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OPERATOR'S MANUAL
Thermal Imaging Weapon Scope
HALO-LR

Revision 3.1 February 2019

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General Information

Familiarize yourself with the entire manual before operating the equipment. Read the complete manual and follow all **WARNINGS** and **NOTES**. Study this manual carefully and understand all related safety precautions.

Scope

This manual provides the user with information related to operations, maintenance, and troubleshooting of the advanced thermal imaging weapon scope HALO-LR.

Introduction

The HALO-LR is an uncooled thermal imaging weapon scope detecting the long IR part of the spectrum (7.5 - 13.5 µm) and designed to meet the demands of military and security professionals, as well as recreational users. The HALO-LR offers unsurpassed performance when used for targeting, surveillance, search and rescue operations, perimeter control, and vehicle identification as well as a variety of other applications.

The rugged and lightweight HALO-LR combines a high performance engineered plastics housing with long-range optics that will satisfy the most stringent and demanding requirements. Regardless of ambient light conditions, smoke or haze, the HALO-LR detects even the slightest temperature differences of everything in the field of view and provides the user with clear “white hot” or “black hot” images of what otherwise would be invisible to the naked eye.

HALO-LR comes with a MIL-STD-1913 (Picatinny) compatible mount that can be attached to any weapon that is outfitted with the appropriate rail.

HALO-LR can be attached to an external video monitor or a video recorder for replay later. User can switch video output off to maximize battery life or configure it to be PAL or NTSC format.

This document is a User Manual for the HALO-LR thermal imaging weapon scope. Additional technical support for these units is available by phone at 781-505-8360 or via email at info@nvisionoptics.com.

Safety Summary

- HALO-LR is a precision electro-optical instrument and must be handled carefully at all times to prevent damage.

- To protect HALO-LR from unnecessary damage and degradation of performance never point the unit at extremely hot objects, such as the bright sun or a hot, burning fire.

- Do not scratch the lens surfaces.

- Be careful not to touch the lens surfaces. To remove contamination or fingerprints use lens paper to carefully clean the surface of the objective lens.

- Do not carry batteries in pockets containing metal objects such as keys, coins, sharp tools, etc. These objects can damage batteries and short-circuit them. Shorted batteries may become very hot.

Warnings

THE THERMAL IMAGING SENSOR USED WITHIN THE HALO-LR IS VERY SENSITIVE TO EXPOSURE TO EXTREMELY HIGH LEVELS OF RADIANT FLUX (HEAT).

NEVER EXPOSE THE HALO-LR, EITHER TURNED ON OR NOT, DIRECTLY TO THE SUN OR ANY OTHER SOURCE OF HEAT THAT THE HUMAN EYE CANNOT TOLERATE. EXPOSURE TO THE HIGH LEVEL OF RADIATION MAY DAMAGE THE HALO-LR SENSOR.

KEEP THE OBJECTIVE LENS COVER CLOSED OR ON AT ALL TIMES WHEN THE HALO-LR IS NOT IN USE.

INADVERTENT SUN DAMAGE IS NOT CONSIDERED A DEFECT IN MATERIAL OR WORKMANSHIP, AND IS NOT COVERED IN THE PRODUCT WARRANTY.

NEVER MIX PRIME AND RECHARGEABLE BATTERIES.

NEVER USE RECHARGEABLE BATTERIES THAT ARE NOT APPROVED BY N-VISION OPTICS. USE OF UNAPPROVED RECHARGEABLE BATTERIES MAY LEAD TO DAMAGE OF HALO-LR AND PRESENT SAFETY RISK.

Unit Overview

Figure 1 below shows the HALO-LR thermal imaging weapon sight.

Figure 1. HALO-LR Thermal Weapon Sight

Features

- Long range observation regardless of light level
- Six user selectable reticles
- Electronic windage and elevation adjustments
- Black hot/white hot, black/white edge detect polarity selections
- Digital 2x and 4x zoom
- High resolution throughout the entire field of view
- Standard MIL-STD-1913 (Picatinny) rail mounting system
- Nitrogen purged in order to prevent internal fogging and extend service life
- State of the art impact-resistant engineered plastics housing

Key Specifications

Key specifications are presented below in Table 1. Model specific characteristics can be found on product specification sheets or by contacting N-Vision Optics.

Table 1 Key Specifications

Sensor type	Uncooled vanadium oxide (VOx) microbolometer
Detector resolution	640 x 480
Spectral response, µm	7.5 - 13.5
Detector pitch, µm	12
Refresh rate, Hz	60
Start-up time, sec	< 4
Reticle type	6 user selectable types
Objective lens	Germanium Athermalized 50mm F1.2
FOV, degree	9 x 7
Focus	Fixed
Detection, man size target, typical	2020yd (1850m)
Recognition, man size target, typical	726yd (660m)
Identification, man size target, typical	380yd (350m)
Analog output	NTSC or PAL
Output resolution, NTSC	640 x 480
Output resolution, PAL	768 x 574
Power, internal	Four CR123 (DL123) batteries
Power, external	USB
Display type	OLED
Display resolution	640 x 480
Diopter adjustment, diopters	-6 to +2
Size (L x W x H)	8.5" (215mm) x 3.2" (82mm) x 3.1" (80mm)
Weight	28.2oz (800g)
Surface finish	Dark
Environmental protection	IP67
Memory	60 Images

