TONBO imaging

SPARTAN-ST

CLIP ON NIGHT SIGHTS (THERMAL IMAGING)
FOR TAVOR ASSAULT RIFLES

OPERATION AND MAINTENANCE MANUAL

SPARTAN

Model No: Spartan-ST

CLIP ON NIGHT SIGHTS (THERMAL IMAGING)

FOR

TAVOR ASSAULT RIFLES

User Handbook/Operators Manual

PREPARED AND PUBLISHED BY

Technical Review

Reviewer	SS/SK	Technical Manager
Approver	PA	Chief Technical Officer

Version History

Version	Date	Description	Author
01	March 2025	Initial Issue	KN

Safety Instructions - System

Ensure the following measures to avoid damage to the unit and risk of serious injury:

Handling
The unit is a precision optical device and must be handled carefully to prevent damage.
DO NOT scratch the external lens surfaces or touch them with your fingers.
DO NOT dismantle the unit.
DO NOT remove any factory installed screws. Damage to the units may void any warranty associated with the unit.
Thoroughly clean and dry each item before placing them into the ruggedized container.
Keep the unit clean. Protect it from moisture, dramatic temperature drops, and electrical shocks.
DO NOT force the control buttons on the unit past their stopping points.
To avoid losing unsaved data, DO NOT remove the battery or disconnect the external power source while the unit is powered On.

Operation
When installing the unit on a weapon, ensure that the weapon is clear, and that the safety lock is on before proceeding.
Operating the unit outside of the specified input voltage range or the specified operating temperature range can cause permanent damage.
It is important to do a pin-to-pin power check and ground check on all connectors. Ensure that the power and ground are applied only where specified. The unit may get damaged if power or ground is applied to the wrong point.
Use only the supplied interface cable (if applicable) or a communication cable of minimum 24AWG.
To prevent personal injury and equipment damage, follow ESD (Electrostatic Discharge) guidelines.

Caution:

To prevent thermal damage to the unit, never point it directly at the sun or any other source of high intensity light that the unprotected human eye cannot tolerate (such as a welding arc).
To prevent inadvertent exposure to these sources, always secure the unit with the supplied lens cap.

Safety Instructions

DOs
Keep lens covered by lens cap when unit is not in use.
Clean the lens and eyepiece glass only using the microfiber cloth provided.
Clean and dry the lens completely before storing it in a bag/box.
Always inspect the battery visually and physically before use.
Blow away any dirt from the battery terminals.
Ensure battery compartment is clean and dry before battery insertion.
Match polarity on the system and battery charger when inserting batteries.
Replace low endurance batteries with a fully charged battery.
Use only the supplied charger to charge the battery.
Always keep the batteries clean and dry.
Protect the batteries from physical damage such as cuts, punctures or dents.
Periodically check batteries for signs of damage, swelling, leaks, oxidation and for loosening of terminals.
Keep the battery away from direct heat, sunlight and fire.
Store batteries in a dry place as moisture can damage them.
Charge batteries to ~30% before storage. Do not store them fully charged or discharged.
Remove the batteries from the unit when not in use.
Clean batteries before storage using a dry cloth to remove dirt or debris.
Store batteries in storage facilities that allow the escape of harmful gases.

Battery storage facilities should be away from confined spaces to prevent human exposure to harmful fumes in case of a thermal runaway.
Batteries should be stored in metallic, fireproof containers.
Store batteries away from other combustible materials.
Use only the accessories provided by the manufacturer.
Always keep accessories clean and dry.
Keep the accessories away from direct heat.
Replace accessories if they become damaged.
Replace accessories if they become damaged.
Protect the unit from moisture, dramatic temperature drops and electrical shocks.
When installing the unit on a weapon, ensure that the weapon is clear, and that the safety lock is on before proceeding.
Always wear goggles and gloves while using/handling batteries.

DON'Ts
Do not scratch the lens' surface.
Do not touch the lens surface with your fingers.
Do not clean the lens with alcohol, soap, or other solvents.
Do not store the lens in wet or damp containers.
Do not short the battery terminals.
Do not let the battery get fully discharged.
To prevent overcharging, do not leave charging batteries unattended.
Do not hammer, drop, or strike the batteries.

Do not put the battery in your pocket along with other metal objects as it can cause the battery to short circuit and explode.
Do not leave batteries in extreme temperatures as extreme heat or cold may damage the battery.
Do not overcharge or fully discharge batteries.
Do not expose the batteries to water, rain or snow.
Do not store batteries in direct sunlight as heat can reduce battery lifespan.
Do not store batteries with other metal objects as this can cause short circuits.
Do not dispose of end-of-life batteries with your regular garbage disposal.
Do not cut, open, dismantle or modify any cables, chargers or adapters.
Do not dip any of the accessories in water.
Do not try to force any connection between the accessories.
Do not dismantle the unit.
Do not remove any factory installed screws. Damage to the sights may void the warranty.
Do not point the sight at the sun or other high intensity light that the naked eye cannot tolerate. Always use the objective lens cap when the device is not in use.
Do not force the control buttons on the sight past their stopping point.
Do not carry batteries in your pocket as pockets may contain metal objects or debris that may cause the battery to short circuit and explode.
Do not expose the battery chamber to water. Screw the battery cap tight.
Do not remove the battery or disconnect the external power source when the sight is powered ON, to avoid loss of unsaved data.

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1 System Overview

Spartan is a lightweight uncooled Thermal Imaging (TI) monocular for multi-mission operation with an option to work as a stand-alone, clip-on, or helmet.

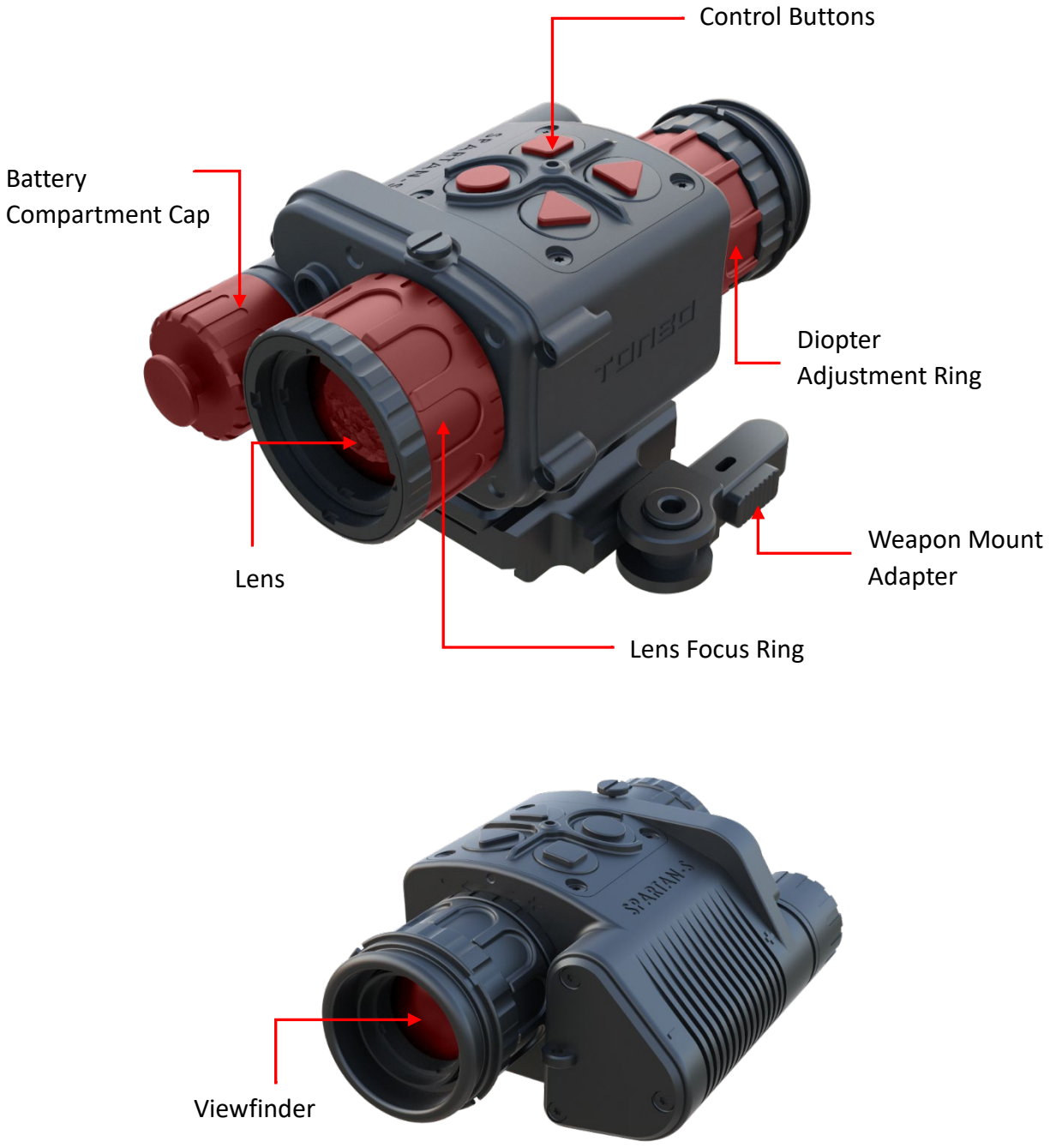


Figure 1: Unit Components

1.1 Key Features

- Lightweight, portable, and easy to operate
- Quick detach adapter for easy weapon and helmet mount
- High Resolution micro display
- Powered by Lithium battery
- Real-time display
- Polarity selection
- Extreme environmental durability
- JSS 5855-11-2019 Qualified.

1.2 System Components

1.2.1 Thermal Imager

Spartan features a state-of-the-art thermal imaging core, which provides outstanding sensitivity and excellent image quality. With advanced thermal image processing, it provides crisp thermal images at high framerates. It is immune to the glare of search lights and can penetrate through smoke and darkness providing the user with an enhanced vision capability.

Caution: *To prevent thermal damage to the unit, never point it directly at the sun or any other source of high intensity light that the unprotected human eye cannot tolerate (such as a welding arc).*
To prevent inadvertent exposure to these sources, always secure the unit with the supplied lens cap when not in use.

1.3 System Configuration

Spartan is supplied with appropriate adapters that make it configurable for weapon-mounted, and handheld use.

1.3.1 Weapon Mount Adapter - QDS

The unit is supplied with a weapon mount adapter - Antaeus Quick Detach System (QDS) Picatinny mount secured to the bottom of the Spartan-ST unit. The following image explains the various parts of the mount.

