

# USER MANUAL

## HHTI with LRF (Z7/BEL - 1700 003 210 13)



1672 G Bty

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## **DO's**

1. Carry the instrument in carry pack/logistic container.
2. Clean the objective and eye piece lens periodically with cleaning kit provided. Care to be taken while cleaning the lens surface
3. Cover the front lens with protection cover whenever the system is not in use.
4. LRF shall be fired at a distance of 100 meters or more only.
5. Remove the rechargeable battery when it is not required to operate HHTI with LRF for a long period of time.
6. Before battery insertion/removal, make sure that the unit is in 'OFF' position.
7. Use the rechargeable batteries for their intended purpose only. Always charge the rechargeable batteries using the supplied battery charger else damage caused to batteries is irrevocable.
8. The approximate charging time of battery is 5 hours.
9. Keep batteries clean and dry during use and storage. Charge the rechargeable battery, during storage, once in 3 months.
10. While inserting/removing rechargeable battery from charger ensure that the charger is in off position
11. Before disposal of battery, make sure to discharge completely. Insulate contacts properly to avoid short circuit. Dispose off the batteries through an authorized agent for recycling or burying the batteries.

12. Use only regulated AC power supply 230V, 50 Hz for battery charger

### **DONT's**

1. Do not fire LRF in short ranges (less than 100 meters) as it may damage the APD receiver of the LRF unit.
2. Do not touch the optical surface by hand or finger.
3. Do not short circuit the rechargeable battery.
4. Do not use the rechargeable battery for any other purpose, else irrevocable damage occurs.
5. Do not incinerate or mutilate the battery, it may burst or release toxic materials. Failure to comply may cause injury to personnel.
6. Do not charge the battery below 0°C and above 45°C temperature.
7. DO NOT operate the battery charger under wet conditions.
8. Do not charge any batteries other than HHTI with LRF batteries using this charger. Doing so, damages the charger.



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Ordering No: 9166 065 010 29

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## Record of Changes and Revision

Change No. and Date	Title and Description	Date Entered	Signature



## **List of Abbreviations**

<b>AC</b>	Alternating Current
<b>CCD</b>	Charge Coupled Device
<b>CCIR</b>	Consultative International des Radiocomm
<b>DC</b>	Direct Current
<b>DMC</b>	Digital Magnetic Compass
<b>FOV</b>	Field of View
<b>FPA</b>	Focal Plane Array
<b>GPS</b>	Global Positioning System
<b>HHTI</b>	Hand Held Thermal Imager
<b>IGRS</b>	Indian Geodetic Reference system
<b>LED</b>	Light Emitting Diode
<b>LRF</b>	Laser Range Finder
<b>NFOV</b>	Narrow Field of View
<b>NMEA</b>	National Marine Electronics Association
<b>OLED</b>	Organic Light Emitting Diode
<b>TI</b>	Thermal Imager
<b>UNC</b>	Unified National Coarse
<b>WFOV</b>	Wide Field of View
<b>WGS</b>	World Geodetic System
<b>TGL</b>	Target Localization

## **1. HHTI with LRF General Description**

### **1.1 General**

This chapter provides general introduction about HHTI with LRF and its assemblies, operating principles, technical specifications and interface details.

### **1.2 Introduction**

HHTI with LRF (Handheld Thermal Imager with Laser Range Finder) is an integrated Multifunction Sight consisting of Thermal Imager, Laser Range Finder, Colour CCD, Global Positioning System, and Digital Magnetic Compass with inbuilt Clinometer. The equipment is capable of providing day and night viewing capability, target range measurement, self position of observer, and target coordinates, during day/night. It works with 14.8V Li-ion rechargeable battery. The sight provides controls for functions like focusing, Field of View change, various menu selections, etc.

### **1.3 Principle of Operation**

HHTI with LRF, as shown in Figure1-1, is a compact, modular and consists of 3rd generation thermal imager based on advanced 320X256 InSb digital FPA detector, a Colour CCD Camera, Laser Range Finder, Digital magnetic Compass and Global positioning system. Basically Thermal Imaging process is defined as conversion of heat (Infra-red) energy into a real time picture and thermal image is a pictorial representation of thermal contrast across the target relative to its background.





Figure 1-1: HHTI with LRF

"HHTI with LRF" provides real time thermal video operating in 3-5 $\mu$ m spectral region. The sight provides day and night surveillance and acquisition capability. The Colour CCD camera provides day vision capability. An eye safe Laser Range Finder is integrated in the equipment for providing range of target. The Global Positioning System (GPS) is integrated into the equipment and provides the coordinates of the place where equipment is positioned. A Digital Magnetic Compass (DMC) is integrated into the equipment and it provides the azimuth angle with respect to the true North. The digital clinometer is built into the DMC which provides elevation.

## 1.4 System Contents



Figure 1-2: Logistic container contents

Table 1-1: Contents of Logistic container

S.No.	Description	Qty
01.	Carrying Pack	1 No.
02.	Battery Charger with AC and DC cable	1 No.
03.	Battery Lithium Ion	5 No.
04.	User Manual	1 No.



Figure 1-3: Tripod Carrying Pack



Table 1-2: Contents of Tripod Carrying Pack

S.No.	Description	Qty
01.	3 Section Carbon Tripod	1 No.
02.	Pro Gear Head	1 No.
03.	Height Extender, Tripod	1 No.
04.	LRF Ranging Cable Assembly	1 No.



Figure 1-4: Carrying Pack

Table 1-3: Contents of Carrying pack

S.No.	Description	Qty
01.	HHTI with LRF	1 No.
02.	Shoulder Strap	1 No.
03.	Brow Pad	1 No.
04.	Cleaning set	1 No.