HALO-LR Components

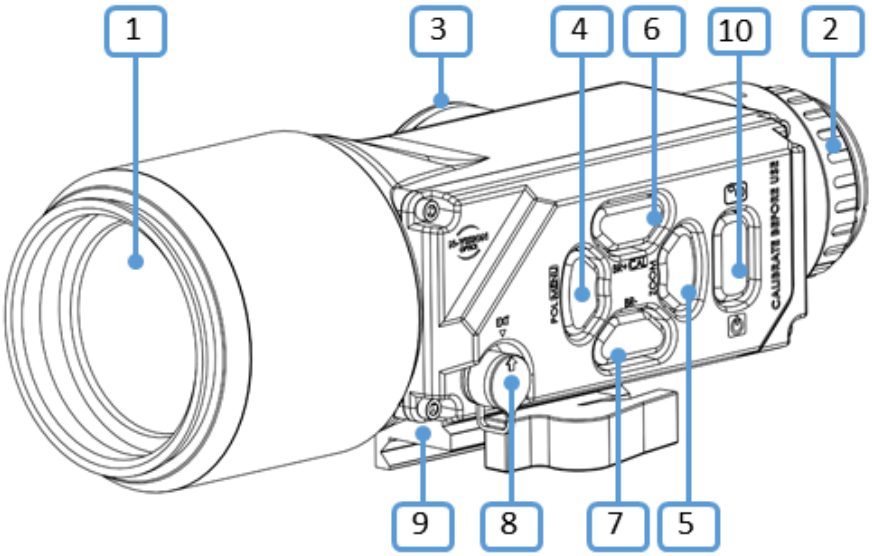

Figure 2 HALO-LR Front Side View

Refer to Figure 2 to identify key components.

1. Objective Lens. Lens cover is not shown for clarity
2. Ocular (eye piece)
3. Battery Compartment Cover
4. **POL (MENU)** Polarity (Menu) Button
5. **ZOOM** Digital Zoom Button
6. **BR+ (CAL)** Contrast Enhancement + Adjustment (Calibration) Button
7. **BR-** Contrast Enhancement – Adjustment Button
8. Electrical Connector (under dust cup)
9. MIL-STD-1913 (Picatinny) Rail Mount
10. Power/Photo Button

Standard Kit

Standard HALO-LR kit includes unit, hard carrying/storage case, USB cable, lens-cleaning paper, quick reference guide, and four (4) CR123 (DL123) size batteries.

Operation

Refer to Figure 2 to identify key components.

Installing Batteries

WARNINGS:

DO NOT MIX OLD AND NEW BATTERIES. DO NOT MIX BRANDS OF BATTERIES. DO NOT MIX DISPOSABLE AND RECHARGEABLE BATTERIES.

INSPECT BATTERIES FOR BULGING AND DAMAGE PRIOR TO USE. IF THE BATTERY SHOWS SIGNS OF BULGING OR DAMAGE, DO NOT USE.

DO NOT DAMAGE, PUNCTURE, SHORT CIRCUIT, ATTEMPT TO RECHARGE OR OTHERWISE TAMPER WITH BATTERIES. TURN OFF THE HALO-LR IF THE BATTERY COMPARTMENT BECOMES TOO HOT. IF POSSIBLE, WAIT UNTIL IT COOLS DOWN BEFORE REMOVING BATTERIES.

ALWAYS REMOVE BATTERIES WHEN STORING OR SHIPPING THE HALO-LR.

NEVER USE RECHARGEABLE BATTERIES THAT ARE NOT APPROVED BY N-VISION OPTICS. USE OF UNAPPROVED RECHARGEABLE BATTERIES MAY LEAD TO DAMAGE OF HALO-LR AND PRESENT SAFETY RISK. THE USE OF REPUTABLE BRAND NAME, HIGH QUALITY BATTERIES IS RECOMMENDED. BATTERIES OF THE LESSER QUALITY MAY HAVE SIGNIFICANTLY SHORTER LIFE AND MAY NOT HOLD RECOIL.