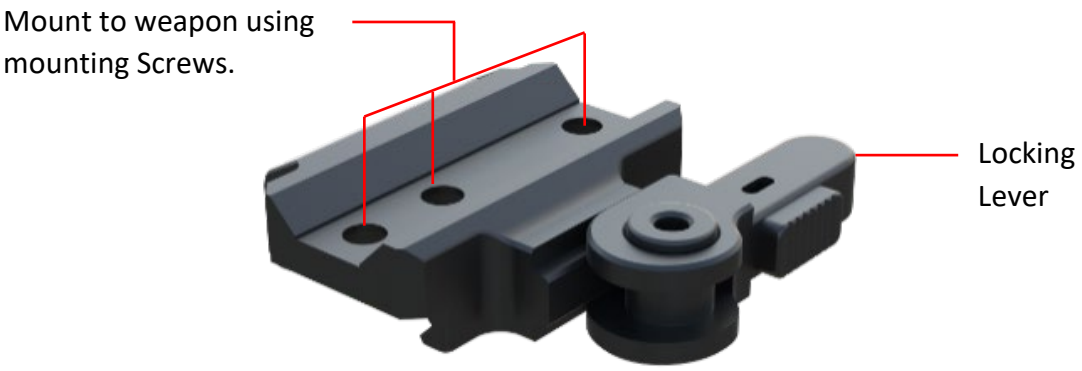


Figure 2: Weapon Mount Adapter - QDS

2 System Setup

2.1 Packaging

The unit is packed in a ruggedized container lined with high-density foam casing to protect individual parts and accessories as well as the entire package against damage during transit.

2.2 Unpacking and Inspection

Follow these guidelines to unpack the unit:

1. Inspect the exterior of the ruggedized container for damage that may have occurred in transit.
2. Carefully open the packaging and remove the unit safely from the container.
3. Verify that all components have been included in the package as per the parts list in ***Section 3.3*.**
4. Inspect all components for any damage before use. In case of damage, contact Tonbo Imaging.

Caution: *Handle the product with care during unpacking and installation.*

2.3 Standard Parts List

The following is a list of standard parts packaged with each delivery.

Note: *The complete system along with batteries and all listed accessories are packaged in the ruggedized container.*

Table 1: Standard Packaging List

Sl. No	Item Description	Reference	Qty
1	SPARTAN-ST unit		1
2	Batteries		5
3	Battery Charger		1
4	AC-DC Adapter for Battery Charger with cable	 	1

5	DC-DC Adapter for Battery Charger		1
6	External Interface Cable		1
7	Eye Guard (Open)		1
8	Eye Guard (Shuttered)		1

9	Weapon Mount Adapter – QDS		1
10	Tools for QDS		1
11	Lens Cap		1
12	Lens Cleaning Kit		1
13	Soft Carry Case		1

14	Ruggedized Container		1

3 Installation

Spartan is designed to play multiple roles for a wide array of modularity and functionality, eliminating the need to purchase several bulky thermal imaging systems. The following sections detail installing the unit for different uses.

3.1 Mounting Unit on a Weapon

Caution:

To prevent thermal damage to the unit, never point it directly at the sun or any other source of high intensity light that the unprotected human eye cannot tolerate (such as a welding arc).
To prevent inadvertent exposure to these sources, always secure the unit with the supplied objective lens cap when not in use.

Caution:

Before beginning the installation process, ensure that the weapon is not loaded, and the safety lock is on.

Spartan can be fitted on any MIL-STD-1913 compatible rail with the help of the supplied weapon mount adapter - Quick Detach System (QDS) Picatinny mount that has a single lever locking mechanism.

Figure 3: Weapon Mount Adapter - QDS

The following is the locking and unlocking mechanism of the mount:

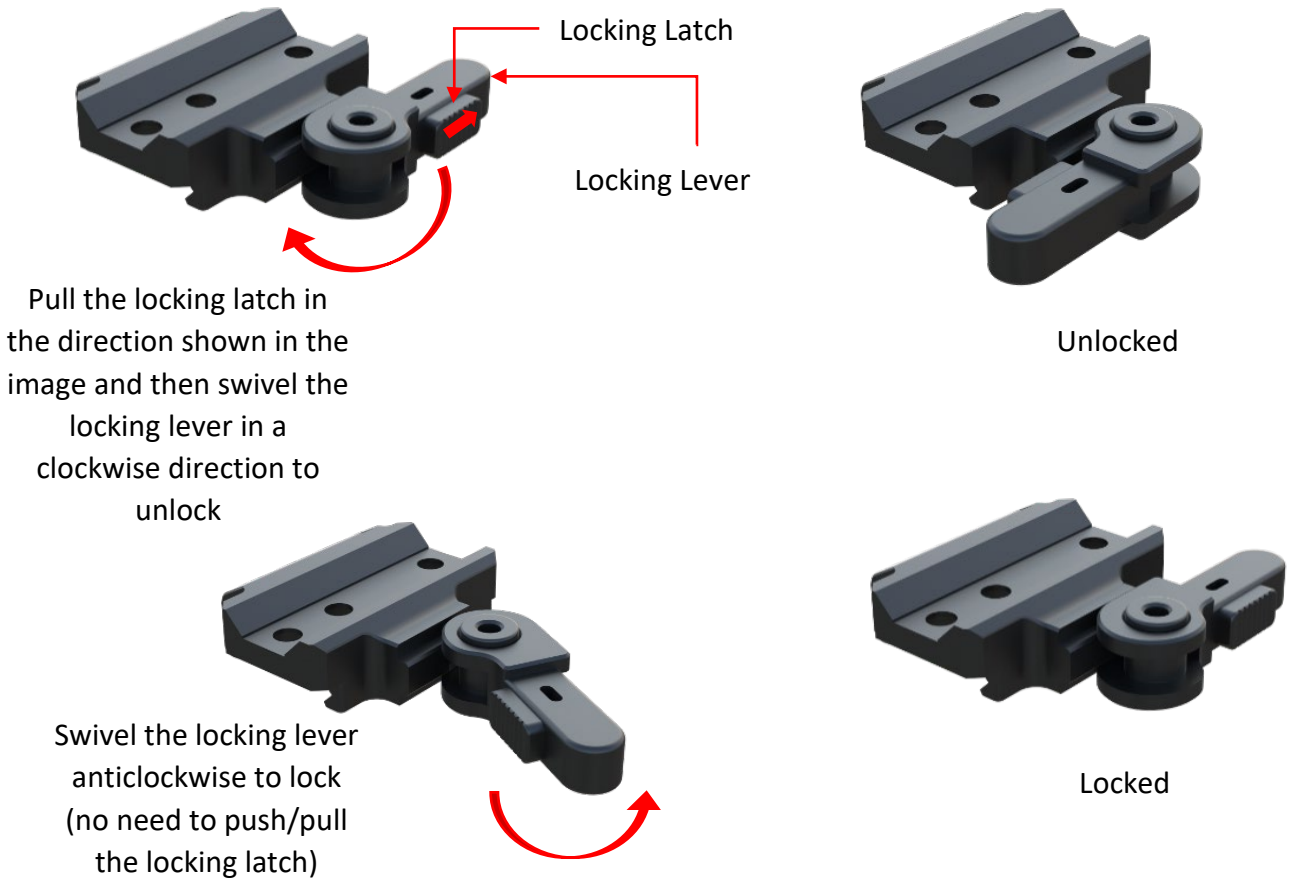


Figure 4: Weapon Mount Adapter - Locking Mechanism

To mount the unit to your weapon:

1. Pull the locking latch and then swivel the locking lever away from you to unlock the mount. Tilt the weapon mount slightly to the right and place it on the weapon rail.