## 1.5 Physical Description

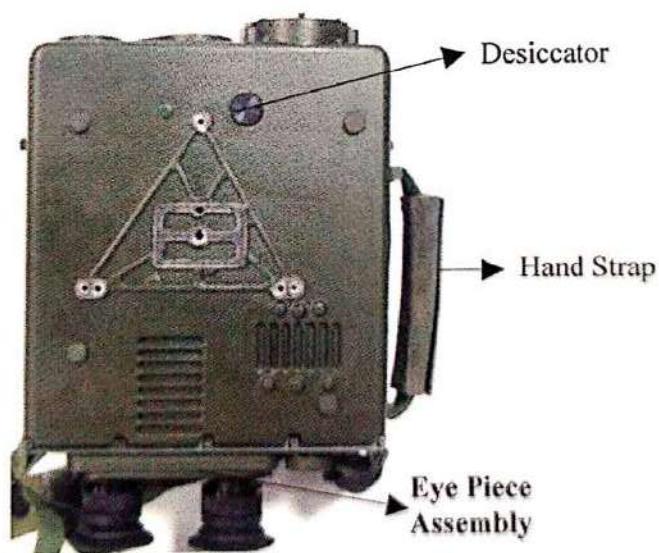
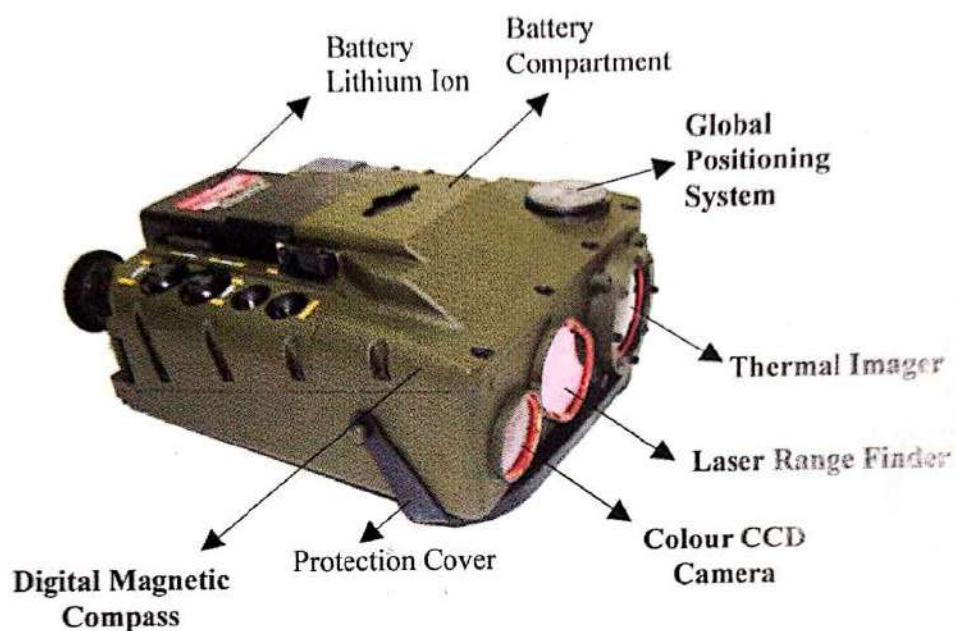
### 1.5.1 Sub Systems of HHTI with LRF

The various sub systems of the equipment are:

- (i) Thermal Imager
- (ii) Colour CCD Camera
- (iii) Laser Range Finder
- (iv) Global Positioning System (GPS)

HHTI with LRF User Manual

- (v) Digital Magnetic Compass (DMC)
- (vi) Display and Eye Piece Assembly Module



Bottom View

Figure 1-5: HHTI with LRF



## 1.5.2 Switches

The switch position and functions of various switches are given below

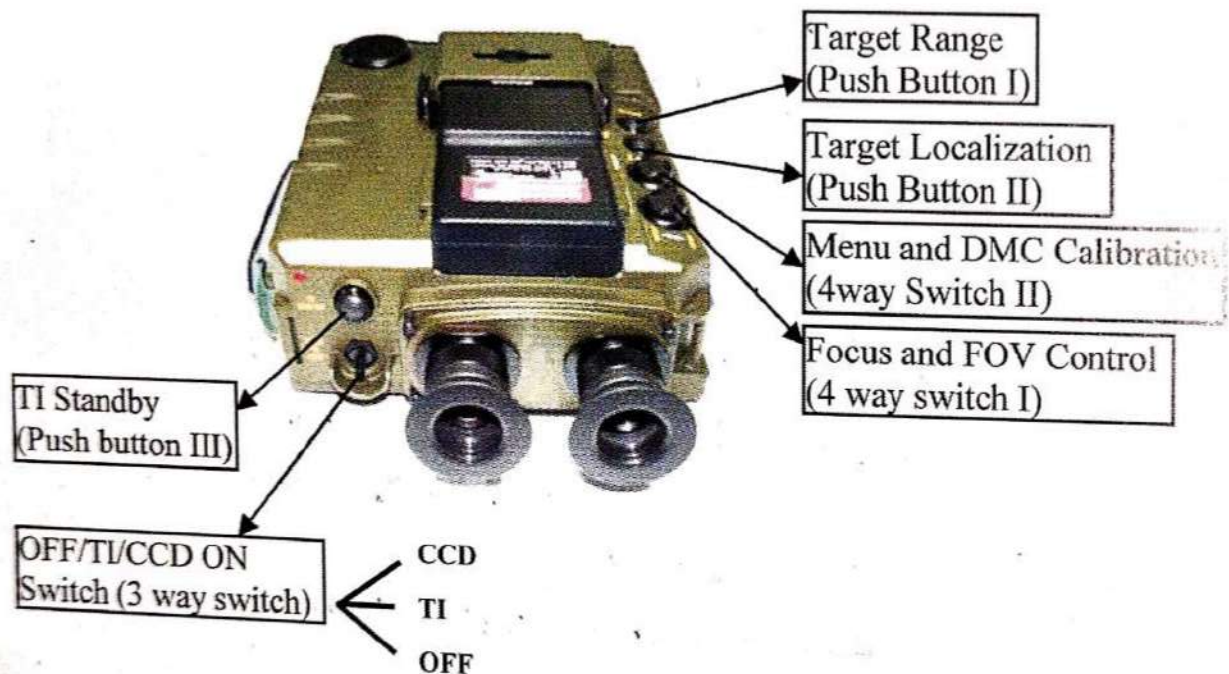


Figure 1-6: HHTI with LRF Switches

## 1.6 Interfaces

### 1.6.1 Mechanical Interface

**Tripod Interface** – The interface is achieved using 1/4" – 20UNC female thread at the base.

### **1.6.2 Power Interface**

HHTI with LRF is powered by a Lithium Ion Battery inserted in the battery compartment

### **1.6.3 Display Interface**

Real time video generated by the HHTI with LRF is displayed on an OLED Display which is viewed through the eye piece

### **1.6.4 Electrical Interface**

A 19 pin circular connector present on the equipment serves as the system electrical interface for the following functions

- a. Target range measurements using LRF Ranging Cable Assembly
- b. Functional tests during maintenance



## 1.7 HHTI with LRF Accessories



Figure 1-7: HHTI with LRF Accessories

1. HHTI With LRF
2. Carrying Case
3. Logistic Container
4. Battery Charger
5. Power Cord For AC Input (For Battery Charger)
6. DC Cable (For Battery Charger)
7. Battery Lithium Ion

8. User Manual
9. Shoulder Strap
10. Brow Pad
11. Protection Cover
12. Height Extender, Tripod
13. LRF Ranging Cable Assembly
14. Pro Gear Head
15. Tripod Carrying Pack
16. 3 Section Carbon Tripod
17. Cleaning Set
18. Hand Strap

