAG is a precision optical instrument and must be handled carefully at all times, to prevent damage.*

### A. Battery and Power Pack Installation

**WARNING**

*Inspect the batteries for damage or defects before using them. If the batteries are damaged or show signs of leakage, do not use with the NVAG. Inspect batteries for bulging prior to use. If the battery shows signs of bulging, do not use. Do not short-circuit, incinerate, mutilate, or attempt to charge these batteries (unless designed to be recharged). Do not carry batteries loosely in pockets or cases where they could short circuit and cause damage or injury. Do not replace batteries in a potentially explosive atmosphere. Contact sparking may occur while installing or removing batteries and cause an explosion. Failure to follow these instructions could result in death or injury or imposition of long-term health hazards.*

**CAUTION**

*Be sure the power pack is switched off before installing the batteries.*

**NOTE**

*The primary battery compartment is the right compartment from the aviator's perspective. The alternate compartment is the left compartment from the aviator's perspective.*

The batteries mounted in a battery cartridge are inserted into the battery pack as shown in figure 2-2. The battery cartridge will accept two 1.5V AA batteries.

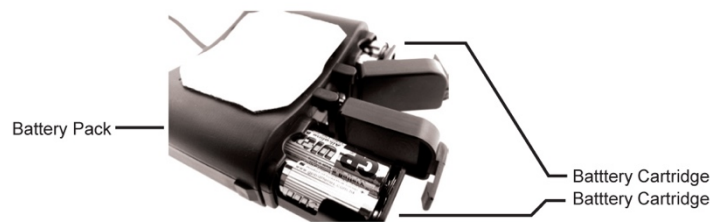


Figure 2-2. Battery Installation.

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1. Push the battery pack doors up (open)
2. Remove the cartridges containing the two 1.5V AA batteries.
3. Check to make sure the interior of each battery compartment is clean.
4. The required polarity for the battery is illustrated on the inside of the cartridge module. Insert the replacement battery into each battery cartridge module (Figure 2-3)
5. Insert the battery cartridges into the battery pack and close the battery pack doors.

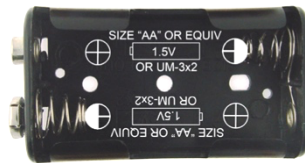


Figure 2-3. Battery Cartridge for Low Profile Battery Pack

**NOTE**

*It is recommended to use fresh (unused) batteries in the alternate (left) compartment (from the aviator's perspective) before beginning a mission. Some batteries that have been used and still have many hours of life remaining can be used depending on unit procedures. Make sure to install these used or "time" batteries in the primary (right) compartment (from the aviator's perspective).*

**B. Low Battery Indicator Check:** At the base of the NVAG mount is a red light-emitting diode (LED) that comes on or blinks at a steady rate when battery voltage is low (see figure 2-4). To make sure this indicator works, perform the following check.

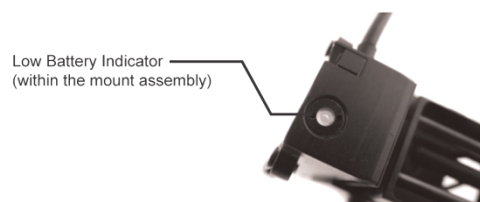


Figure 2-4. Low Battery Indicator

**CAUTION**

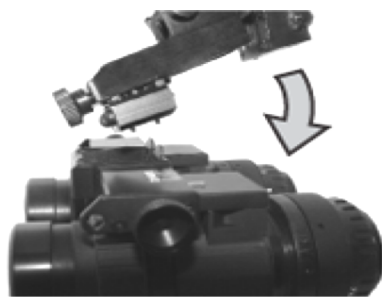
*The low-battery indicator must be checked without the binocular attached to the mount or in the flipped-up position.*

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1. With good batteries installed in both compartments of the power pack, take the battery cap to the alternate compartment. Pull the cartridge part way out, to make sure you break the electrical contact.
2. Turn the power switch to the **alternate** ON position (The compartment with the cap removed). The Low-battery indicator should come on or blink.
3. Return the switch to the OFF (middle) position and put the battery cap back on.
4. Take off the battery cap to the **primary** compartment. If using batteries, pull the cartridge part away out to make sure you break electrical contact.
5. Turn the power switch to the **primary** ON position (the compartment with the cap removed). The low-battery indicator should come on or blink.
6. If the low-battery indicator does not come on, replace the batteries with fresh ones and try again. Make sure the power cable is properly connected. If the indicator still does not function, return the NVAG (with this power pack) and mount to Nivisys.