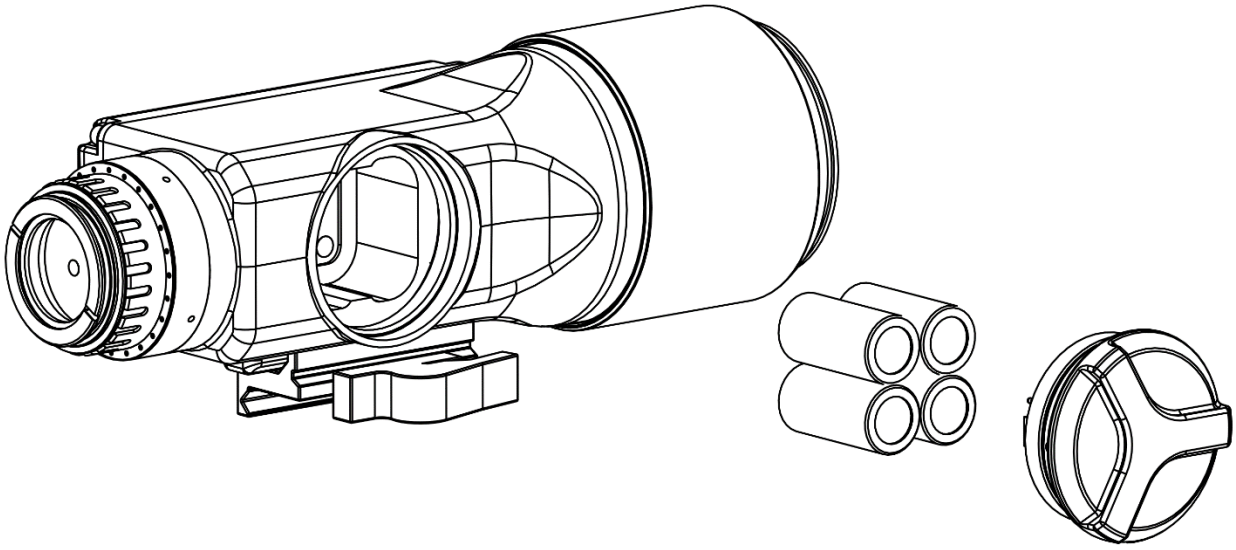

Figure 3. HALO-LR With Removed Battery Compartment

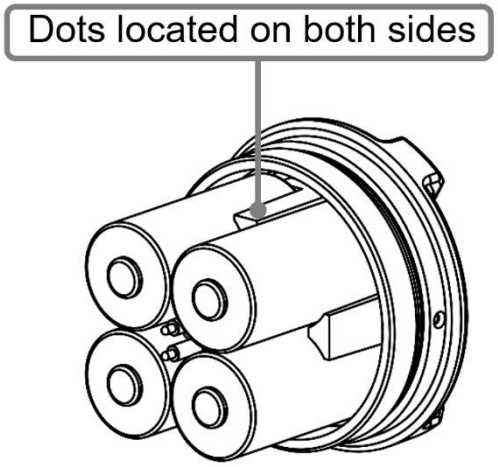

Figure 4. Side Marked With Dot Should Be Facing Up When Installed

Unscrew the Battery Compartment Cover (3). Install four CR123 batteries as shown in Figure 4 with **+** end of batteries facing out. Inspect the rubber O-ring inside the Battery Compartment Cover (3) for damage. Replace and/or lubricate if necessary. Slide Battery Compartment Cover (3) with installed batteries back into the HALO-LR Housing with one of the sides marked with light dots pointing up and screw Battery Compartment Cover (3) onto the HALO-LR Housing.

NOTE: Battery Compartment Cover (3) has a built-in magnet that holds batteries in place and does not allow them to easily fall out during installation and handling.

Switching the Unit ON and OFF

Press and hold down the Power Button (10) for approximately two seconds. When the display in the Ocular (2) lights up, release the Power Button. To turn the unit off press and hold Power Button (10) for approximately two seconds until the image in the Ocular (2) disappears.

IMPORTANT: Thermal Calibration

HALO-LR requires calibration before each use after powering the unit up, or after a significant change in ambient temperature, etc. To calibrate the system, press and hold **BR+ (CAL)** (6) for approximately two seconds until image refreshes while the lens cover is closed or the objective lens is completely covered with a hand, etc.

Focusing

NOTE: The Objective Lens of the HALO-LR is a fixed focus lens and does not require any adjustments.

Diopter Adjustment

Rotate the Diopter Adjustment Ring of the Eyepiece (2) clockwise or counterclockwise to focus the ocular according to your vision. Details such as reticle and battery level indicator should appear sharp and clear.

Mounting the HALO-LR on a Rifle

The HALO-LR is equipped with Picatinny (MIL-STD-1913) Compatible Mount. To achieve the best results and accuracy, the HALO-LR must be mounted properly. The Picatinny rail needs to be parallel to the bore of your weapon to allow for maximum elevation and windage adjustments. It is strongly recommended that the MIL-STD-1913 rail be installed by a qualified gunsmith.

Installation Steps:

1. Before attempting to install your HALO-LR thermal weapon scope, please take the time to ensure that your firearm is **clear and safe of ammunition** and the muzzle is pointed in a safe direction.
2. Look at the Picatinny (MIL-STD-1913) Compatible Mount and become familiar with its components.