## 1.8 Technical Specifications

Table 1- 4: HHTI with LRF Technical Data

S.No.	Parameter	Specifications
<b>1. PHYSICAL DATA</b>		
(a)	<b>Weight</b>	$\leq 3.5$ kg with Battery
(b)	<b>Dimensions</b>	$\leq 350 \times 300 \times 125$ mm
<b>2. OPTICS</b>		
<b>2.1 Thermal Imager</b>		
(a)	<b>Spectral Band width</b>	$3 - 5 \mu\text{m}$
(b)	<b>FOV Wide</b>	$\geq 6^\circ \times 5^\circ$
	<b>Narrow</b>	$\geq 1.9^\circ \times 1.4^\circ$
	<b>E-Zoom</b>	2X
<b>2.2 Colour CCD</b>		
(a)	<b>FOV (Narrow)</b>	$\geq 3^\circ \times 1.8^\circ$



## 2.3 Eye Piece

(a)	<b>Diopter Adjustment</b>	-4 to +4 Diopter
(b)	<b>Reticule</b>	Horizontal and Vertical Scale, 5 mils graduation (ref. fig. 3-5)
(c)	<b>Parallax</b>	$\leq 0.2$ Diopter
(d)	<b>Eye relief</b>	$25 \pm 3$ mm
3.	<b>Video Output</b>	CCIR of 625 lines

## 4. POWER SUPPLY

(a)	<b>Power Source</b>	Lithium Ion Rechargeable battery 14.8V Typical
(b)	<b>Low Voltage Indication</b>	Available
(c)	<b>Low Voltage Protection</b>	Available
(d)	<b>Reverse polarity protection</b>	Available

### (e) Power Consumption :-

(i)	<b>During Cooling</b>	$\leq 30W$
(ii)	<b>After Cool Down</b>	$\leq 25W$
(f)	<b>Operational life of fully charged battery</b>	4 Hours (Min)

## 5. ENVIRONMENTAL

(a)	<b>Operating temperature</b>	$-20^{\circ}C$ to $+50^{\circ}C$
-----	------------------------------	----------------------------------

(b)	Storage temperature	-20°C to +55°C
(c)	A Desiccator maintains dry environment inside the equipment	

## 6. LASER RANGE FINDER

(a)	Range	100m to $\geq 8000$ m
(b)	Accuracy	$\pm 5$ m
(c)	Measuring Frequency	Minimum one shot every six seconds
(d)	Discrimination	50 m
(e)	Laser Type	Class 1 Eye safe Laser

## 7. DIGITAL MAGNETIC COMPASS (DMC)

(a)	Resolution	1°
(b)	Accuracy	$\leq 1^\circ$
(c)	Accuracy on Tripod	$\leq 0.6^\circ$
(d)	Elevation accuracy	$\leq \pm 0.5^\circ$

8.	Global Positioning System	<p>1. HHTI with LRF is having Integrated GPS</p> <p>2. HHTI with LRF can also be connected to external Military GPS with following settings:</p> <ol style="list-style-type: none"> <li>Baud Rate: 19200</li> <li>Data bits: 8</li> <li>Stop bits: 1</li> <li>Parity: None</li> </ol>
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		<p>e. NMEA 0183 Messages: GGA and RMC messages</p> <p>3. External GPS must be configured either for WGS84 or INDIAN grid to receive the data in the respective format.</p> <p>4. Data displayed: Position in IND/ WGS84, Zone and No. of satellites</p> <p>5. Initialization time: typically 8 minutes based on the availability of the satellite data</p> <p>6. If external GPS is connected, the system selects the external GPS only.</p>
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#### 9. SYSTEM SERIAL LINK

(a)	Link Type	RS-232
(b)	Settings	Baud rate: 9600, Data bits:8, Stop bits:1, Parity: None
(c)	Dedicated protocol for the system remote control.	

#### 10. DISPLAY

(a)	Internal Display Type	Colour OLED
(b)	Data Displayed	<p>1) Range to the target</p> <p>2) Azimuth angle of the target w.r.t. True North</p> <p>3) Elevation angle of the target</p>

		4) Horizontal distance, height difference, slope distance, horizontal angle, vertical angle between last two targets.
(c)	<b>Video Displayed</b>	TI or Colour CCD camera Video
(d)	<b>External Video Output</b>	CCIR of 625 lines
<b>11. BATTERY</b>		
(a)	<b>Nominal Voltage</b>	14.8V (Typical)
(b)	<b>Operational Discharge</b>	-20°C to + 55°C
(c)	<b>Operational Charge</b>	0°C to + 45°C
12.	<b>Miscellaneous/ Accessories</b>	(a) Carrying Case (b) Tripod assembly (c) Tripod carrying pack (d) Battery charger (e) Battery Lithium Ion-5 Nos. (f) Brow pad (g) Shoulder Strap (h) Hand Strap (i) Protection cover (j) Cleaning Set (k) Logistic container (l) User Manual



## 2. System Deployment

### 2.1 Procedure for Installation

- Take out the 3 Section Carbon Tripod from the Tripod carrying pack.
- Unlock the Locking tabs of the Tripod and extend the legs of the tripod to the desired length.
- Press the locking tab back into the closed position.

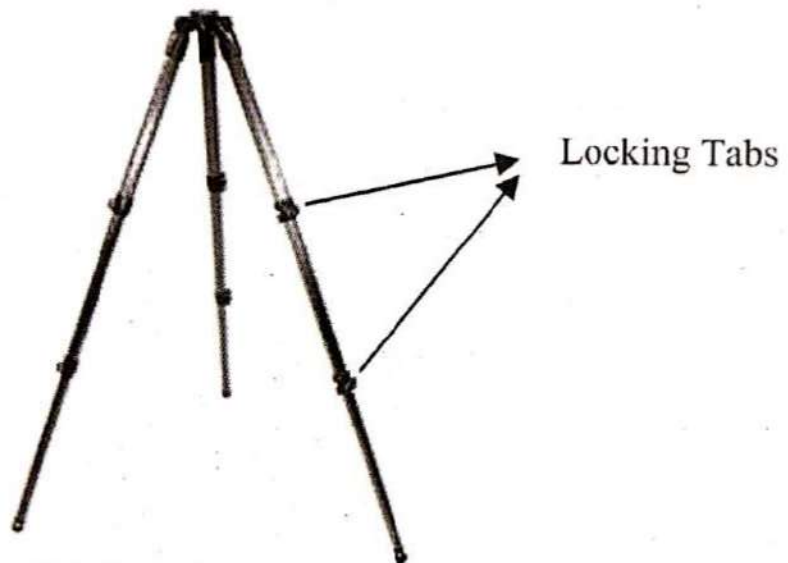


Figure 2-1: 3-section carbon Tripod

- Fit the Height Extender to the tripod by screwing (if more height is required).