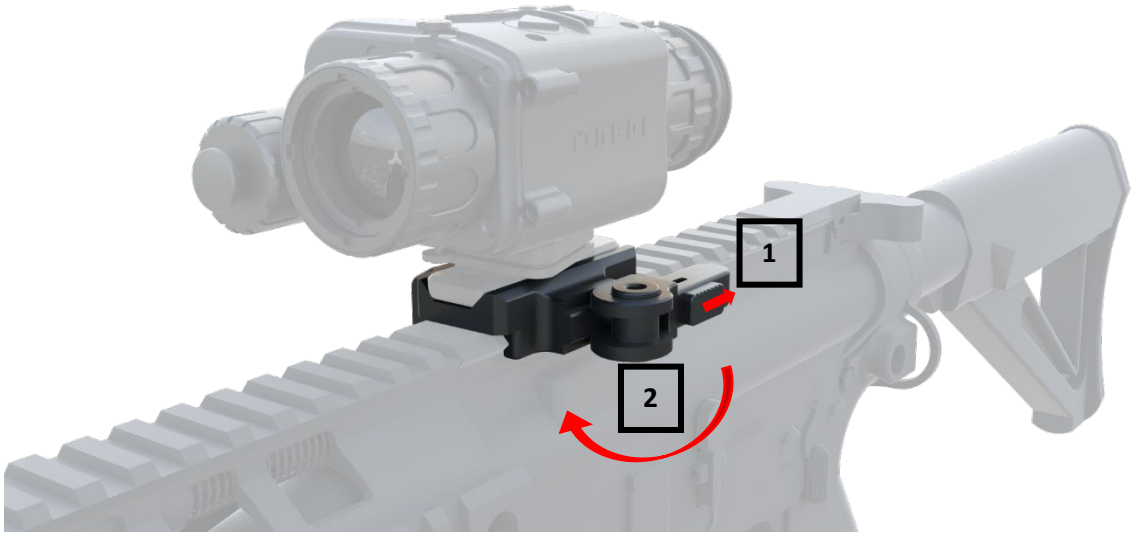


Figure 5: Mounting Unit on Weapon: Lever Unlocked

2. Swivel the locking lever towards you to secure the unit on the rail and lock the unit in place.

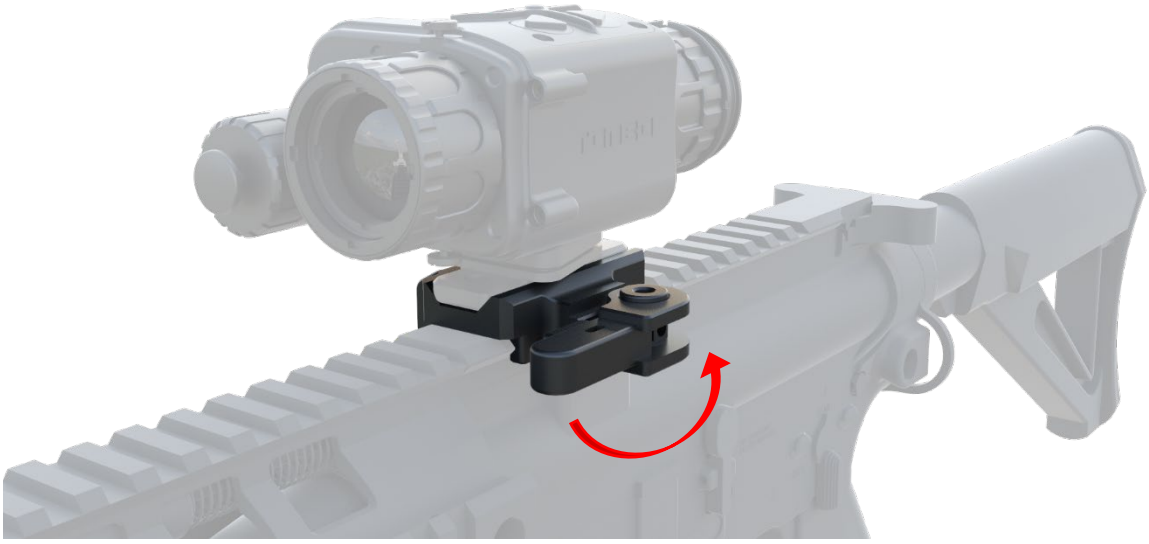


Figure 6: Mounting Unit on Weapon: Lever Locked

3.1.1 Zeroing Spartan to the Weapon

Zeroing Spartan to the weapon is an important process to ensure that the point of aim and the point of impact are the same, allowing you to accurately engage your target. Consult the Zeroing Guide provided in **APPENDIX A** for detailed instructions. Additionally, it's important to follow all safety guidelines when handling firearms and conducting live fire exercises.

3.2 Mounting as a Clip-On Sight

To mount Spartan-ST in a clip-on configuration on a weapon:

1. Ensure the unit is firmly placed in front of the optical scope on the weapon. There is no specific distance required between the day scope and the TI scope.
2. Ensure the parallax is rectified by adjusting the diopter to get a parallax free image. Alignment between the reticle on the day scope and the target should be maintained across different head positions. Refer to Section **3.2.2** for related information.

3.2.1 Zeroing Spartan in Clip-On Configuration

Spartan-ST can be used as a clip-on sight and does not require extra bore sighting/zeroing. It can simply be mounted in front of the day scope and the reticle on the day scope is used to point and engage with the target.

In case a point of aim and point of impact shift is observed, adjust the display vertically and horizontally to correct the same.

If the group size is bigger than the standard group size of the weapon while using Spartan-ST, the parallax between the day scope and the TI scope should be fixed by adjusting the diopter ring on Spartan-ST’s viewfinder.

3.2.2 Parallax Correction in Clip-On Configuration

In the context of firearms and weapon sights, parallax refers to the apparent movement of the reticle relative to the target when the shooter's eye position changes. Which means that when you move your eye position, the reticle moves accordingly and is not fixed on the target even if the weapon is stationary. This creates an error that causes your point of impact to shift from the target.

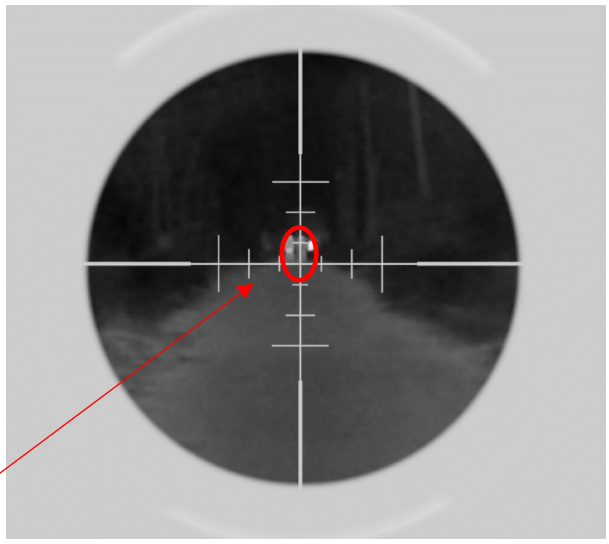
The parallax error needs to be corrected to ensure accuracy while shooting at different distances. We make this correction by aligning the reticle of the day scope to the thermal scope so that they share a common point of aim. The

objective is for the reticle to stay true to aim no matter how you move your head.

The following are the steps for parallax correction:

1. Place your rifle on a solid rest or sandbag to ensure that it remains steady throughout the adjustment process.
2. Turn on the day scope and make sure the reticle is clear to the eye and centered on its display.

3. Navigate to **Menu > Advanced > Sight Configuration** and set it to Clip-on mode. Place the Spartan-ST unit securely in front of your day scope. Ensure that the mount is tightened properly.



4. Turn the eyepiece focus ring on the Spartan-ST unit anti-clockwise till you feel resistance which means it has reached one end of the movement.

5. Then look through the day scope and begin adjusting the focus on the Spartan-ST unit, while moving your head to change the position of the eye during this process.

6. If there is parallax error, the reticle will move relative to the target when you move your head.

7. Keep adjusting the focus till the reticle aligns and stays fixed on the target in spite of you moving your head. You may need to experiment with different head positions to find the most consistent view.

3.3 Battery Installation

Figure 7: Battery Insertion

Note: *Power the unit On and check the battery status displayed on the screen before use.*

To insert the battery:

1. Unscrew the battery compartment cap as shown in **Figure *7***.
2. Observe polarity as indicated on the outside of the battery.
3. Insert the battery into the compartment.
4. Close the battery compartment cap.

Note: *Do not ship or store the unit with battery loaded.*

3.3.1 Charging the Batteries

The unit is supplied with rechargeable batteries, a 2-bay smart battery charger with a USB cable, and an AC-DC adapter. The battery charger has an LED Display that indicates the charge or discharge status.

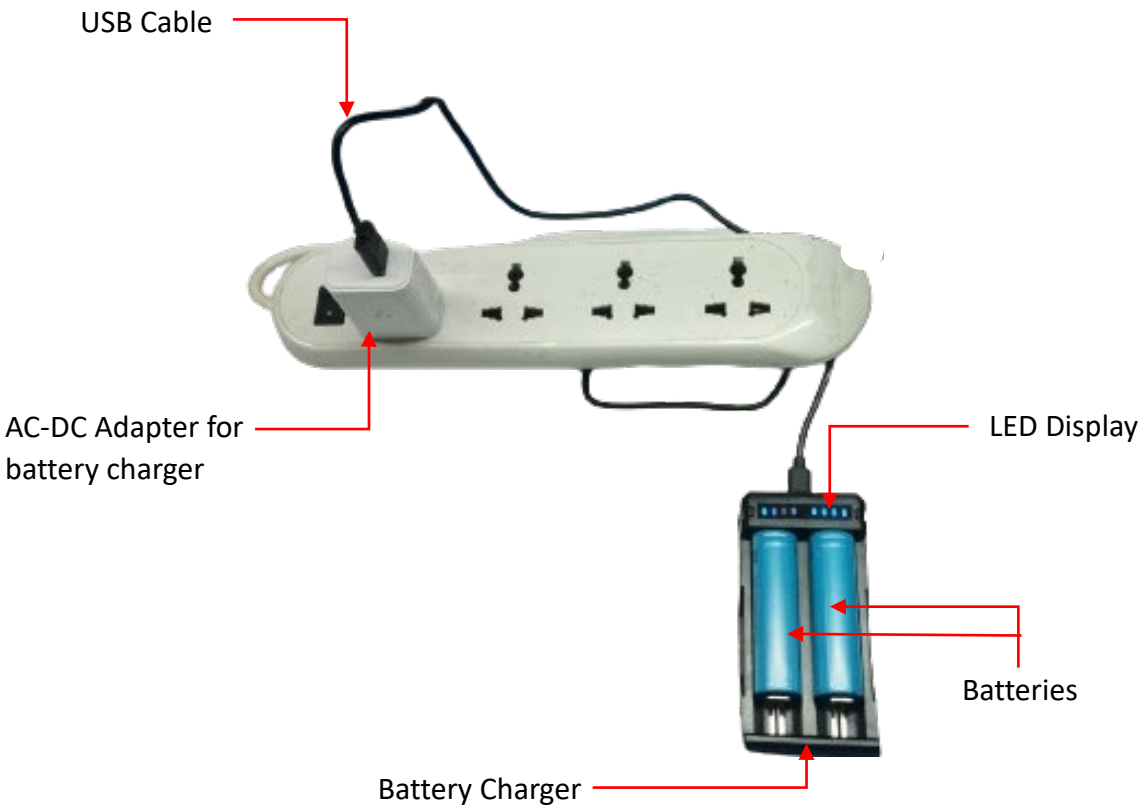


Figure 8: Battery Charging

To charge the battery:

1. Place the battery charger on a flat, level surface, away from heat and moisture.
2. Inspect for any visual or physical battery damage, including worn out casing etc.
3. Insert the batteries into the designated bays on the battery charger.
4. Plug the AC-DC adapter into the battery charger and connect it to a power source.

5. Connect one end of the USB cable to the adapter and the other end to the battery charger
6. Switch the power source On to charge the batteries.

Note: *The unit is also supplied with a 12-24V DC-DC adapter to charge batteries through a DC power source.*

Tip: *To ensure uninterrupted equipment usage, it is recommended that you always keep the standard inclusion and spare battery (if applicable) fully charged.*

4 Operating Instructions

4.1 Controls

The controls for the unit are explained in the figure below.