### C. Attaching the Binocular to the Mount

1. Make sure the power switch is turned **OFF**.
2. Hold the binocular with both hands with the eyepieces facing you, and slide the spring-loaded ball bearings into the channels of the mount until they lock in place (see figure 2-5).



**Figure 2-5. Inserting the Binocular into the Mount**

3. Press the lock-release button (see Figure 2-6) and rotate the binocular to the up and lock position.

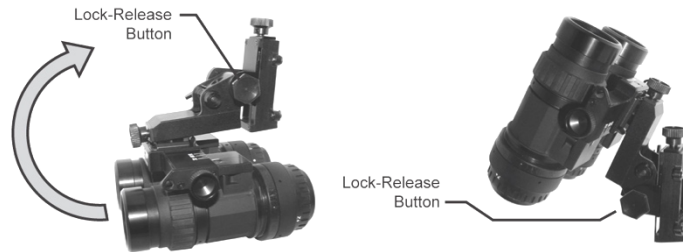


Figure 2-6. Lock-Release Button

Press the lock-release button and ensure it locks properly.

#### D. Removing the Binocular to the Mount

1. Make sure the power switch is turned **OFF**.
2. Hold the binocular with both hands with your thumbs on the PAS (Pivot Adjustment Shelf).
3. While pressing against the PAS, rotate binocular down then up.

#### CAUTION

DO NOT remove binocular by pulling or twisting. Damage to the binocular can occur and collimation may be adversely affected.

## 2.4 OPERATING PROCEDURES

### A. Setting the Controls and Adjustments:

The NVAG is designed to adjust for differences in head shape and correct for most differences in eyesight.

#### NOTE

*Although the NVAG is designed to be used without eyeglasses, if eyeglasses are needed to read the aircraft instruments and the eyeglass lenses will fit within the eye relief distance of the binocular's eyepiece, eyeglasses can and should be worn.*

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**WARNING**

*If eyeglasses are worn, the eyeglasses upper rim can obscure the low-battery indicator.*

**NOTE**

*Before using the NVAG for flight operations, be sure to check out the system's operation. Perform the checkout under darkened conditions. Use the following operating procedures for check out. If a failure occurs, refer to the troubleshooting procedures in Chapter 3, Section I. If the problem persists, the system must be returned to Nivisys.*

1. Make sure the batteries are installed as described in paragraph 2-3A. Remove the lens caps.
2. Turn the power switch initially to the primary ON position. A green glow will appear in each eyepiece (after a slight delay). Begin in a mission with the power switch in this position as in the event of a failure; it is easier and more natural to flip the switch down than up.

**NOTE**

*If a red light appears at the base of the NVAG mount, the batteries in that compartment are low and need to be replaced. Switch to the other battery compartment and make sure those batteries are good.*

3. Turn the vertical adjustment knob (see Figure 2-7) to center the eyepieces in from of your eyes. Minor readjustment may be needed after adjusting the tilt lever.

**NOTE**

*If the NVAG eyepieces are not properly aligned with the eyes, optimal resolution will not be achieved. Proper alignment of the eyepieces is achieved when the distance between the monocular matches the distance between your pupils and the line of sight is the same as the vertical angle of the binocular. When all the eyepiece adjustments (eye-span, vertical and tilt) are properly set, the edges of the images in both monoculars will be clear.*

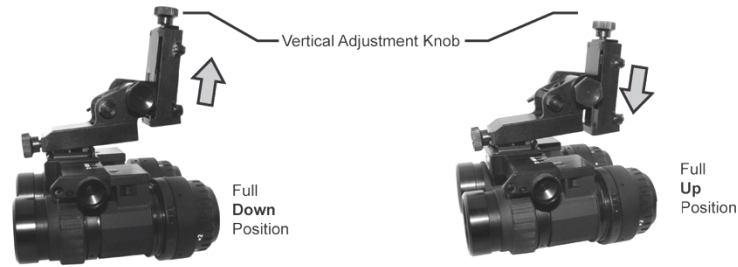


Figure 2-7. Vertical Adjustment Knob

**CAUTION**

*Do not attempt to adjust the tilt angle of the binoculars by pushing or pulling the monoculars up and down as this will damage the adjustment mechanism. Use only the tilt lever to make tilt angle adjustments.*

4. Move the tilt lever (see Figure 2-8) up or down to obtain the optimum line-of-sight view. If the upper or lower edges of the image areas are blurred, adjust both the vertical adjustment knob and the tilt lever until the blurred edge is removed and an optimal line of sight is achieved.