Figure 2-2: 3-section carbon Tripod with Height extender

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- Fit the Pro Gear Head on top of the Height Extender or 3 Section Carbon Tripod.

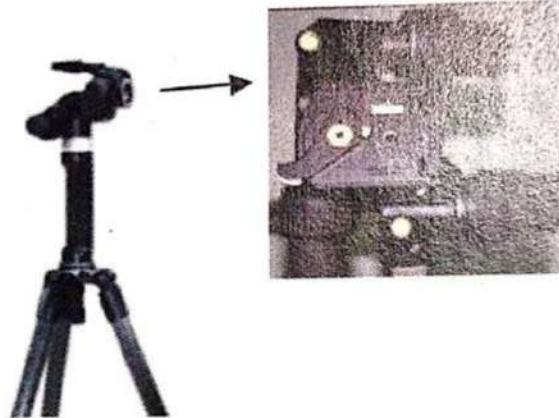


Figure 2-3: 3-section carbon Tripod with Height extender, Pro Gear Head

- Fit the quick release plate to the HHTI with LRF with the help of screw provided along with the plate.

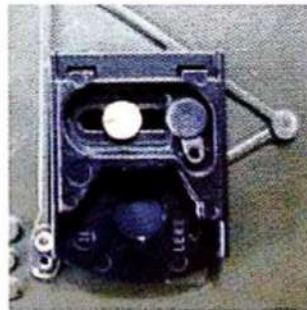


Figure 2-4: Quick release plate

- Keep the head in unlocked position as shown in the figure.



Figure 2-5: Pro Gear Head



- Place the HHTI with LRF in the slot provided on the tripod head upon which the instrument gets locked into the position automatically. (For detailed installation procedure of Tripod refer Appendix A)



Figure 2-6: Mounting of HHTI with LRF

- If desired, connect “LRF Ranging Cable Assembly” to “19 Pin connector” for ease of LRF Ranging.

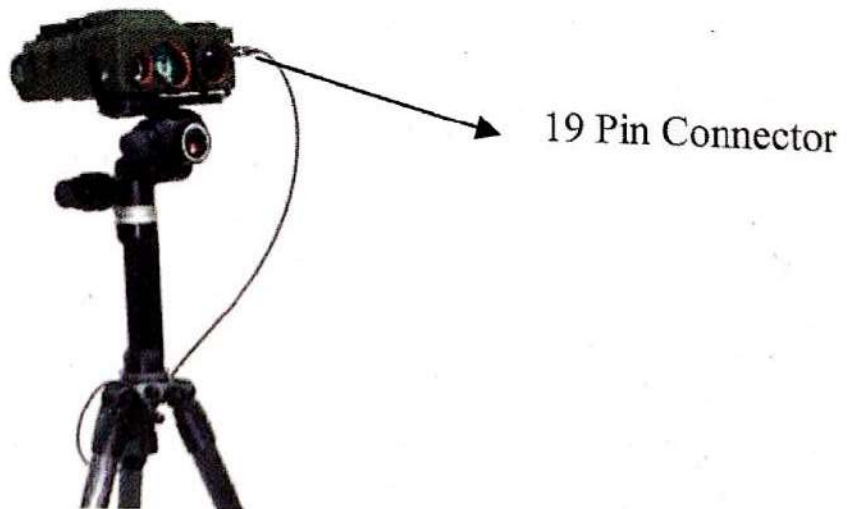


Figure 2-7: HHTI with LRF with LRF Ranging Cable

- Ensure that the OFF/TI/CCD switch is in ‘OFF’ position

- Insert the Battery Lithium Ion into the Battery compartment.
- Remove the protection cover and put the OFF/TI/CCD switch either in TI or CCD position as desired and system is ready for use.
- On power on the user is prompted to carry out the quick DMC Calibration
- **DMC Calibration is to be carried out:**
  - On Non-magnetic tripod supplied along with the equipment only.
  - After detector is cooled down
  - At NFOV position (TI/CCD)
- To enter into DMC Calibration, press the "UP" key of the **4-way switch no.II: Menu & DMC Calibration** Follow the instructions on the display. (Explained in detail in Chapter- 6)
- The user can skip this step by pressing the "DN" key of the **4-way switch no.II: Menu & DMC Calibration** if user wishes to use the equipment only for surveillance. (It is strongly recommended to calibrate the DMC when the equipment is to be used for target acquisition and localization)
- If the user requires more precise Azimuth and Target data, "HARD" or "SOFT" magnetic calibration is recommended. Out of these two methods, "SOFT" calibration is more precise. Based on the available time to deploy the system, user can choose among the three available calibration methods.



- For carrying out "HARD" or "SOFT" DMC Calibration press the "CAL" key of the **4-way switch no.II: Menu & DMC Calibration**. Follow the instructions on the display. (Explained in detail in Chapter- 6)
- When user selects TI mode, it takes around 8 minutes to get proper video upon initial power on. This time is required for detector to reach its operating temperature. Upon power on, system will be in Wide Field of View (WFOV). WFOV can be used to carry out surveillance in a large area. To obtain more details of target user can put TI in NFOV mode.
- When user selects Colour CCD Camera mode, the equipment is in zoom out condition. To obtain more details of target user can put Colour CCD Camera in NFOV mode.
- Details about switch controls and various menu functions are explained in chapter:4 and 6

## 2.2 Packing

When the system is not in use, the following steps are to be followed to pack the system:

- Put the 3 way switch in 'OFF' position and remove the battery from its housing and keep them in the slot provided in carrying pack or logistic container.
- Unlock the quick release plate and then lift it up for dismounting from the pro gear head.
- Keep the HHTI with LRF in its carrying pack after closing the front surface with protection cover.

- Place the carrying pack in Logistic container and close the lid.
- Remove the Pro gear head from the tripod and close the legs of the tripod.
- Place tripod, pro gear head, Height extender and LRF Ranging cable assembly in the tripod carrying pack.