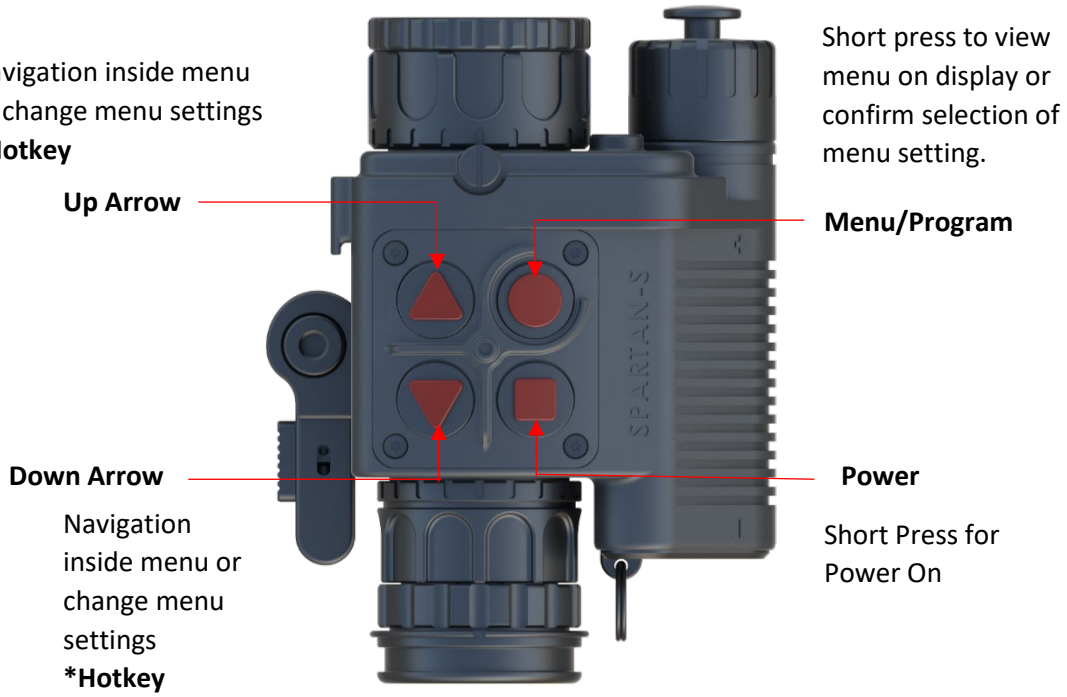


Figure 9: Unit Controls

A detailed description of menu functions in combination with the control buttons is explained in ***Section 4.5*.**

Note: *Always use the shutdown option in the main menu to power the unit off. Long pressing power button on the unit can help reboot if the display freezes or for any other troubleshooting.*

4.2 Hot keys

	Set Zoom
	Set
 + 	Move the menu from the center of screen to the left side of the screen
	Press Menu button twice to perform NUC

Note: *Press the menu button once to exit after using the hotkey.*

4.3 Powering On

Caution: *To prevent thermal damage to the unit, never point it, either in On/Off state, directly at the sun or any other source of high intensity light that the unprotected human eye cannot tolerate (such as a welding arc).*
To prevent inadvertent exposure to these sources, always secure the unit with the supplied lens cap.

To achieve optimal performance and image clarity, the following procedures should be accomplished in the same order, each time the unit is used:

1. Remove the unit from the ruggedized container.
2. Insert battery to the unit and secure cap.
3. Power the unit On by short pressing the power button 
4. Check the screen on the unit display.
5. Perform Non-uniformity Correction (NUC) by pressing menu button  twice.
6. Turn the diopter adjustment ring until the reticle or menu appears clear.
7. Remove the lens cap.

8. Use lens focus ring to bring the scene into focus.
9. Install the unit on the weapon mount adapter or helmet mount, as required.
10. Ensure the unit and adapter are secured well on the helmet or weapon.
11. Access the Menu by pressing the  button.
12. Using the control buttons, configure the unit to suit your environment.

4.4 Display

Indications on Spartan unit's micro display are shown in the Figure below.

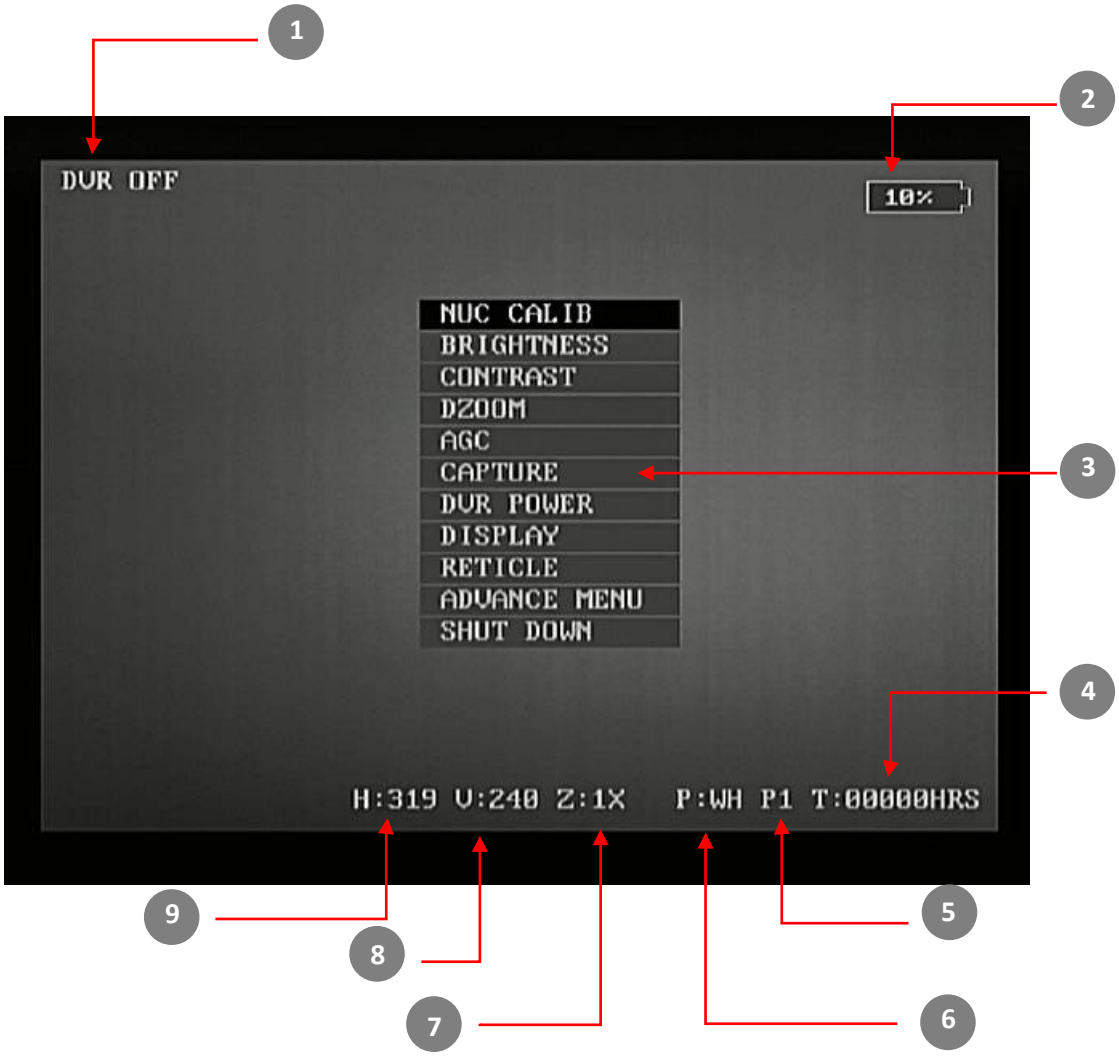


Figure 10: Indications on Display

Table 2: Indicators – Spartan Micro Display

S. No	Display Indicator	Description
1	Digital Video Recording (DVR) Power	Displays powering On or Powering Off status of Digital Video Recording.
2	Battery Percentage	Displays the battery charge remaining
3	Menu	Displays a list of functions to configure the system
4	Run time (T)	Displays the runtime of the equipment in hours. It will update in every 1 hour
5	Presets (P)	Displays the Preset options from – P1 to P4
6	Polarity (P)	Displays the current polarity type – White Hot, Black Hot, White Edge, Black Edge and Thermal Dart
7	Zoom (Z)	Displays the current digital zoom level
8	Vertical (V)	The vertical position of the reticle on the display
9	Horizontal (H)	Horizontal position of the reticle on the display

Note: *To zero the sight with the weapon barrier, properly align the reticle both vertically and horizontally.*

4.4.1 Battery Indicator

The battery power indicator is visible on the top right corner of the unit's micro display.

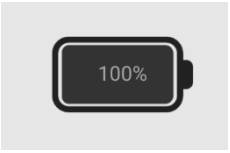
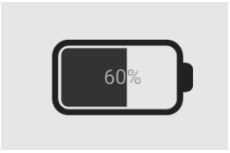
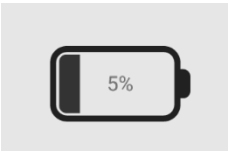
	Fully charged
	Partially charged
	Low battery

Figure 11: Battery Indicators

The battery indicator blinks when the charging level reaches 5%. The battery should be replaced with a fully charged one when the battery level reaches low.

Note: *For optimal battery life, we recommend that you change the battery when it is ≤5%.*

4.5 Menu Access and Navigation

The Spartan unit can be controlled using the menu and control buttons. The selection and activation of menu options is explained in the table below.

Note: *NUC must be performed every time the system is powered On and whenever image quality deteriorates.*

4.5.1 Main Menu

Table 3: Main Menu

NUC Calib	Place the lens cap On and press  button twice to perform **NUC.** We recommend performing this on each system boot up and when you see image quality deteriorating.
Brightness	Press  button to select **Brightness**. Use  or  button to adjust brightness level of thermal image from a minimum to a maximum (0 to 10).
Contrast	Press  button to select **Contrast**. Use  or  button to adjust contrast level of thermal image from a minimum to a maximum (0 to 10). This option helps differentiate the subject of interest from its background. Clarity adjustment is not same as contrast adjustment.

DZoom	Press  button to select **DZoom**. Use  or  button to increase or decrease zoom levels. Zoom range, 1X, 2X, 4X.
Auto Gain Control (AGC)	Press  button to select **AGC**. To switch between 0 – AGC Mode 0, 1 -AGC Mode 1 and 2 – AGC Mode 2 Use the  or  button to navigate between different modes.
Capture	Press  button to select **Capture.** Use  or  button to navigate the available options: ■ **SNAPSHOT**: To click a snapshot of the view on display. ■ **REC ON:** To start recording the current scene on display. ■ **REC OFF:** To stop recording. ■ **Exit**: To exit from the current menu.
DVR Power	Press  button to select **Capture.** Use  or  button to navigate the available options: ■ **DVR ON:** Turn on the DVR and wait a few seconds for it to power up. Once it's on, you can start recording the scene currently displayed. ■ **DVR OFF:** To stop recording. ■ **Exit:** To exit from the current menu
Display	Press  button to select **Display**.

	Use  or  button to navigate the available options: **BRT**: To adjust brightness between 0 to 100. **CONT**: To adjust gain mode between 0 to 100. **VERT**: To move the display area vertically between 0 to 255. To center the display, set the value to 128. **HORZ**: To move the display area horizontally between 0 to 336. To center the display, set the value to 168. **Exit**: To exit from the current menu. **Note**: For horizontal menu movement, use the up-arrow button to move right and the down arrow button to move left.
Reticle	Press  button to select **Reticle**. Use  or  button to select reticle and press  to confirm. Available options: **Color** – Auto, White, Black, Gray 1, Gray 2, and Gray 3 **Type**: Cross, Center Dot, T-Dot for 25m, T-Dot for 50m, T-Dot for 100m, T-Dot for 200m, and MIL-Dot + SVD. ■ **VERT**: To move reticle vertically between 0 to 480. ■ **HORZ**: To move reticle horizontally between 0 to 640. ■ **Preset**: To select between Presets P1 to P4.