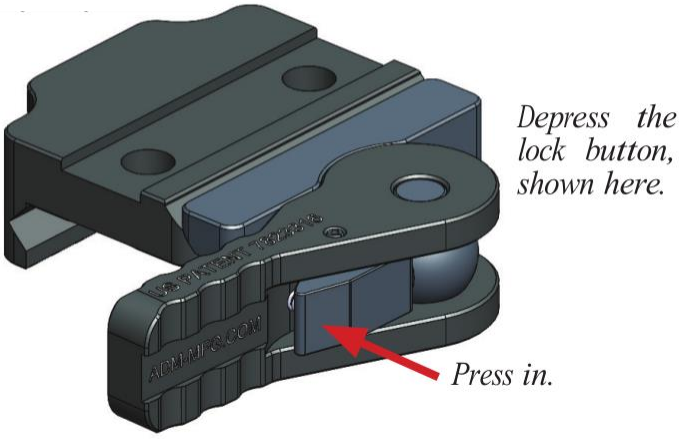

Figure 5. Unlocking Picatinny Mount

3. Unlock the mount. To do this, depress the lock button and swing the lever 180º to the open position.

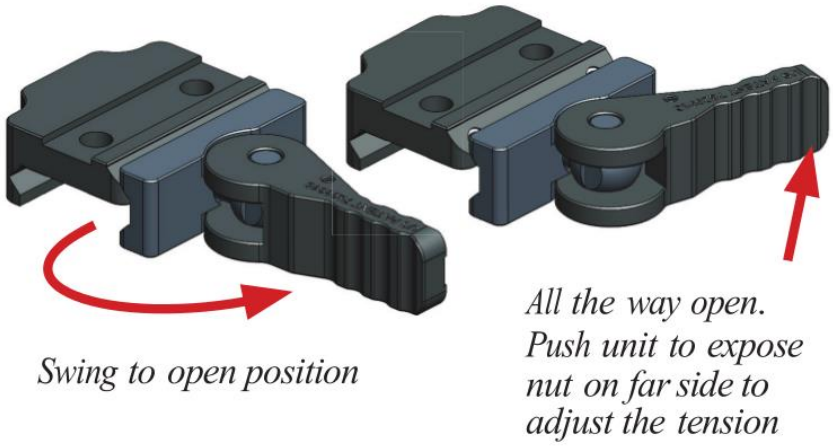

Figure 6. Moving Lever to the Fully Unlocked Position

4. Install the HALO-LR onto the rail and move the lever to the locked position.
5. Check the tension to close. The correct amount of tension is the maximum amount to apply with one hand to move the lever to a closed position.

NOTE: How much pressure you prefer is dependent on your own judgement and personal preference. Please remember, this system has a lot more surface contact than some other systems, so you may not need to push the lever as hard to achieve the same result.

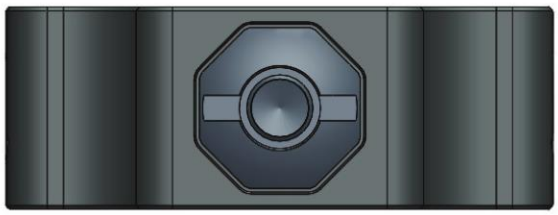

Figure 7. Tension Adjustment Nut

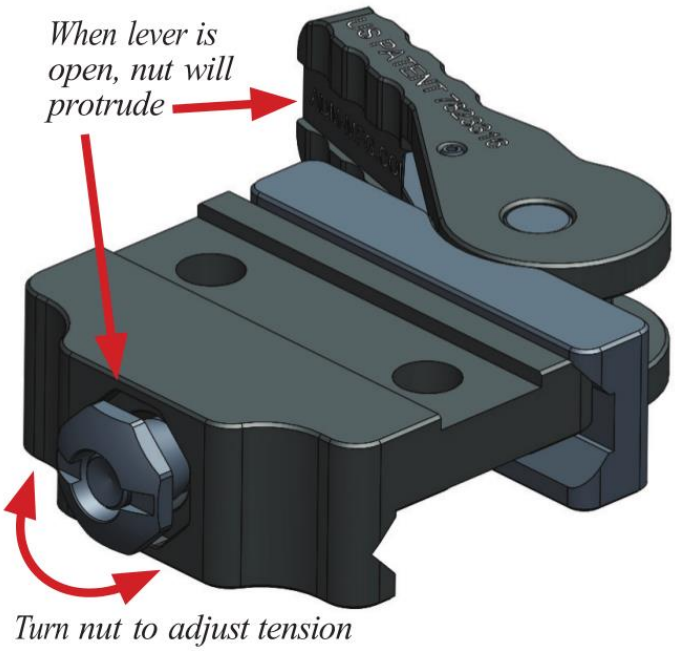

Figure 8. Adjusting Tension of the Mount

6. To adjust the tension, move the lever to the open position and push the lever towards the base. This will make the adjustment nut protrude on the opposite side of the base. With the nut protruding, it may be turned to the right or to the left to make the necessary adjustment. We recommend tightening one to two flats per time, then testing the

tension. Since there are eight flats on the octagonal nut, this process may take a few tries to get it where you want it. You will need no tools for this step.

Operating Modes and Menus

The HALO-LR has the following operating modes:

Normal Mode

Normal mode is used for observation and aiming with the HALO-LR. When the user powers up the HALO-LR, the Normal Mode is the default setting for the system.

Zeroing Mode

Zeroing mode is used to zero the HALO-LR to a rifle. Zeroed settings are saved in an energy independent memory and recalled upon startup of the unit or after changing the reticle number under the Reticle Menu.

Menu Mode

Menu Mode allows the user to conduct system configuration and review some of the system's parameters.

USB Mode

The HALO-LR will enter USB Mode when it is connected to the USB port of a Personal Computer (PC) or any other USB power source capable of providing at lease 1A of current with the USB cable. When HALO-LR is connected to the USB, its core electronics powers up automatically, but the rest of the system remains off and there is no image displayed through eyepiece. In this mode, it is possible, using appropriate software on the PC, to download images to the PC from the HALO-LR unit and delete them from the HALO-LR memory.

NOTE: It is possible to power up the HALO-LR using power from the computer's USB port or any other USB power source and start the HALO-LR in Normal Mode. In order to prevent HALO-LR from going into USB Mode and, instead, power up in Normal Mode, press down and hold Power button while connecting HALO-LR to the USB port. In this case it is still possible to download images to PC and delete them from the HALO-LR but image is visible through the eyepieces and device can be operated as normal.