### 3. Operating Procedure

This chapter describes the operating instructions of the HHTI with LRF

#### 3.1 Operation of various switches

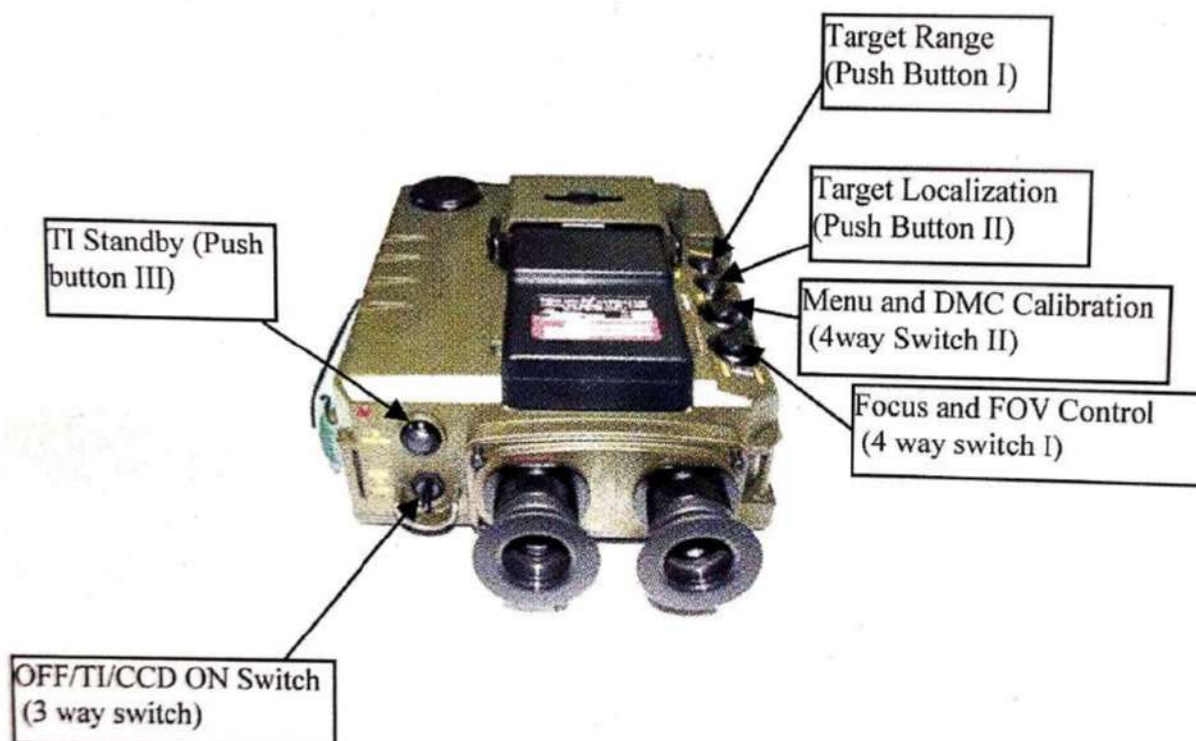
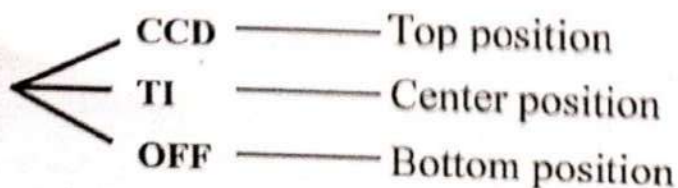


Figure 3-1: HHTI with LRF Switches

##### (a) OFF/TI/CCD ON Switch

User can select the desired sensor (CCD/TI) by using this switch. The three positions of the 3-way switch are used for switching on the Thermal Imager (TI) or CCD or switching the equipment off as shown below:



## (b) Push Button I: Target Range

**Caution: LRF shall be fired at a distance of 100 meters or more only. Do not fire LRF in short ranges (less than 100 meters) as it may damage the APD receiver of the LRF unit.**

This switch is used to obtain the Target Range as well as the target coordinates. By default (upon Power On and mode change), LRF is in Sleep mode (LRF S). For obtaining the Target Range, LRF should be put in wake up mode (LRF W) by navigating through menu using 4-way switch no:2. Ensure that system is in NFOV (TI/CCD) and target is aligned with the center dot of the Reticle. For obtaining the range, press and release this push button. As the LRF is getting activated the message **"WAIT FOR LRF"** will be displayed over the video. After the LRF is ready for firing, a message **"LRF READY"** will be displayed over the video. The LRF then fires to get the range of the target selected which is displayed below the video. If no target is available, **"NO RANGE"** will be displayed over the video.

There is an option available to select either first or last range in case of multiple targets. This option can be selected from the menu using 4-way switch no.: for TI and Colour CCD Camera. The default LRF range displayed is first target's range.







Target Range and Co-ordinates data

### (c) Push button II: Target Localization

On pressing this button for time duration between 3 and 4 seconds, Target Localization data comprising horizontal distance, vertical distance, slope distance, horizontal angle and vertical angle between last two targets are displayed below the video as shown in Figure below.



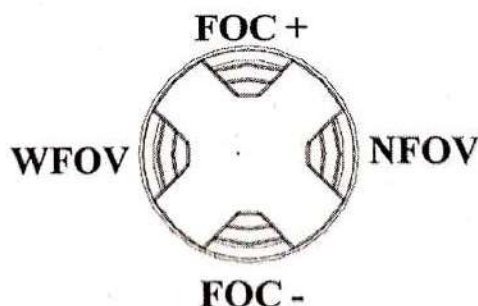
Target Localization data

#### (d) Push button III: TI Standby

Pressing this pushbutton for 3-4 seconds puts the Thermal Imager into power saving mode by placing the cooler in standby mode. To return from TI Standby mode, press the same pushbutton for 7-8 seconds. During standby mode, cooler acoustic noise gets reduced and displayed thermal picture will be degraded.

#### (e) 4-way switch No.I : Focus & FOV Control

This four way switch is used to control Focus and Field of View of the Thermal Imager or Colour CCD Camera depending on the sensor selected. The functions are shown below. Normally WFOV is used for surveillance purpose whereas NFOV is used for acquisition purpose. For achieving fine focus, repetitively press and release the FOC+/FOC- button. For coarse focus, press FOC+/FOC- for 3 to 4 seconds and release the button when desired focus is achieved.

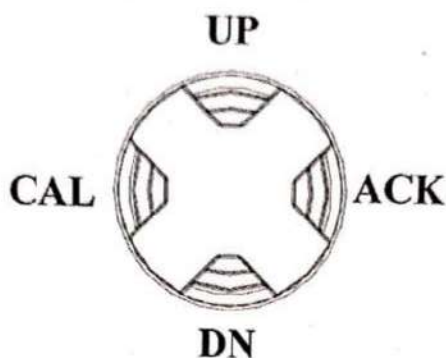


#### (f) 4-way switch no.II: Menu & DMC Calibration

This four way switch is used for selecting the MENU of the Thermal Imager or Colour CCD Camera. The positions labeled as UP and DN are used for navigating through the MENU. Any particular function can be activated by



pressing the ACK position of the key. Position labeled as CAL is used for DMC Calibration.