	▪ **Exit**: To exit from the current menu. **Note**: Use preset options (P1 to P4) to store the reticle position for various purposes, such as using different weapons, different users, or different ammunition. For example, store the reticle position of a particular weapon in preset 1, and store the reticle position of a different weapon in preset 2. Choose the preset based on the weapon you are using.
Advanced Menu	See detailed table below.
Shutdown	To power the unit Off

4.5.2 Advance Menu

Table 4: Advance Menu

Image Enhance	Press  button to select **Image Enhance**. Use the  or  button on the unit to configure the following options: **Smoothing**: To reduce the noise in an image. Use the  or  button on the unit to set the image smoothing to either of the two available values – 0 to disable and 1 to enable smoothing. **Sharpness**: To adjust or enhance the details of the image. Use the  or  button on the unit to adjust the image sharpness between available values 0 to 8. **Soft NUC**: 0 – Disable, 1 - Enable

	Exit: Exit current menu
Sight Config	**Sight Mode** – To select between stand-alone, clip-on, or helmet configuration depending on your mission requirement. **Exit**: Exit current menu.
AGC Advance	Press  button to select **AGC Advance**. Use  or  button to select an advanced AGC option and press  to confirm. **A0** - Gain **A1** – Gain **A1** – Offset **A2** – Gain Each of these options can be adjusted for a value between 0-100, except A2-Gain, which can be adjusted for a value between 0-5. **Exit**: Exit Current Menu. Ensure that the AGC option (A0, A1, A2) selected here corresponds to the AGC mode (0,1,2) set in the main menu.
NUC Advance	Press  button to select **NUC Advance**. Use  or  button to select an advanced NUC option and press  to confirm. The available options are: **Mode** – Choose from Auto, Semi-Shutter and Manual.

	Auto - No NUC required. **Semi-Shutter**: NUC required at boot up. **Manual**: Need to perform NUC manually by covering the lens with uniform temp object **Exit**: Exit Current Menu **Note**: We recommend setting NUC Mode to **Semi-Shutter** for optimal image output.
BIT	Press  button to select **BIT.** Use  or  button to select options: **STATUS** - To run a diagnostic test on individual components of the system. An error code is displayed when a component fails the BIT **Exit**: Exit current menu.
Settings	**Load User**: To load and use a saved user preset. **Load Factory:** To load and use the factory settings. **Save**: To save a user preset, the user must first select Load User and then Save for the preset to be saved. **Exit**: To exit from the current menu.
System Info	Displays the firmware version.

Standby	To enable/disable system standby mode. When the system is in Standby mode, it can be restored to full functionality by pressing any control button except the power button.

4.5.3 BIT Procedure

When the unit boots up it performs a power on self-test and the status is relayed on the micro display. You can also perform detailed BIT on the entire system from the Advanced settings menu by using keypad controls and navigating to the **Advanced Menu > BIT**. An error code is displayed when a component fails the BIT.

Understanding the BIT code. For instance: 51110121111111

5 - Fixed

(1 is for working and 0 is not working)

1 – IR Camera

1 – Micro Display

1 – Battery Status

0 – Reserved

1 – Analog Video Status

2 – Temperature Area

1 – Reserved

1 - Reserved

1 - Reserved

1 - Reserved

1 - Reserved

1 – Reserved

1 – Reserved

4.6 Reticles

4.6.1 Cross Reticle

A reticle represented by two intersecting lines.

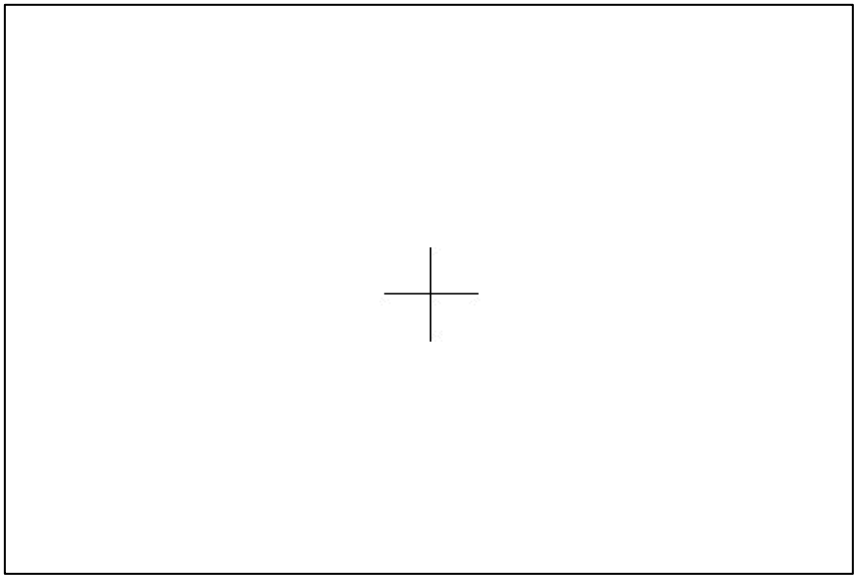


Figure 12: Cross Reticle Pattern

4.6.2 Center Dot Reticle

A reticle represented as intersecting lines in the shape of a cross typically with a dot in the center.

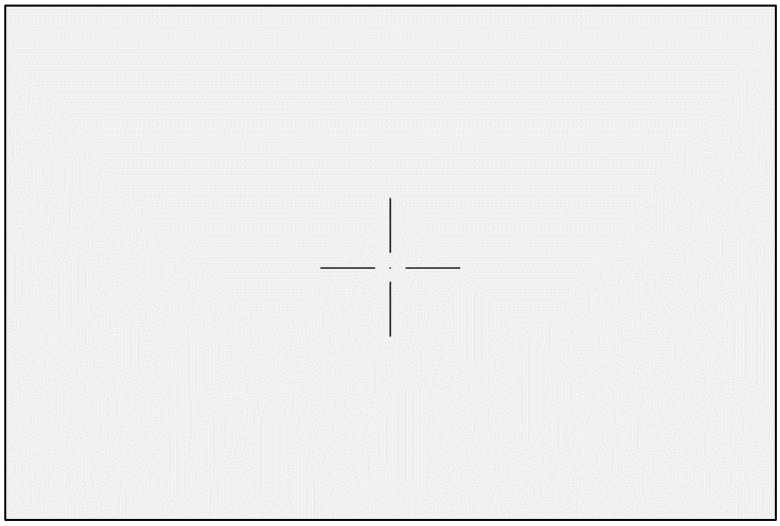


Figure 13: Centre Dot Reticle Pattern

4.6.3 T-Dot Reticle

A reticle represented as three intersecting lines typically with a dot in the center. It is used for zeroing and firing at 25m, 50m, 100m, 200m.

This reticle is designed to adjust the windage and elevation between shots at different distances, without manual user intervention.

Depending on your product variant, the zeroing point is denoted by a dot. The aiming point for targets at different ranges is denoted by range markings below the zeroing point.

The Spartan unit includes T-Dot reticle for 5.56 x 45 mm caliber ammunition optimized up to the range of 200m.