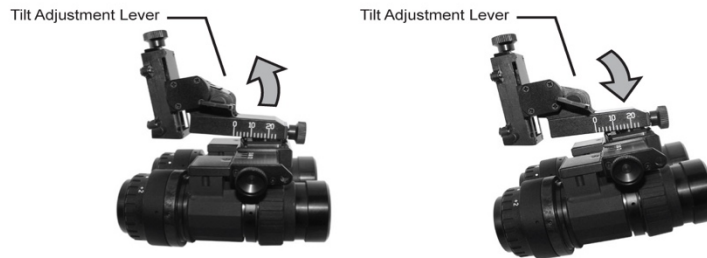


Figure 2-8. Tilt Lever

5. Turn the fore-and-aft adjustment knob (see Figure 2-9) to move the monoculars away from the eyes as far as possible without losing the field of view. This makes edge clarity easier to judge. You may use the fore-and-aft scale to preset this adjustment.



Figure 2-9. Fore-and Aft Adjustment Knob

**CAUTION**

*Do not attempt to adjust the eye-span distance by pulling the monoculars away from each other or pushing them together. Using force on the monoculars to make this adjustment will damage the adjusting mechanism inside the adjustment shelf. Use **only** the eye-span knob(s) to adjust the eye-span distance.*

6. If your eye-span distance has been measured prior to mounting the binocular, turn the interpupillary knob(s) (see Figure 2-10) to set this value on the scale. If not, move the binoculars closer together or further apart to adjust the eye-span distance for the proper spacing between your eyes. When properly adjusted, the edges of the images in both monoculars will be clear and the resultant binocular view will appear as a single circle or as two circles, overlapped and slightly displaced laterally.

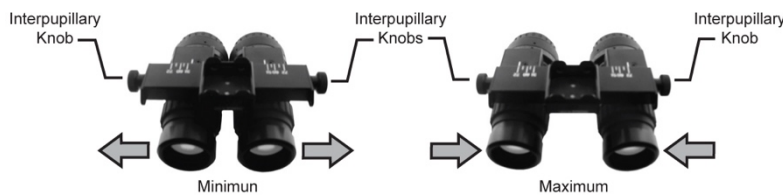


Figure 2-10 Interpupillary Adjustment Knobs

7. Now, turn the fore-and-aft adjustment knob to move the monoculars closer to the eyes as desired for individual preference. Your eyelashes should not touch the lenses or the assembly. A 25mm distance between the eye and the eyepiece provides for optimal viewing.

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## Chapter 3 Maintenance and Repairs

Service of the NVAG Goggle should be performed routinely on a 180 day cycle or immediately after major repairs are performed. Maintenance or repairs should only be performed by a trained, qualified technician (typically at a Calibration/Service Depot), or by Nivisys, LLC.

### WARNING

**There are no user-serviceable parts inside the Goggle.** Opening the monocular housings could result in operational malfunction, damage to equipment, and/or personal exposure to a serious electrical shock hazard. *Servicing should only be attempted by qualified technicians who are familiar with electronics and trained in the proper servicing of an NVAG Goggle.* **Unauthorized attempts to service the Goggle will void the warranty.**

### 3.1 Maintenance

#### CAUTION

*The binocular is a precision electro-optical instrument and must be handled with care. Do not scratch or touch the external lens surfaces.*

*Do not use abrasive materials to clean the gold-plated electrical contacts.*

User maintenance is limited to:

- Battery replacement
- Dust or FOD removal using compressed air or an optical brush.
- Light external cleaning (Wiping the NVAG with a soft cloth moistened with water or denatured alcohol).
- Lens cleaning (cloth provided).
- All other maintenance items should be addressed with Nivisys representatives.

### 3.2 Lubrication

Using lubrication on the NVAG mechanical components is not required and is advised against.

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### 3.3 Troubleshooting Procedures

Table 3-1 lists common malfunctions that you may find with your equipment. Perform the tests, inspections and corrective actions in the order they appear in the table. This table cannot list all the malfunctions that may occur, all the tests and inspections should find the fault or all the corrective actions that need to be taken in order to rectify the fault. If the equipment malfunction is not listed or in the event that the actions listed do not rectify the fault, notify Nivisys.