### 3.2 On screen Display information

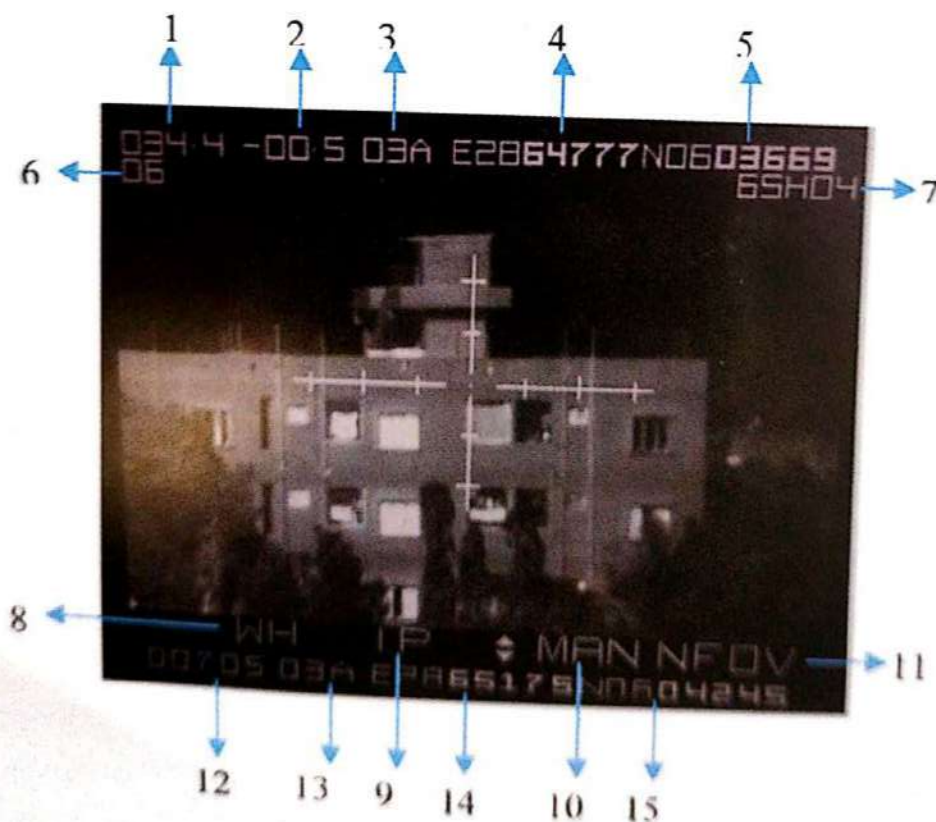


Figure3-2: On Screen display after LRF Ranging

Table 3-1: On screen display information - I

1 – Azimuth angle	Displays the angle of the target w.r.t true North. This value will get stabilized within 3-4 seconds after aiming the desired target and keeping the system stable.
2 – Elevation angle	Displays the angle of the target w.r.t Horizontal. This value will get stabilized within 3-4 seconds after aiming the desired target and keeping the system stable.
3 – Self Zone	Displays the Self Zone number
4 – Self Easting	Displays the Self Easting value in IND/WGS 84 grid depending on the selection.
5 – Self Northing	Displays the Self Northing value in IND/WGS 84 grid depending on the selection.
6 – No. of satellites	Displays the total number of GPS satellites in view
7 – Map sheet number	Displays the map sheet number of the self location.
8 – Polarity indication	Displays the present video polarity status. WH: White Hot BH: Black Hot
9 – Menu	Displays the current menu selection
10 – AGC or Manual mode indication	Displays the present AGC selection. AGC: Automatic Gain Control MAN: Manual Gain control
11 – Field of view indication	Displays the present Field of View status WFOV: Wide Field of View NFOV: Narrow Field of View



12 – Target Range	Displays the target range in meters
13 – Target Zone	Displays the target Zone number
14 – Target Easting	Displays the Target Easting value in IND/WGS 84 grid depending on the selection.
15 – Target Northing	Displays the Target Northing value in IND/WGS 84 grid depending on the selection.

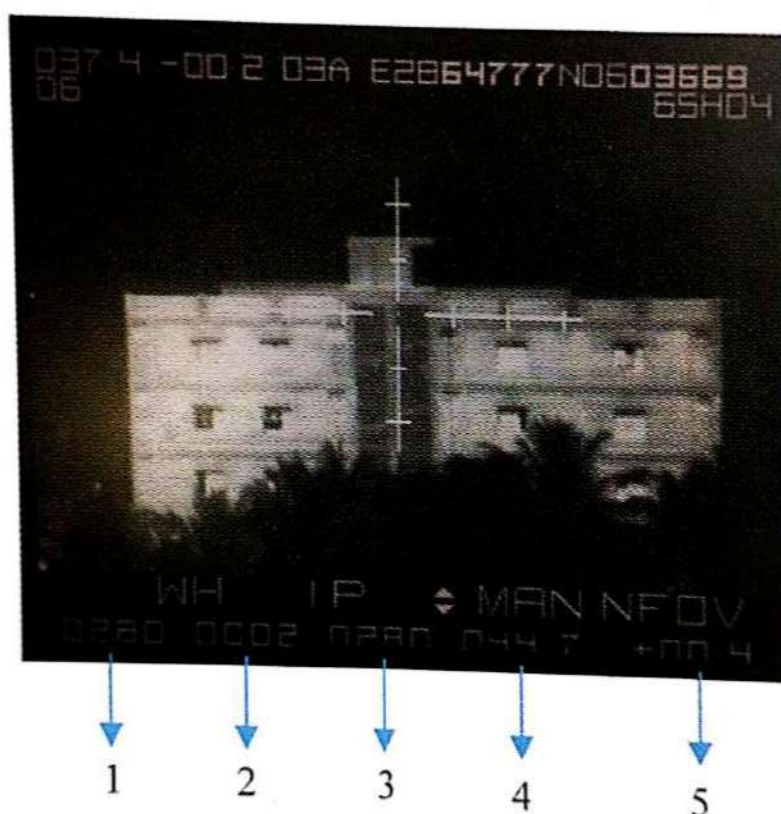


Figure3-3: On Screen display after pressing Target Localization (TGL) button

Table 3-2 : On screen display information - II

1 – Horizontal distance	4 – Horizontal angle
2 – Vertical distance	5 – Vertical angle
3 – Slope distance	

### 3.3 Menu Functions

The operation of HHTI with LRF is governed by a main menu that includes various functions for better image quality under different field conditions, functions for target acquisition and localization. There are various fields in the main menu that are described as under:

(a) **RET Y / N** (menu appears in both TI and Colour CCD Camera modes)

**Reticle Display:** The reticle is displayed by default upon power on. On pressing the ACK key for the first time, user can remove reticle from the FOV. On subsequent pressing of the ACK key, user can display or remove the reticle.