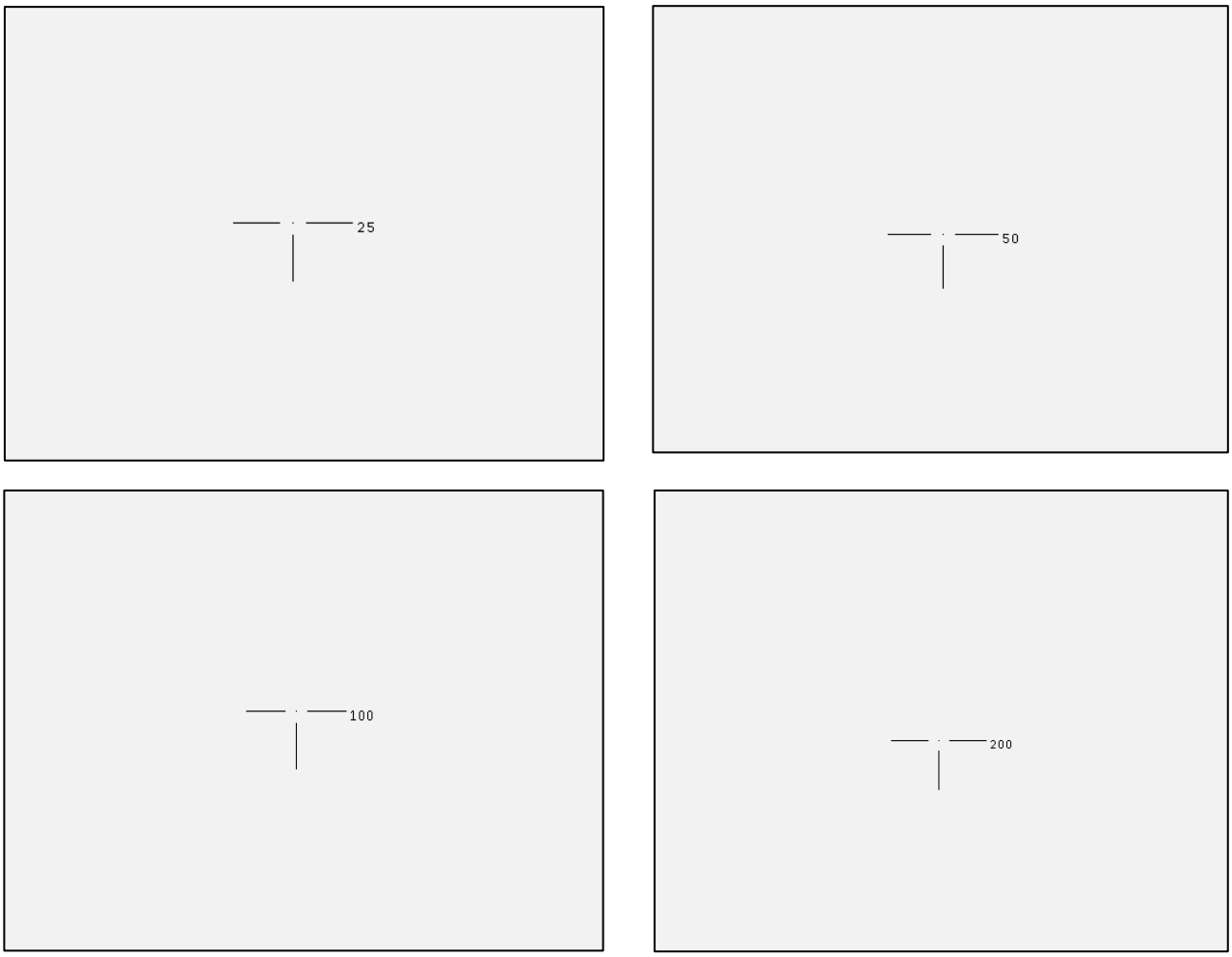


Figure 14: T-Dot Reticle Pattern

4.6.4 MIL-Dot + SVD Reticle

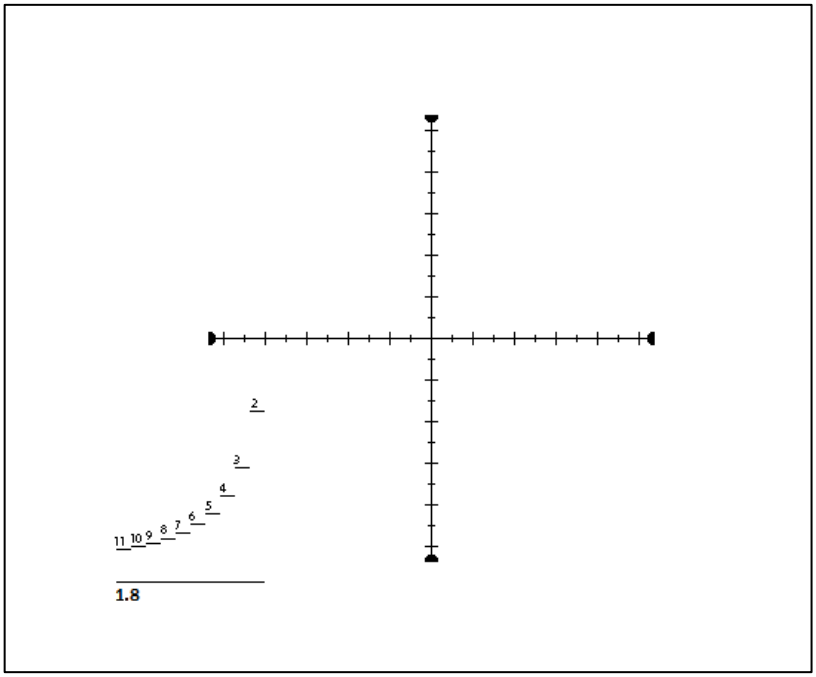
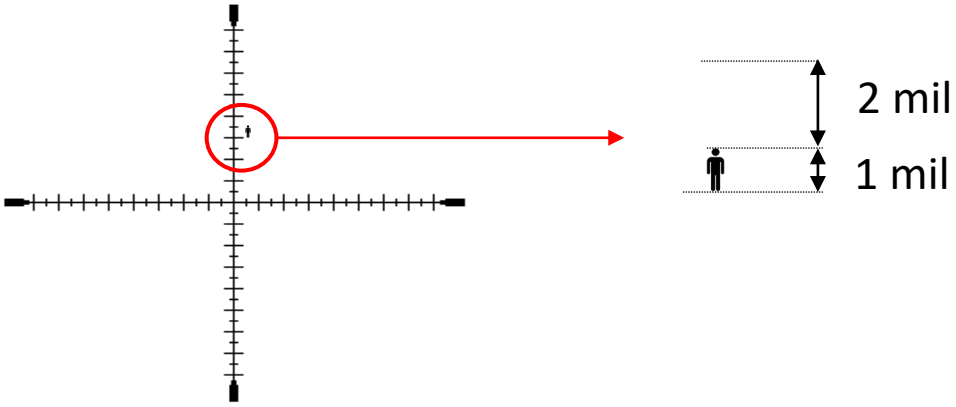


Figure 15: MIL-DOT + SVD Reticle

4.6.4.1 MIL-Dot Reticle

Mil-Dot reticle is designed to obtain the target's distance of known size by using a weapon sight. Here the distance between the 2 markers is 1 milliradian. If a target of 1m subtends an angle of 1 milliradian in the image, then the distance to the target is:

$$\frac{1m}{1mrad} = 1000m.$$



Standard formula that is used for different units of measurement are given below:

$$\frac{Height\ of\ the\ target\ (in\ meters)\ x\ 1000}{MILs\ reading} = Distance\ to\ target\ in\ meters$$

$$\frac{Height\ of\ the\ target\ (in\ inches)\ x\ 25.4}{MILs\ reading} = Distance\ to\ target\ in\ meters$$

An example on how to use the MIL-DOT and calculate the distance to the target represents in the following image:

A man covers 2 MIL dots. Assuming an average height of 1.8 m for a human and his distance from the unit is:

$$\frac{1.8\ x\ 1000}{2} = 900m$$

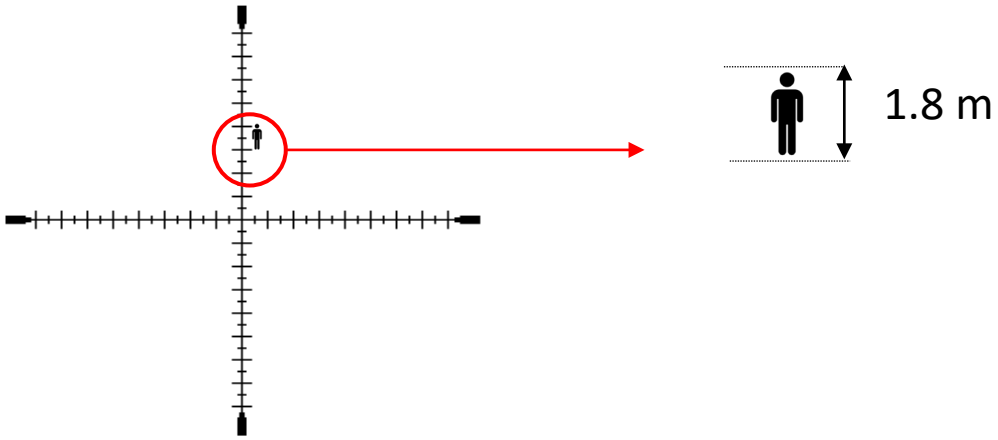


Figure 16: MIL-Dot Reticle Pattern

4.6.4.2 Stadiametric Vertical Distance (SVD) Reticle

The SVD reticle is used to find the approximate range of a human target. This reticle can be enabled along with any other reticle to measure distance to a human target passively.

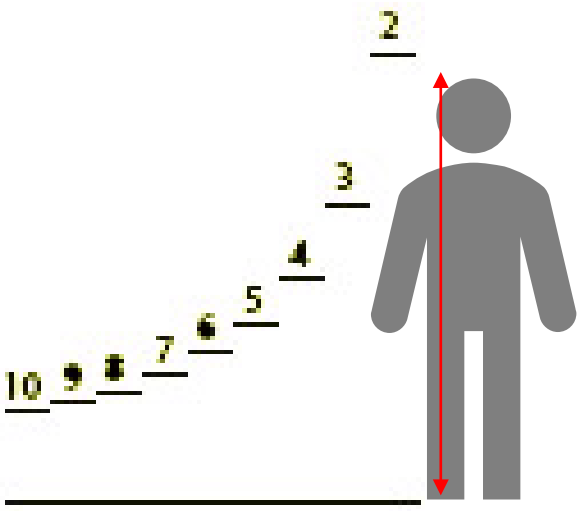


Figure 17: SVD Reticle Pattern

To find the range of a human target:

Fit target's legs on the bottom line. Note the number of the top mark that matches with target's head.

Distance to object (D)

D = Mark * 100

= 2 * 100

= 200 m

4.7 Retrieving Images and Video

The Images and videos recorded on the Spartan unit are stored in its built-in storage. Use the provided external interface cable to retrieve these images and videos from the unit to an external storage device. The functionalities of the interface cable connectors are explained in the table below.

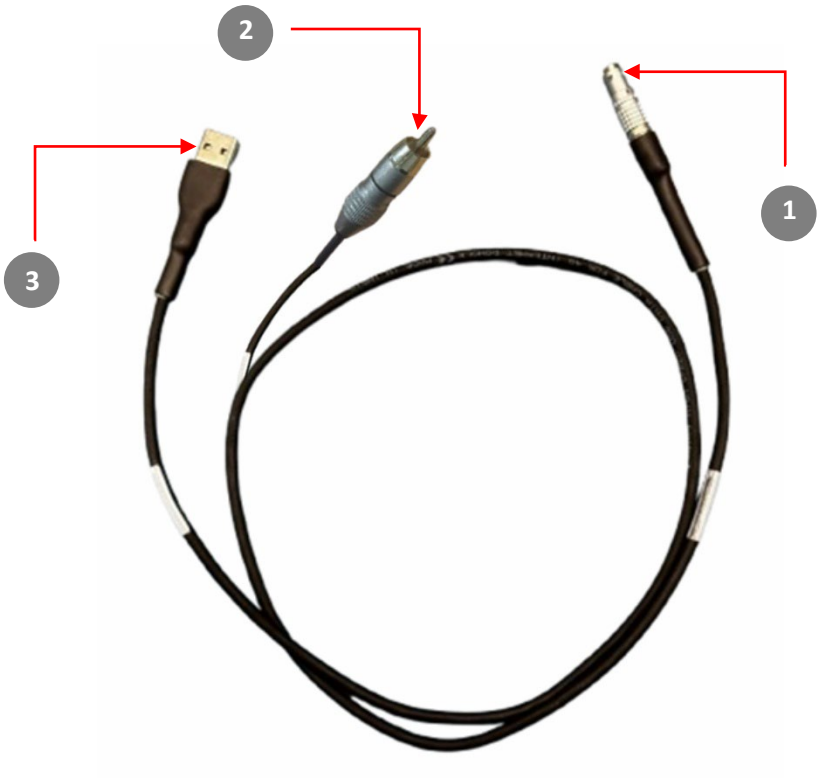


Figure 18: External Interface Cable

Table 5: External Interface Cable Specifications

S. No	Connector Name	Connector Reference	Function
1	Interface Connector		Connect to unit external interface port.
2	RCA Connector		To live stream videos from the unit to an external display.

3	USB Connector		To retrieve images and recorded videos from the unit.

Caution:

Ensure the unit is powered Off before attempting to connect/disconnect external equipment.
Replace the protective cap when the external connector port is not in use.