<b>Problem</b>	<b>Probable Cause</b>	<b>Corrective Action</b>
Binocular will not come on.	Batteries are defective. Batteries are missing or improperly installed. Electrical contacts are dirty or corroded.  Power cable connectors are not properly engaged.  Broken power cord, mount or power pack.	Replace batteries. Insert batteries or install batteries correctly. Use a dry cloth or pencil eraser to clean all electrical contacts. Reconnect.  If power cord is damaged, return NVAG and/or mount to Nivisys.
Intermittent operation.	Defective mount or binocular.	Return NVAG and mount to Nivisys.
Poor image quality.	Objective lenses or eyepiece lenses not focused correctly or lenses are fogged or dirty.	Adjust the focus of the lenses or clean them. If the image is still not clear, or the lenses are fogged internally, return to Nivisys.
Objective cannot be focused.	Focus mechanism loose or broken.	Return NVAG to Nivisys.
Eyepiece cannot be focused.	Eyepiece loose or focus mechanism broken.	Return NVAG to Nivisys.
Eye-span adjustment cannot be made.	Defective eye-span mechanism.	Return NVAG to Nivisys.
Binocular will not lock in mount.	Mounting hardware is dirty or broken.	Clean the mounting hardware. If problem persists the mechanism is damaged. Return the NVAG and mount to Nivisys.
Visor will not operate in mount.	Visor and mount improperly installed. Visor link defective.	Return helmet mount to Nivisys.  Return helmet mount to Nivisys.

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<p>Low battery indicator will not illuminate during check.</p>	<p>Batteries defective or missing. Batteries improperly installed. AA cartridge not pulled part way out. Poor power cable connection. Defective power pack. Defective mount.</p>	<p>Install new batteries. Install correctly. Pull partly out to break electrical contact. Check connector. Return NVAG to Nivisys. Return NVAG to Nivisys.</p>
<p>Operator experiences eyestrain, headache, or nausea while using goggles.</p>	<p>Incorrect sight picture or focus. Collimation off, poor image, adjustment shelf defective or defective monocular housing.</p>	<p>Correct sight picture or focus. Turn in binocular to maintenance personnel for collimation check, visual image dark, and adjustment shelf as well as monocular housing check.</p>

**Table 3-1. Trouble Shooting Procedures**

### **3.4 Preparation for Long Term Storage**

Before the NVAG Goggle is put away for an extended period of non-use:

- Make sure all optics lenses are clean and dry.
- Place protective caps on eye-pieces and objective lenses
- If batteries are installed, remove the batteries from the battery pack. Batteries may be stored in the case.
- Store all Goggle components in its protective case.
- While not in use, do not stack heavy items on top of the protective case.

### **3.5 Preparation for Shipment**

If the Goggle is to be shipped, package it for shipping using a strong corrugated cardboard box that is of sufficient size to have resilient packing material on all sides of the NVAG Case (original packaging is suggested).

## **Chap. 4 Preflight / Post-flight Inspection Procedures**

**WARNING** It is required to preflight the NVAG Night Vision Aviator Goggle in accordance with the preflight instructions outlined below. Failure to preflight the goggle and verify proper operational performance can jeopardize pilot operations and risk mission and/or crew safety. Consult your flight operations director for guidance.

Operator's are required to document NVAG operational performance by logging preflight inspection results in the Operator's Log Book prior to each flight.

### **4.1 Preflight User Inspection Items**

1. Inspect objective and eyepiece lenses for cleanliness, scratches, chips or cracks.
2. Check eyepieces and objective lenses to make sure the whole assembly is not loose, that there is free movement through full range of travel.
3. Inspect pivot and adjustment shelf for cracks, broken electrical circuits, dirty or corroded dual contacts. Check for proper installation of neck cord assembly if required.
4. Inspect helmet mount assembly for cracks, broken electrical circuits, dirty or corroded dual contacts, proper operation of the spring loaded hearings. Check fore-and-aft and vertical adjustment for full range of travel. Ensure free movement of tilt adjustment lever
5. Check eye span adjustment/tilt by rotating right and left adjustment screws from full outside to full inside for smooth even motion and lack of binding.
6. Inspect exterior of monocular housing for cracks or damage. Ensure purge screw covers are secured.
7. Check mount lock mechanism for proper operations. Ensure goggles lock in both the down and up position. Press the lock release button and rotate the binocular assembly to both positions, releasing the button to verify it locks.
8. Ensure batteries are properly installed in the battery holders.
9. Install one of the battery holders in the right side of the low profile battery pack.
10. Ensure NVD is mounted to the bracket assembly on the helmet and locked down.
11. Move battery selector switch to the right select position. Ensure NVD functions.
12. Move battery selector switch to the left select position. NVD will not function and low battery indicator will illuminate.

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13. Move battery switch to the middle position. Remove battery from the right battery well and place it in the left battery well.
14. Move battery selector switch to the left select position. Ensure NVD functions.
15. Move battery selector switch to the right select position. NVD will not function and low battery indicator will illuminate.
16. Move battery switch to the middle position. Ensure serviceable batteries are installed in both battery wells.