HALO-LR Control Buttons

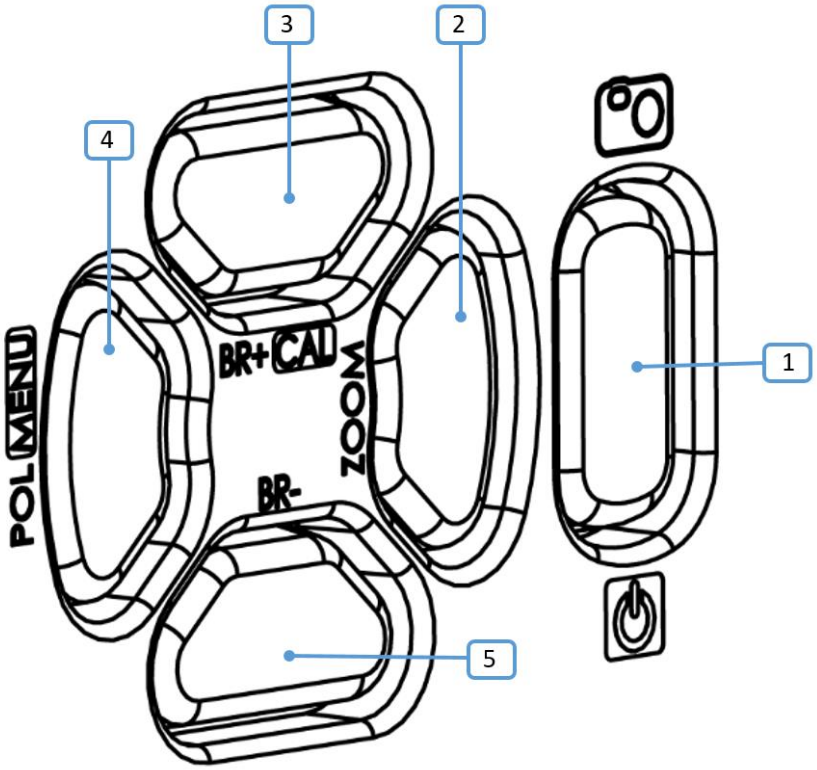

Figure 9. HALO-LR Control Buttons

Table 2 below provides descriptions of the button functionality in different modes. Refer to Figure 10 above to identify the buttons.

Table 2. Functionality of Buttons in Different Modes

Normal Mode		
Individual Functions		
Button	**Function (Marking)**	**Description**
1	Power / Photo (**Power / Photo Icons**)	Powers unit up if pressed and held for approximately two seconds. Powers unit down if pressed and held for two seconds. Takes picture if pressed and released quickly. This only works if Enable Photo is set to Yes in System Settings.
Note about taking pictures: If Enable Photo is set to Yes in the Systems Settings Menu,		

pressing and releasing Button (1) in the Normal Mode will take picture and save it to internal memory. It is recommended to set Enable Photo to No in order to prevent accidental picture taking in Normal Mode.		
2	Digital Zoom (**ZOOM**)	Cycles digital zoom settings (1X, 2X, 4X).
3	Increase Contrast Enhancement / Calibration (**BR+ / CAL**)	Increases the Contrast Enhancement (CE) level of the image if pressed and released. Performs calibration if pressed and held down for approximately two seconds
4	Black/White Hot, Black/White Edge Detection Selection (**POL / MENU**)	Changes White Hot/Black Hot, Black/White Edge Detection mode if pressed and released. **NOTE**: Either of the Edge Detection mode can be enabled or disabled in Video Settings Menu. Enters Menu Mode if pressed and held down for approximately 2 seconds.
5	Decrease Contrast Enhancement (**BR-**)	Decreases the Contrast Enhancement (CE) level of the image if pressed and released.
Menu Mode		
Button	**Function**	**Description**
Button 1	Not Used	
Button 2	Not Used	
Button 3	Move	Move to the previous menu item
Button 4	Select/Save	Select menu item to move to submenu or upper level menu or make item changeable. Save changed menu item.
Button 5	Move	Move to the next menu item
USB Mode		
No buttons are active in USB Mode unless Button (1) was pressed and held down while unit was connected to the USB port of a PC or any other USB power supply. If Button (1) was pressed and held down while unit was being connected to the USB port of a PC or any other USB power supply, all buttons will function as in Normal Mode.		
Zeroing Mode		
NOTE: Zeroing Mode is accessible from Main Menu by selecting Zeroing.		
Button	**Function**	**Description**
Button 1	Save and Exit	Pressing the button down will save reticle position and exit to Normal mode.
Button 2	Windage adjustment right	Moves reticle one **step** right
Button 3	Elevation adjustment up	Moves reticle one **step** up
Button 4	Windage adjustment left	Moves reticle one **step** left
Button 5	Elevation adjustment down	Moves reticle one **step** down
Note about moving the reticle: Pressing and holding down any button 2, 3, 4, or 5 for more than two seconds will enter reticle movement into Rough Adjustment Mode. In Rough Adjustment Mode, the reticle will move in 5 pixels steps as long as the control button is pressed. Release of the control button will immediately end Rough Adjustment Mode.		

Normal Mode Description

Normal Mode is used for observation and aiming with the HALO-LR. When the user powers up the HALO-LR it always starts in Normal Mode. For controls available in Normal Mode, see Table 2 above.

The following functions are supported in Normal Mode:

Taking Photos

Pressing and quickly releasing **Power / Photo** button captures the image and saves it in the HALO-LR memory. Saved pictures can be later viewed under Gallery in Menu Mode. Images can be downloaded later to a PC using the optional USB cable and software. Image Capture function is turned off by default. It can be enabled under the System Settings Menu in Menu Mode.