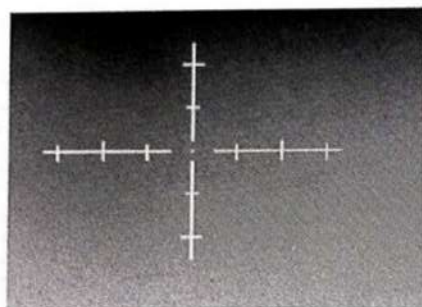


Figure 3-4: Reticle in NFOV

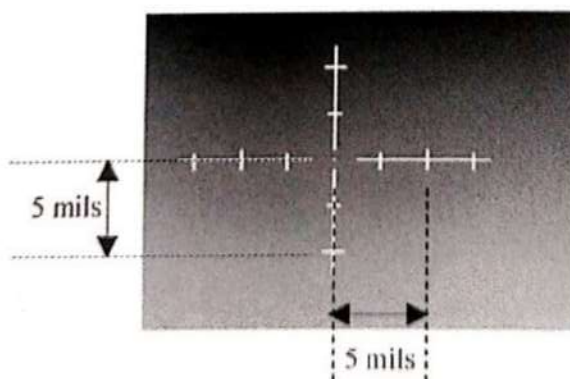


Figure 3-5: Reticle gradation



(b) **POL W / B** (menu appears in TI mode only)

Polarity Selection: On pressing ACK key, user can change the video polarity to black hot or white hot.

(c) **R\_P W / B** (menu appears in both TI and Colour CCD Camera modes)

Reticle polarity selection: On pressing ACK key, user can change the reticle polarity.

(d) **T\_P W / B** (menu appears in TI and Colour CCD Camera mode)

Text Polarity: Used to change the polarity of the text that is appearing on the top lines.

(e) **AFO Y/N** (menu appears in Colour CCD camera mode only)

Auto Focus: Used to enable or disable the auto focus feature of the Colour CCD camera. The default menu reads as AFO Y (Auto focus enabled). On pressing the "ACK" key it changes to AFO N (Auto focus disabled).

(f) **LRF M / A** (menu appears in both TI and Colour CCD Camera modes)

LRF Firing Mode: This menu is used to select the LRF firing mode. 'M' stands for manual mode which is the default setting. On pressing the ACK key, it changes to 'A' (Auto) mode.

(g) **LRF F / L** (menu appears in both TI and Colour CCD Camera modes)

**LRF range selection:** On firing the LRF, two echoes corresponding to first and last target in Line of Sight are obtained. On pressing the ACK key, user can select between the first (LRF F) echo and the last echo (LRF L).

(h) **LRF S / W**(menu appears in both TI and Colour CCD Camera modes)

**LRF Wake or sleep:** Used to power ON or power OFF the LRF module. The default menu reads as LRF S (LRF is Off). On pressing the “ACK” key it changes to LRF W (LRF is On)

(i) **IND/WGS** (menu appears in both TI and Colour CCD Camera modes)

**Datum Selection:** HHTI with LRF displays grid information in two datums, Indian and WGS 84. The ACK key is used to select IND or WGS (WGS 84) datum.

(j) **FNU N / Y** (menu appears in TI mode only)

**Field NUC:** Field NUC is done to perform 1-point compensation during field operations. On power on, the default condition for FNU is No (FNU N). User should cover the front lens of the TI channel using the protection cover provided and press the ACK key to perform field NUC. The menu displayed will be FNU Y. After performing field NUC, remove cover in front of the lens. Subsequent pressing of the ACK key results in deselection of field NUC.



(k) **AGC/ MAN** (menu appears in TI mode only)

Automatic gain control (AGC) / Manual (MAN) control: On pressing the ACK key, user can select between Automatic (AGC) and Manual (MAN) control.

On Selection of Manual Control, press the "DN" key. This results in display of CON (contrast adjustment) in the menu. Press "ACK" key to enter contrast adjustment. Then press "UP" or "DN" keys to increase or decrease the contrast value. Press "ACK" key to come out of CON (contrast adjustment).

Press the "DN" key to move to OFF (offset/ brightness adjustment). Press "ACK" key to enter brightness adjustment. Then press "UP" or "DN" keys to increase or decrease the brightness value. Press "ACK" key to come out of OFF (brightness adjustment).

Press "UP" key successively to reach next menu, that is, THS.

(l) **THS** (menu appears in TI mode only)

Threshold Selection: Use the THS menu in combination with AGC to select different threshold values for displaying images in different environmental scenarios.

Press ACK key to enter THS menu, then use "UP" and "DN" keys to scroll and select a particular value.

(m) **ADV N / Y** (menu appears in TI mode only)

Advance Menu: The Advance Menu selection on default is No (ADV N). If the image being displayed is sharp and of appropriate brightness, the user can skip the Advance menu and press the "UP" key to move to first menu, that is, RET Y/N.

To enter into Advance Menu, press the "ACK" key (ADV Y gets displayed) followed by "UP" key to proceed to the menus available within Advance Menu.

(n) **NUC** ◆ (menu appears in TI mode only)

Non Uniformity Correction: HHTI with LRF provides 3 tables that can be selected for non uniformity correction. To enter NUC menu, press "ACK" key, the menu displayed will be NUC 0, indicating that Table 1 is selected. To scroll and select a different table, press the "UP" or "DN" keys. To come out of NUC menu, press "ACK" key. Select NUC 0 for normal ambient temperature, NUC 1 for low ambient temperatures and NUC 2 for high ambient temperatures.

(o) **INT** ◆ (menu appears in TI mode only)

Integration Time: HHTI with LRF provides 8 values that can be selected for different Integration Time. To enter INT menu, press "ACK" key, the menu displayed will be INT 0, indicating that initial value is selected. To scroll and select a different value, press the "UP" or "DN" keys. To come out of INT menu, press "ACK" key.

(p) **ROI** ◆ (menu appears in TI mode only)

Region of Interest Processing: HHTI with LRF provides 8 values that can be used for selecting different ROI values. To enter ROI menu, press "ACK" key, the menu displayed will be ROI 0, indicating that initial value is selected. To scroll and select a different value, press the "UP" or "DN" keys. To come out of ROI menu, press "ACK" key.



(q) **IP** ◆ (menu appears in TI mode only)

Image Processing: HHTI with LRF provides 15 values that can be used for selecting various image processing functions that improve the displayed image under different scenarios. To enter IP menu, press "ACK" key, the menu displayed will be IP 0, indicating that initial value is selected. To scroll and select a different table, press the "UP" or "DN" keys. To come out of IP menu, press "ACK" key.

(r) **OLB** ◆ (menu appears in both TI and Colour CCD Camera modes)

OLED Brightness: Used for adjusting the brightness of the OLED display. Press the ACK key, to enter the OLB menu. Then press "UP" or "DN" keys to increase or decrease the brightness of the OLED display. Press "ACK" key to come out of OLB.