1. Uncap the external interface port on the base of the unit.
2. Locate the red dot on the unit's interface port.

3. Align the red dot on the external interface cable with the red dot on the unit interface port and insert the cable.

4. Connect the USB end of the cable to the USB port on your PC or laptop.

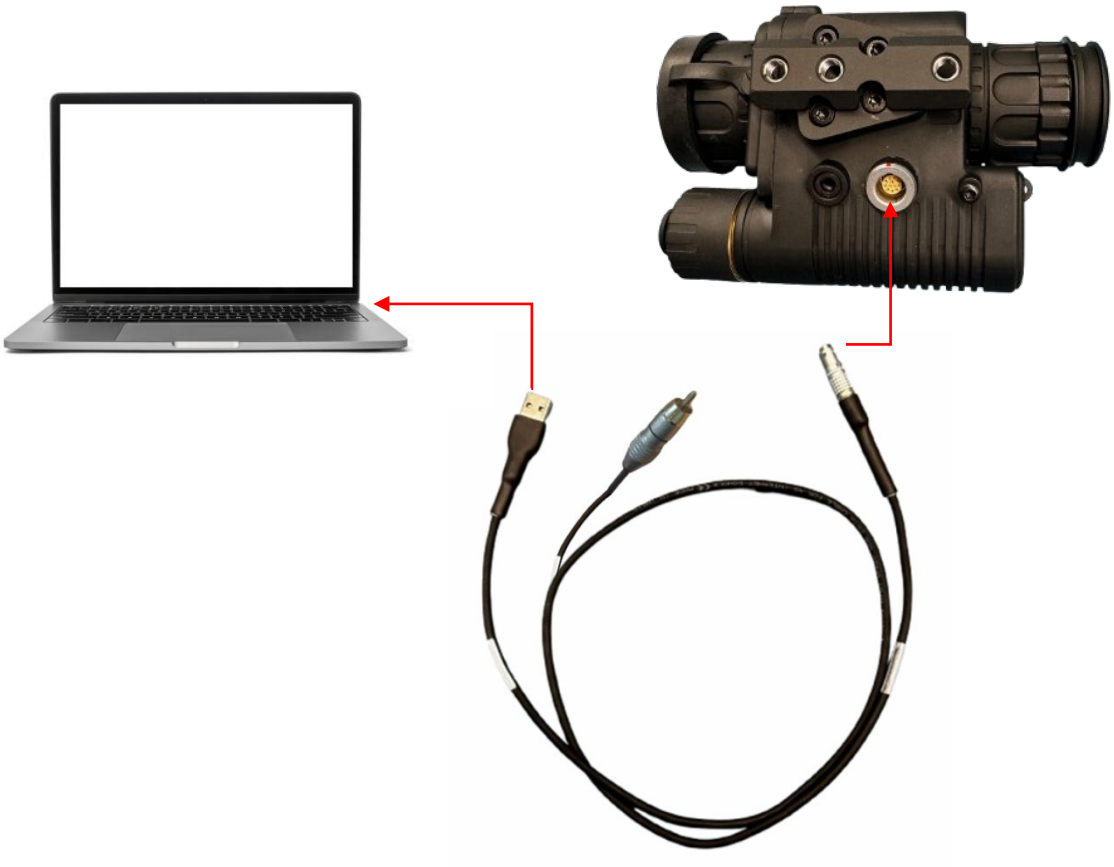


Figure 19: Image and Video Retrieval

5. The connected PC or laptop recognizes the SD card as an external drive and opens a Windows Explorer instance to display the contents of the SD card.
6. Download the images or videos to your PC or laptop, as required.

Note:

Images and videos initiated from a wired remote device will be stored locally on that device and will not be available on the unit's built-in SD card.

7. To remove the cable, retract the quick-release ring and unplug from the port.

Note: *Carefully remove the external interface cable by retracting only on the ribbed quick-release ring, not the casing. Do not rotate the connector while inserting or removing the cable from the port.*

4.8 Powering Off

1. Power off the unit by navigating to **main menu > shutdown.**
2. Cover the lens with the lens cap.
3. Dismount the unit from the weapon.
4. Remove the battery from the battery compartment.
5. Store unit and accessories in the soft carry case. In case of prolonged storage, store the unit in the ruggedized container.

5 Maintenance Instructions

The operator should inspect the unit before each use and after it has been in extreme conditions, such as prolonged exposure to intense temperatures. The following procedures will extend the life of the unit and help ensure safe operation.

5.1 Inspection / Periodic Maintenance Checks

The table below provides the details for inspection / maintenance checks to be done with the unit periodically.

Table 6: Periodic Inspection Checklist

S. No.	Inspection / Test		Description (Periodic Checks)	Status / Remark
1.	Visual Inspection (Initial Verification Checks	Ruggedized Container and packaging details	Visually check for dirt or foreign material on the ruggedized container. Check for tears, cuts, excess wear, or damage. Open the ruggedized container and visually verify items by comparing them with the data specified.	Clean as required.
2.		Spartan Unit	Visually check for damage including cracks, missing parts, and any other visible defects.	Clean as required.
3.		Control buttons	Check for damage and missing parts. Check for engraving details on the control buttons. Ensure that the buttons are working and are not stuck	

S. No.	Inspection / Test		Description (Periodic Checks)	Status / Remark
4.		Lens and Cap	Visually check for cleanliness, scratches, cuts, tears, dirt, and foreign material. Check for proper cap fitting.	Clean as required.
5.		Eye Guard	Visually check for cuts, tears, dirt, torn, bent or improperly fitting eye cup.	Clean as required.
6.		Battery Compartment, and Cap	Visually check the battery compartment for dirt, dust, moisture, and defective contacts. Visually check the battery compartment cap for damaged or retainer breaks. Check for the proper working of battery compartment cap.	Clean as required.
7.		External Interface Port	Visually check for damage, corrosion, moisture, and connector pin bends. Visually check the connector cap for damage or retainer breaks.	Clean / replace as required
8.		Battery Inspection	During this inspection, thoroughly examine the battery health, including cuts or damage to the casing, swelling or oxidation of terminals. This will help	Clean / replace as required

S. No.	Inspection / Test		Description (Periodic Checks)	Status / Remark
			prevent potential damage to both the user and the system.	
9.		Optical Surfaces	Inspect all lenses for dirt, fingerprint residue, chips, or cracks.	Clean as required.
10.		Battery Endurance	Prior to every mission, it is beneficial to perform a battery endurance check to assess battery health and reliability.	Ensure battery is fully charged and functioning before the next mission.
11.		AC-DC, DC-DC Adapter for battery charger	Visually check for damage or corrosion or missing parts. Check for proper operation and LED indication.	Clean as required
12.		External Interface Port	Visually check for damage, corrosion, moisture, and connector pin bends. Visually check the connector cap for damage or retainer breaks.	Clean / replace as required
13.	Performance Checks	Power On Inspection	Insert the battery into the Spartan unit. Power the unit On as per procedure. Check the thermal image on the display.	If a problem persists, refer **Section 7** for fault diagnosis
		Control buttons	Ensure that the control buttons are responsive.	If a problem persists, refer **Section 7** for fault diagnosis

Note: *To ensure optimal performance and safety, it is crucial to conduct regular visual and periodic inspections while the system is in active use.*

Note: *To maintain the system's operational capability when it is not in active use or is in storage, it is recommended to power the system at regular intervals, such as fortnightly to ensure its proper functionality.*

5.2 Cleaning Procedure

Caution: *Before performing any inspection or maintenance procedure, verify that unit is powered Off and the battery is not installed.*

5.2.1 Battery Removal and Cleaning

1. Open the battery compartment cap by turning it anticlockwise.
2. Remove the battery from the battery compartment.
3. Clean the battery compartment and cap using a clean cotton cloth.
4. Wipe away dirt, dust, and corrosion.
5. Wipe it dry with a soft, clean cotton cloth or allow unit to air-dry.
6. Close the battery compartment and secure the cap by turning it clockwise.

5.2.2 Cleaning Optical Surfaces

1. Blow any loose dirt or grit away from the surface of the lens.
2. Moisten the supplied lens tissue with water or lens cleaning fluid. Lightly wipe the optical surfaces in a circular motion from the center of the lens outwards.
3. Dry with a clean unused lens tissue.

Caution: *Before performing any inspection or maintenance procedure, verify that unit is powered Off and the battery is not installed.*

Note: *Discard the lens tissue after use to avoid transferring grit or foreign matter onto the lens surfaces.*

5.2.3 Cleaning the Unit and Accessories

1. Gently wipe the outside of the unit, (except optical surfaces), weapon mount, helmet mount, and external interface cable using a moist clean cotton cloth.
2. Wipe away dirt and dust that may restrict performance or damage moving and mating parts.
3. Ensure that the area around control buttons and brackets are clean and free from any damage / dust. If needed, use a diluted detergent solution.
4. Wipe dry with a soft, clean cloth or allow unit to air-dry before storing it.

6 Storage Instructions

The following should be ensured for the storage of the goods.

1. Ensure the sight is cleaned as per cleaning instructions received in the maintenance manual.
2. Ensure the sight does not have any battery inside.
3. Store and transport the unit only in its hard case.
4. For extended storage, wipe the device housing, clean the optical surfaces and store in the rugged case supplied.
5. Although the equipment is tested to withstand storage temperatures and humidity conditions as per JSS 5855-11-2019, for prolonged life of the equipment we recommend you do not store it in extreme temperatures for long periods. The ideal recommended temperature for extended storage is 20 degrees and 40% RH in a controlled environment or in a storage chamber, if available.

6.1 Battery Storage Guidelines

6.1.1 Charging Levels

It is essential to store the battery with approximately 30% charge to optimize longevity and performance.

6.1.2 Charge Monitoring

Check the battery charge level during periodic maintenance to ensure the battery does not deplete below the optimal 30%. Recharge if necessary.