Selecting Polarity

Pressing and releasing Button (4) (marked **POL** / **MENU**) cycles through Black Hot, White Hot, Black Edge Detect and White Edge Detect modes (in sequence).

Black Hot mode displays the heat sources as black. The cooler objects are displayed as increasingly lighter shades of gray while the coldest objects are displayed as white.

White Hot mode displays the heat sources as white. The cooler objects are displayed as darker shades of gray while the coldest objects are displayed as black.

NOTE: If preferred, Edge Detect modes can be turned on and off under Video Settings Menu in Menu Mode.

Edge Detect mode darkens or lightens areas of the image that are algorithmically insignificant and outlines objects that produce a distinctive heat signature. This helps users to stay focused for longer periods of time and quickly identify objects of interest when they become visible.

Digital Zoom

The HALO-LR features digital zoom (E-Zoom). E-Zoom is activated by pressing on the button marked ZOOM and is used to magnify the central area of the output image. The E-Zoom sequence allows the user to select multiple e-zoom factors. When the system is turned on, the sight will display images without any digital magnification. When the Zoom button is pressed, the sight will sequence through 2X then 4X then return to 1X. Indicator in the lower left corner of the display shows current zoom setting.

Contrast Enhancement (CE) Adjustment

CE adjustment allows the user to increase or decrease algorithmic contrast adjustment of the

image. Increasing CE helps to distinguish fine image details in low thermal contrast conditions, but setting the value too high will lead to a grainy image.

To increase Contrast Enhancement press Button 3 (**BR+ / CAL**). To decrease Contrast Enhancement press Button 5 (**BR-**).

NOTE 1: Different CE Adjustment settings maybe required for different observation conditions.

NOTE 2: CE Adjustment can be required when switching between radically different scenes, switching polarity of the image, etc.

NOTE 3: It is also possible to adjust the CE value under the Video Settings Menu. Setting CE level between 0-2 works well for average conditions.

Menu Mode Description

Refer to Figure 9.

Menu Mode allows user to conduct system configurations (choice of reticle, zeroing, brightness, etc) and review some of the system's parameters (part number and software revision), as well as see pictures that were saved to the unit's memory. To enter the Menu Mode press and hold Button (4) (**POL / MENU**) for approximately three seconds.

NOTE: Menu fonts may be hard to read in Edge Detect mode. If this causes difficulties, it is recommended to enter menu mode while in Black Hot or White Hot mode.

Navigation in Menu Mode

To **move up** between menu items press Button (3) (**BR+ / CAL**).

To **move down** between menu items press Button (5) (**BR-**).

NOTE: The indicator on the left of a menu item shows which menu item is current.

Selecting a menu item: press Button (4) (**POL / MENU**). Selecting a menu option makes it possible to change its value or leads to immediate transition to upper or lower level menu.

NOTE: The indicator on the left of a menu item changes shape when the option is selected. When the indicator changed its shape the corresponding setting can be changed.

Changing a menu item (if changeable): Use Button (3) (**BR+ / CAL**) to increase its value or Button (5) (**BR-**) to decrease it.

To save the changed menu item press Button (4) (**POL / MENU**).

Main Menu

Main Menu contains the following choices:

System Settings Menu

Under this option, a user can choose the format of the output video signal (PAL or NTSC), turn analog video output off, and enable or disable taking pictures.

Video Settings Menu

This submenu allows users to change display brightness, set contrast enhancement (CE) level, image sharpness, select gamma setting for the display, turn edge detect on or off and select the Region of Interest (ROI).

Reticle Menu

Reticle menu allows the user to turn the reticle on or off, select reticle number to be used and configure the reticle type.

System Info Menu

In the System Info Menu, a user can access the following information: software revision and model of the unit. There are no user modifiable parameters in this option.

Gallery
Within the Gallery menu, the user can review images that were saved to the HALO-LR memory.

Zero Menu

When Zero Menu is selected, unit is entering the zeroing mode; where users can adjust the reticle position for the reticle number that was selected in the Reticle Menu.

Save and Exit

Selecting Save and Exit in the Main Menu brings the user back to the Normal Mode.

System Settings Menu

Video Output

This menu item allows user to configure analog video output format by choosing between PAL and NTSC or turn it off completely.

NOTE: Setting Video Out to OFF when no external monitor or DVR is connected will reduce total power consumption and will preserve the battery life.

Enable Photo

If Enable Photo is set to Yes, pressing and releasing Button (1) in Normal Mode will take photo and save it in the HALO-LR memory. If Enable Photo is set to No this functionality is disabled.

Save and Exit

Selecting Save and Exit in Settings Menu brings the user back to the Main Menu.

Video Settings Menu

Brightness

Adjusts display brightness between 1 and 8. Recommended setting is 5.

CE Level

Changes Contrast Enhancement level between 0 and 12. Recommended setting is 0-2.

NOTE: The contrast enhancement level represents a tradeoff between image dynamic range and contrast. Higher enhancement level makes smaller emittance differences more discernable but reduces the visible dynamic range. Setting CE level too high may lead to grainy looking image.

Sharpness

Changes image Sharpness between 0 and 4. Recommended setting is 2.

NOTE: Live imagery can be enhanced by either sharpening or introducing slight blurring. **0:** Introduces slight imagery blurring. **1:** Leaves imagery as is. **2 – 4:** Introduces progressive level of sharpening. Setting Sharpness level too high may lead to grainy looking image.