<b>NOTE</b>
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It is recommended to use fresh (unused) batteries in the alternate (left) compartment (from the aviator's perspective) before beginning a mission. Some batteries that have been used and still have many hours of life remaining can be used depending on unit procedures. Make sure to install these used or "time" batteries in the primary (right) compartment (from the aviator's perspective).

## **4.2 Preflight User/NVAG Focus**

The following adjustments must be made prior to flight using the ANV-20/20 or eye lane or similar focusing device:

1. Vertical adjustment up and down positions for the NVD.
2. Fore and AFT Adjustment: determine the closeness of the NVD to the user's eyes.
3. Tilt: the offset angle for user's eyes
4. Eye span adjustment (IPD): distance between the users left and right eye.
5. Preset the eyepieces and objective lenses fully counterclockwise.
6. Use lens cap or close your left eye.
7. Focus on the target in within ANV-20/20 test set which has been mounted / placed at eye level.
8. Turn the right objective lens clockwise until you achieve the sharpest image
9. Turn the right eyepiece lens clockwise until you obtain a clear image.
10. It may be necessary to go back and forth between objective lens and eyepiece lens to

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fine-tune the image.

11. Once the eyepiece adjustment has been made, visual acuity should be evaluated. If the target can be seen clearly, the monocular has been focused correctly and is functioning adequately.
12. Repeat the three previous steps for the left monocular assembly.
13. Ensure to do both the Flight and the low resolution test.

### **4.3 Post Flight User Inspection Items**

1. Inspect objective and eyepiece lenses for cleanliness, scratches, chips or cracks.
2. Check eyepieces and objective lenses to make sure the whole assembly is not loose, that there is free movement through full range of travel
3. Inspect Pivot and adjustment shelf for cracks, broken electrical circuits, dirty or corroded dual contacts. Check for proper installation of neck cord assembly if required.
4. Inspect helmet mount assembly for cracks, broken electrical circuits, dirty or corroded dual contacts, proper operation of the spring loaded bearings. Check fore-and-aft and vertical adjustment for full range of travel. Ensure free movement of tilt adjustment lever.
5. Check Eye span adjustment / tilt by rotating right and left adjustment screws from full outside to full inside for smooth even motion and lack of binding.
6. Inspect exterior of monocular housing for cracks or damage. Ensure purge screw covers are secured.
7. Check the mount lock mechanism for proper operation. Ensure goggles lock in both the down and up position. Press the lock release button and rotate the binocular assembly to both positions, releasing the button to verify it locks.
8. Notify Maintenance personnel of any problems or defects noted. Remove NVG from service if problem affects goggle operation.

## **Chapter 5 Nivisys Inspection Requirements**

The NVAG must be inspected and maintained every 180 days by a certified repair facility such as Nivisys, LLC. Repair of the NVAG by facilities or personnel that are not certified by Nivisys, voids the manufacturer's warranty and limits the manufacturer's terms of liability.

### **5.1 180 Day Inspection**

The minimum 180 day standard inspection must include the following:

#### **SYSTEM INSPECTION**

- Inspect objective and eyepiece lenses for cleanliness, scratches, chips or cracks
- Inspect and clean complete exterior of NVG unit
- Check objective lenses for freedom of movement
- Check eyepiece lenses for freedom of movement through full range of travel +2 to -6
- Check objective focus
- Check pivot adjustment shelf
- Check eye span adjustment and tilt
- Check monocular housing
- Check mount lock mechanism
- Check Vertical adjustment
- System current test
- Gain test
  - Minimum acceptable
  - Gain differential
- Resolution Test
  - Low light
  - High light
- Objective lenses
  - Infinity focus
- Diopter settings
- Collimation settings
- Low battery indicator circuit functional check
- Battery compartment inspection
- Verify Approved Batteries are in Use
- Nitrogen purge (If required)
- Clean and inspect all electrical contacts
- Check and adjust Inter-Pupillary Distance IPD knobs

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## IMAGE INTENSIFIER INSPECTION

- Shading
- Edge glow
- Bright spots
- Flashing/flickering
- Fixed pattern noise
- Chicken wire
- Veiling glare
- Black spots

The above inspection is to be completed IAW standards maintained by the following organizations and are incorporated as reference from:

- Nivisys, LLC
- U.S. Air Force
- U.S. Navy
- FAA

<b>NOTE</b>
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**Nivisys, LLC operates under a Continuous Improvement Policy. Should you note any corrections required in this manual or have suggestions to improve its content or usability, please let us know.**

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