7 Troubleshooting

The procedures below will help address basic problems that may arise with the unit. If your equipment malfunction is not listed here, or the actions listed do not correct the fault, please contact Tonbo Support Staff at **+91-80-41999555/support@tonboimaging.com**

Table 7: Common Troubleshooting Scenarios

S. No	Problems	Probable Causes	Solutions
1.	Not Powering On	Battery installed in incorrect orientation	Insert the battery as per polarity marking on the battery chamber.
		Battery is not charged or faulty	Recharge the battery or replace it with a new one.
		Battery cap not properly closed	Close and secure the battery compartment cap by turning it clockwise until tight.
		Battery terminals oxidized/require cleaning.	Clean the battery terminals with a clean cotton cloth.
2.	No Video Output	Lens cap on	Remove the lens cap and check the display on the unit.
		Incorrect Image settings – Brightness set to very low, and contrast set to very high	Adjust brightness/contrast settings by navigating to **Menu > brightness/contrast** and check the display on the unit or Use load factory settings

S. No	Problems	Probable Causes	Solutions
		System Powered Off	Power on the system using the power button
3.	Image Freezing	NUC was performed without the lens cap	Cover the lens with the lens cap and press the Menu button twice to perform NUC.
4.	Image Clarity Issues	Issue with brightness/Contrast configuration	Adjust image clarity by navigating to **Menu > Brightness/Contrast**
		Issue with display brightness/contrast configuration	Adjust display brightness/contrast by navigating to **Menu > Display > Brightness/Contrast**
		Improper diopter adjustment	Turn the diopter adjustment ring until the battery indicator on screen appears clear
		Improper focus ring adjustment	Adjust lens focus ring until the scene is clear
		Check for dirt/grime on lens	Apply some lens cleaning solution to the cleaning cloth and wipe the lens surface in circular motions, starting from the center and moving outward.
		Check for physical damage or scratches on lens	
		Excessive humidity and condensation	Allow sight to dry out by placing it in a warm place with the lens cap on.

S. No	Problems	Probable Causes	Solutions
		Non-Uniformity Calibration (NUC) is not performed	Cover the lens and press the Menu button twice to perform NUC.
5.	Menu not seen	Keypad not functional/responsive. Issue with keypad connections.	Restart the unit. Note that the Menu disappears after 5 seconds of non-use.
		Wrong control button used	Use the Menu button to display the menu.
6.	Battery drains quickly	Battery age	Replace battery with a new one
7	Reticle not visible	Reticle is disabled	Enable the reticle from the menu
		Reticle color and subject in the scene are same – e.g. white reticle on white background	Change the reticle color, if target and background are the same/similar color
		Display brightness is set too high/low	Adjust display brightness/contrast by navigating to **Menu > Display > Brightness/Contrast** and check the reticle visibility
8	Display on but no thermal image	Lens cap on	Remove the lens cap and check the display.
		Focus not adjusted for the viewing distance	Adjust the lens focus ring to bring the scene in focus as per the required distance

S. No	Problems	Probable Causes	Solutions
		NUC required	Cover the lens with the lens cap and press the menu button twice to perform NUC
9	Flickering display	Battery cap not secured tight	Close and secure the battery compartment cap by turning the compartment cap clockwise until tight.
		Low battery	Check the battery percentage and recharge the battery or replace it with a new one.
		Faulty display unit or connection	Restart the system and check
10	Overheating of the system	Prolonged use in high-temperature environment	Avoid leaving the system exposed to direct sun / any high temperature environment and allow for cooling time.
		Battery issue	Replace the battery with a new one.
11	Unstable weapon mounting	A loose or incorrectly fitted weapon mount adapter on the weapon	Ensure weapon mount adapter is tightly secured.
12	Sight alignment problems	Sight not aligned properly with the weapon	Check mounting to ensure no loose mounts, which can affect accuracy. Also check reticle adjustment and zeroing before operation.

S. No	Problems	Probable Causes	Solutions
13	Display not moving in clip-on mode	Incorrect sight configuration setting	Check sight configuration settings under advanced menu options and correct it to clip-on configuration.
14	Reticle is moving in clip-on mode	Incorrect parallax correction	To resolve this issue, do parallax correction in clip-on configuration as per instructions mentioned in **section 3.2.2**.

APPENDIX A: Zeroing Guide

ZEROING
Quick Start Guide

2-step weapon and thermal sight check before zeroing

#1 Visual and Physical Inspection

- Before mounting the thermal sight on the weapon, please check the accuracy of the weapon.
- Ensure weapon mount adapter is tightly secured.
- Power On the thermal sight and check the thermal image on the display.
- Ensure that the control buttons are responsive.

#2 Cycle of Operation and Safety Inspection

1. Stand at 25m from zeroing target.
2. Check for MPI (Mean Point of Impact).
3. Ensure weapon produces a grouping as per your group size.
4. Move to 50m, 75m and 100m respectively from zeroing target and repeat steps 2 and 3.
5. At 50m, 75m and 100m, the weapon should produce a grouping as per your group size.

If weapon passes the 2-step verification test, then mount the thermal sight and begin zeroing procedure.

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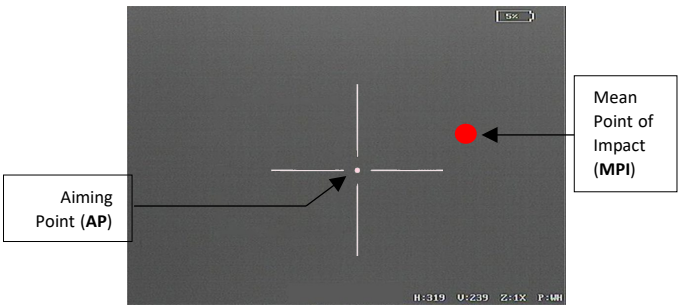
Zeroing is performed by moving the reticle **towards** the Mean Point of Impact.

The steps for zeroing are listed below:

1. Note the starting windage (H) and elevation (V) position of the reticle.
2. Stand at a distance of 25 / 50 / 75 / 100 Yards or Meters from the target.
3. Select one of the cross reticles to zero the sight to the weapon.
4. Aim at the target (Aiming Point or **AP**) and fire shots until you get an appropriate group size of the weapon.



5. Plot the center of the bullet spray (Mean Point of Impact or **MPI**) on the target.
6. Measure the vertical and horizontal distance (in inches or centimeters) of the MPI from the AP.
7. Refer to the zeroing table to find the values for reticle adjustment.

ZEROING
Quick Start Guide

Horizontal / Vertical Distance Between AP and MPI

	Yards			
	25	**50**	**75**	**100**
1	2	1	1	0
2	3	2	1	1
3	5	3	2	1
4	7	3	2	2
5	9	4	3	2
6	10	5	3	3
7	12	6	4	3

Distance from the target

Pixel movement for reticle

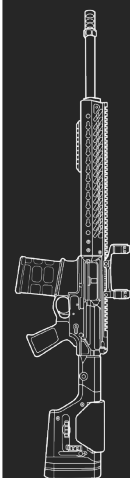
7. Move the reticle towards the MPI. Follow the below formula to correct windage and elevation:

Reticle Movement	Windage / Elevation Calculation		
Left	Current Windage	**-**	Value in Chart
Right	Current Windage	**+**	Value in Chart
Up	Current Elevation	**-**	Value in Chart
Down	Current Elevation	**+**	Value in Chart

ZEROING

Quick Start Guide

MOA				
1.7				
		Yards		
		25	50	75	100
Inches	1	2	1	1	1
	2	5	2	2	1
	3	7	3	2	2
	4	9	5	3	2
	5	11	6	4	3
	6	14	7	5	3
	7	16	8	5	4
	8	18	9	6	5
	9	21	10	7	5
	10	23	11	8	6
	11	25	13	8	6
	12	28	14	9	7
	13	30	15	10	7
	14	32	16	11	8
	15	34	17	11	9
	16	37	18	12	9
	17	39	20	13	10
	18	41	21	14	10
	19	44	22	15	11
	20	46	23	15	11
	21	48	24	16	12
	22	51	25	17	13
	23	53	26	18	13
	24	55	28	18	14
	25	57	29	19	14
	26	60	30	20	15
	27	62	31	21	16
	28	64	32	21	16
	29	67	33	22	17
	30	69	34	23	17



ZEROING

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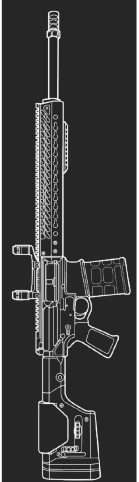


MOA

1.7

Centimeters	Meters 25	50	75	100
1	1	0	0	0
2	2	1	1	0
3	2	1	1	1
4	3	2	1	1
5	4	2	1	1
6	5	2	2	1
7	6	3	2	1
8	7	3	2	2
9	7	4	2	2
10	8	4	3	2
11	9	5	3	2
12	10	5	3	2
13	11	5	4	3
14	12	6	4	3
15	12	6	4	3
16	13	7	4	3
17	14	7	5	3
18	15	7	5	4
19	16	8	5	4
20	16	8	5	4
21	17	9	6	4
22	18	9	6	5
23	19	9	6	5
24	20	10	7	5
25	21	10	7	5
26	21	11	7	5
27	22	11	7	6
28	23	12	8	6
29	24	12	8	6
30	25	12	8	6

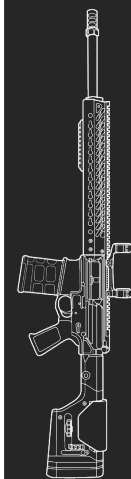
CLIPON ZEROING

Quick Start Guide

MOA for Clip-on Mode

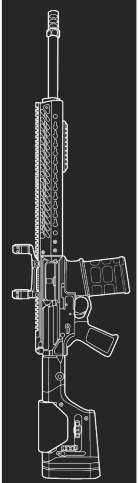
1.1

Inches	Yards			
	25	**50**	**75**	**100**
1	3	2	1	1
2	7	3	2	2
3	10	5	3	3
4	14	7	5	3
5	17	9	6	4
6	21	10	7	5
7	24	12	8	6
8	28	14	9	7
9	31	16	10	8
10	35	17	12	9
11	38	19	13	10
12	42	21	14	10
13	45	23	15	11
14	49	24	16	12
15	52	26	17	13
16	56	28	19	14
17	59	30	20	15
18	63	31	21	16
19	66	33	22	16
20	69	35	23	17
21	73	36	24	18
22	76	38	25	19
23	80	40	27	20
24	83	42	28	21
25	87	43	29	22
26	90	45	30	23
27	94	47	31	23
28	97	49	32	24
29	101	50	34	25
30	104	52	35	26



CLIPON ZEROING

Quick Start Guide



MOA for Clip-on Mode

1.1

Centimeters	Meters 25	50	75	100
1	1	1	0	0
2	3	1	1	1
3	4	2	1	1
4	5	3	2	1
5	6	3	2	2
6	8	4	3	2
7	9	4	3	2
8	10	5	3	3
9	11	6	4	3
10	13	6	4	3
11	14	7	5	3
12	15	8	5	4
13	16	8	5	4
14	18	9	6	4
15	19	9	6	5
16	20	10	7	5
17	21	11	7	5
18	23	11	8	6
19	24	12	8	6
20	25	13	8	6
21	26	13	9	7
22	28	14	9	7
23	29	14	10	7
24	30	15	10	8
25	31	16	10	8
26	33	16	11	8
27	34	17	11	8
28	35	18	12	9
29	36	18	12	9
30	38	19	13	9

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