Gamma

This setting changrd the Gamma curve for the display. Available values are between 0 and 2. Recommended setting is 1.

NOTE: changing the Gamma setting visually changes the brightness of the display but also alters the way the image is presented on the black and white screen. Adjustment may be most effective if done in combination with adjustment of Brightness.

Edge Detection

This setting allows the user to choose which of the Edge Detect modes (Black Edge, White Edge, or neither) will be included in the rotation when switching polarity with Button (4) (**POL / MENU**) in Normal Mode.

NOTE: In Edge Detection mode the HALO-LR outlines regions of the image with similar infrared emittance named “edge”.

ROI (Region of Interest)

Selects the most appropriate Region of Interest (ROI). For scanning, recommended setting ROI to Full. ROI ½ and ROI ¼ leads to the optimization of the image based, correspondingly, on the ½ or ¼ central part of the image. This will make the part of the image that is closer to the center look better but the peripheral parts of the image may suffer.

Save and Exit

Selecting Save and Exit in Video Settings Menu brings the user back to the Main Menu.

Reticle Menu

The Reticle Menu contains the following choices:

Show Reticle

Allows turning reticle on or off.

Reticle Number

User can save up to four reticle positions by selecting one of the Reticle Numbers. Each Reticle Number is saved with its Reticle Type and zeroing information. This functionality allows users to zero the HALO-LR on multiple weapon systems (up to 4) using different Reticle Numbers, and move it in the future between weapon systems without a need to re-zero by simply selecting the appropriate Reticle Number.

Reticle Type

There are six user selectable reticles numbered 1 to 6. When selected, a visual representation of each reticle is displayed instead of the previous one.

Save and Exit

Selecting Save and Exit in Reticle Menu brings the user back to the Main Menu.

System Info Menu

The System Info Menu does not have any user adjustable setting. It allows the user to review system information: unit's Software Revision and Model.

Exit

Exit in the System Information Menu brings the user back to the Main Menu.

Gallery

When in the Gallery, users can review images that were saved in the HALO-LR's internal memory. The following commands are available.

To see the next image press Button (3) (**BR+ / CAL**)
To see the previous image press Button 5 (**-**) (**BR-**)
To exit from the Gallery to the Main Menu press Button (4) (**POL / MENU**)

Zero

Selecting Zero from the Main Menu enters the Zeroing Mode, which allow zeroing of the HALO-LR.

Zeroing Mode Description

Zeroing mode is used to zero the HALO-LR according to procedure described below.

Zeroing Procedure

IMPORTANT: Zeroing can be carried out during either day or night. The Zeroing procedure can be performed at any magnification setting (ZOOM), however the desired zoom level should be selected before entering the Menu Mode.

Zeroing of the HALO-LR is achieved by performing the following steps:

1. Make sure the weapon sight is securely mounted on your weapon.
2. Fix a thermal target, for example, at 25 meters distance.
3. Turn the HALO-LR on.
4. Perform calibration.
5. Ensure that the target is visible with good contrast through the HALO-LR before continuing.
6. Use the digital zoom if it helps you to see target clearer.
7. Adjust, if necessary, settings in the Video Settings Menu to ensure the best possible view of the target.
8. In the Reticle menu, select the appropriate Reticle Number and Reticle Type.
9. Enter Zeroing Mode by selecting Zero in the Main Menu.
10. Use the center of the reticle to aim the weapon at the target and fire 3-5 rounds.
11. After clearing the weapon, visually check the center of the shot group on the target.
12. Make adjustments as necessary to the windage and elevation.
    a. Button 2 and 4 provide movement of the reticle in horizontal direction (windage adjustment). Button 2 moves the reticle right, Button 4 moves the reticle left.
    b. Button 3 and 5 provide movement of the reticle in vertical direction (elevation adjustment). Button 3 moves the reticle up, Button 4 moves reticle down.
    c. In the bottom left corner of the display there is an arrow pointing up or down and a number next to it. The direction of the arrow shows the direction that the reticle

moved relative to the center of the display and the number of steps made in this direction. For example, ↑7 in the left bottom corner of the display means that the reticle is now located 7 pixels above the center of the display.

d. In the bottom right corner of the display there is an arrow pointing left or right and a number next to it. The direction of the arrow shows the direction that the reticle moved relative to the center of display and number of steps made in this direction. For example, ←3 in the right bottom corner of the display means that the reticle is now located 3 pixels to the left from the center of the display.
e. If the counter in the bottom left or right corner reads 00 it means that the reticle is located in the middle of the display in vertical or horizontal direction (or both if both counters are at 00) .
f. In order to move the reticle in regular small steps (1 pixel per step), the corresponding button has to be pressed and released within 0.4 seconds. Pressing and holding the button down for more than 1 second will enter the reticle movement into the Rough Adjustment mode. In the Rough Adjustment mode the reticle moves in 5 pixel increments as long as the button is pressed. Release of the button will immediately end the Rough Adjustment mode.

13. Fire and adjust the reticle until the center of the shot grouping and the reticle converge.
14. Exit from Zeroing Mode by pressing the Button 1 (**Power / Photo**).

Maintenance Instructions

Introduction

The HALO-LR is designed to be used in diverse environments and rugged conditions. It is recommended that regular and simple maintenance be performed for optimal system performance.

Preparing for Maintenance

Before performing any maintenance or cleaning of the system, remove all power sources from the HALO-LR including batteries and/or external power supplies.

Cleaning the HALO-LR

When necessary, use a moistened clean cloth to wipe the outside of the unit, EXCEPT FOR THE OPTICAL SURFACES. Be sure to wipe away excess dirt and dust that may restrict the performance or damage moving and mating parts. If needed, the use of a highly diluted detergent solution is permissible. Dry with a soft clean cloth, or allow unit to air-dry before storing it.

Cleaning the Optics

When cleaning the lens is required, first blow any loose dirt or grit away from the surface of the lens. Use the supplied lens tissue, lightly moistened with water or lens cleaning fluid and lightly wipe the optical surfaces, using a circular motion. Discard each lens tissue after one use to avoid transferring grit or foreign matter onto the lens surface. If the lens remains dirty, use a cotton swab lightly moistened with lens cleaning fluid to remove the foreign matter from the lens. Dry with a clean, unused lens tissue.

Checking for Damage and Corrosion

As a general guideline, conduct an inspection of the HALO-LR, accessories, and the case after every use. Look for heavy wear and cracks in rubber or plastic. Inspect for moisture or corrosion in the battery compartment. Check for scratches, condensation, and foreign matter on optical surfaces.

Description of Additional Functions

Electrical Interface

The HALO-LR is equipped with a 6-pin electrical connector (Hirose Electric Co Ltd 6 Pos Connector p/n HR30-6R-6P(71)) that is located on the side of the housing and is covered by a rubber push-in dust cup. The purpose of this connector is to provide the user with the ability to:

- Power the HALO-LR from external USB power source
- Conduct observation using remote monitor
- Record video input from the HALO-LR
- Download images from the HALO-LR to PC

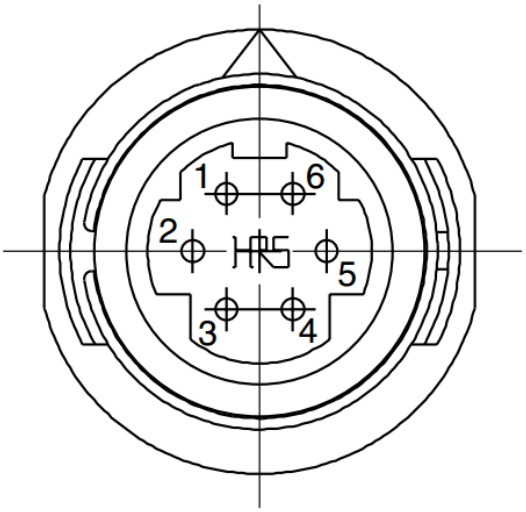

Figure 10. HALO-LR Electrical Connector

Details for Electrical Connector pinout are provided in Table 3.

Per customer request, N-Vision Optics can provide the customer with electrical cables of different lengths and functionality. The customer may also make his/her own cable using the information from Table 3 and description below.

Figure 11 Optional HALO-LR Cable

Table 3 6-Pin Electrical Connector

Pin	Function
1	Video Out
2	Video GND
3	USB VBUS
4	USB D (-)
5	USB D (+)
6	USB GND (-)

Video Out – Video Out – an analog TV video output signal in an SMPTE-170M / NTSC or PAL format with an output impedance of 75-Ohm. With the 75-Ohm termination, the output video is a 1 Volt peak-to-peak signal. Video Out must be terminated in order to get a video signal.

Video GND – output video ground reference; not to be used for any other ground than video.

NOTE: Most commercial displays / monitors will already contain internal terminations.

For advanced users only: USB_D (-), USB_D (+), USB_VBUS, USB Voltage Return – The HALO-LR is capable of communicating via a Universal Serial Bus. Please contact N-Vision Optics for details.

Troubleshooting

Refer to Table 4 below for troubleshooting instructions for most common problems. If the equipment malfunction is not listed or actions listed do not correct the fault, notify your maintainer.

Table 4 Troubleshooting Instructions

Malfunction	Test or Inspection	Corrective Action
Unit fails to turn ON.	Visually inspect. Check for defective, missing or improperly installed batteries.	Inspect Battery Compartment for damage. Replace battery or install correctly. Tighten Battery Compartment.
Flickering image on firing or unit turns off.	Visually inspect. Check for loose Battery Compartment Cover. Check battery charge level.	Make sure that the Battery Compartment Cover is **really** tight. Replace batteries, if necessary.
The HALO-LR is ON but there is no thermal image on the display	Visually inspect. Check if the Lens Cover is on or something else obstructs field of view.	Remove Lens Cover or other obstruction.
Poor image quality.	Visually inspect. Check for fogging or dirt on the Objective Lens or Ocular.	Clean optics. See maintenance section of this manual. Cover objective lens and perform thermal calibration. Adjust settings under the Video Settings Menu to achieve the best possible image.
Diopter adjustment is very hard to turn or grinding	Visually inspect. Check for dirt or debris on Ocular.	Carefully remove the rubber Eye Cup. Clean with a soft dry cloth.
Will not zero.	Check to see if the HALO-LR is securely fastened to the Weapon Mount. Check to see that the Weapon Mount is correctly and securely fastened to the weapon.	Tighten the weapon mount and/or spacer to the HALO-LR. Correctly and securely fasten weapon mount to weapon.