(s) **OLS D / E** (menu appears in both TI and Colour CCD Camera modes)

OLED Save: The brightness value of the OLED display that is set in the above menu is saved on pressing the "ACK" key. The default menu reads as OLS D (OLED Save Disabled). On pressing the "ACK" key it changes to OLS E (OLED Save Enabled). Subsequent changes to the OLED brightness again requires saving the settings.

(t) **BST** ◆ (menu appears in TI and Colour CCD Camera mode)

Boresight: Used to move the reticule in horizontal and vertical axes. The default menu reads as "BST ◆".

**BST menu is meant to be used during maintenance only.  
Not to be used at user level.**

### 3.4 DMC calibration procedure

After powering the equipment, it is recommended to do DMC Calibration for achieving accurate azimuth readings and target data

If the user requires more precise Azimuth and Target data, “HARD” or “SOFT” magnetic calibration is recommended. Out of these two methods, “SOFT” calibration is more precise. Based on the available time to deploy the system, user can choose among the three available calibration methods.

#### 3.4.1 Factors affecting DMC calibration

The accuracy of DMC Calibration is limited by the presence of strong magnetic fields in the vicinity of the equipment, which results in reduced azimuth accuracy.

a) DMC Calibration is to be carried out

- On the Non-magnetic tripod supplied along with the equipment only.
- After detector is completely cooled down
- At NFOV position (TI/CCD)

b) DMC Calibration is recommended in below situations:

- After every battery change.
- After arrival on a new observation site.



- Before a phase which necessitates a precise measure.
- After the equipment has been exposed to strong magnetic fields.
- After change of mode between TI and CCD.

- c) DMC Calibration is to be carried out at the following places:
- In an open area (e.g. a field) at an adequate distance from buildings and metallic objects.
  - In an area where there are no buried pipes, cables, etc. in the vicinity.

### 3.4.2 Quick Magnetic Compensation

On power on the user is prompted to carry out the DMC calibration in the quick compensation mode by following the below procedure:

1. On Power on, in TI or CCD Camera mode, the message **"DMC CALIB Y(↑) / N(↓)?"** appears on the display.
2. To enter into DMC Calibration press the **"UP"** key of the **4-way switch no.II: Menu & DMC Calibration**.
3. System response displayed on the screen will be **"ROTATE 360° CLOCKWISE"**.
4. Rotate the equipment slowly in a full circle clockwise.
5. After completion of step 4, the system response that will appear on the screen of the equipment will be **"CAL SUCCESSFUL"** or **"CAL UNSUCCESSFUL"**

depending on the successful completion of calibration. If calibration is unsuccessful it indicates that surrounding magnetic disturbances are high. It is recommended to change the place and re-calibrate the equipment.

6. User may skip this step to carry out a more accurate Soft/Hard magnetic compensation by pressing the "DN" key of the 4-way switch **no.II: Menu & DMC Calibration.**

### 3.4.3 Soft/Hard Magnetic Compensation (12-Shot):

Soft/ Hard Magnetic Compensation is more accurate as compared to Quick Magnetic Compensation. It is implemented using the **4-way switch no.II: Menu & DMC Calibration.**

#### 3.4.3.1 Soft Magnetic Compensation (12-Shot):

Shot	1	2	3	4	5	6	7	8	9	10	11	12
Azimuth	0°	60°	120°	180°	240°	300°	300°	240°	180°	120°	60°	0°
Elevation	30°	30°	30°	30°	30°	30°	-30°	-30°	-30°	-30°	30°	30°

Table 3-3: 12-Shot Azimuth and Elevation values

1. Press "CAL" key of the **4-way switch no.II** for 3-4 seconds.
2. System response displayed on the screen in response to step 1 is "Continue Y(↑) / N(↓) ? "
3. Press UP key to continue or DOWN key to abort. After pressing UP key, the following message will be displayed:  
**"Press UP key for HARD CAL and Press DN key for SOFT CAL"**



4. Press "Down key of **4-way switch no.II**" to select Soft magnetic compensation.  
System response on the screen will be "**Keep System Stable**"
5. Set azimuth and elevation value for 1-shot according to Table1 and keep the equipment stable at 1-shot for 3-4 seconds.
6. Press "**ACK**" key of the **4-way switch no.II** and wait for next response.  
System response: "**Move to Next Position**"
7. Set azimuth and elevation value for 2-shot according to Table1 and keep the equipment stable at 2-shot.
8. Press "**ACK**" key of the **4-way switch no.II** and wait for next response.  
System response: "**Move to Next Position**".
9. Repeat step-5 and step-6 up to 12-shot
10. After 12-shot, the equipment will go in calculation mode and it will take less than a minute time for displaying the response.

System response will be either "**CAL SUCCESSFUL**" or "**CAL UNSUCCESSFUL**". If calibration is unsuccessful it indicates that surrounding magnetic disturbances are high. It is recommended to change the place and re-calibrate the equipment.

11. Press "**ACK**" key of the **4-way switch no.II** to quit calibration.  
System response: "**QUIT CALIBRATION**"

12. Press "ACK" key of the 4-way switch no.II. System will come out from DMC calibration.

### 3.4.3.2 Hard Magnetic Compensation (4-Shot):

Shot	1	2	3	4
Azimuth	0°	90°	180°	270°
Elevation	30°	-30°	30°	-30°

Table 3-4: 4-Shot Azimuth and Elevation values

1. Press "CAL" key of the 4-way switch no.II for 3 – 4 seconds.
2. System response displayed on the screen in response to step 1 is "Continue Y(↑) / N(↓)?"
3. Press UP key to continue or DOWN key to abort. After pressing UP key, the following message will be displayed:  
**"Press UP key for HARD CAL and Press DOWN key for SOFT CAL"**
4. Press UP key of 4-way switch no. II to select Hard magnetic compensation.  
System response on the screen will be **"Keep System Stable"**
5. Set azimuth and elevation value for 1-shot according to Table2 and keep the equipment stable at 1-shot for 3-4 seconds.
6. Press "ACK" key of the 4-way switch no. II and wait for next response.  
System response: **"Move to Next Position"**
7. Set azimuth and elevation value for 2-shot according to Table2 and keep the equipment stable at 2-shot.



8. Press **"ACK"** key of the **4-way switch no.II** and wait for next response.

System response: **"Move to Next Position"**.

9. Repeat step-5 and step-6 up to 4-shot.
10. After 4-shot, the equipment will go in calculation mode and it will take less than a minute time for displaying the response.

System response: **"CAL SUCCESSFUL"** or **"CAL UNSUCCESSFUL"**. If calibration is unsuccessful it indicates that surrounding magnetic disturbances are high. It is recommended to change the place and re-calibrate the equipment.

11. Press **"ACK"** key of the **4-way switch no.II** to quit calibration.

System response: **"QUIT CALIBRATION"**

12. Press **"ACK"** key of the **4-way switch no.II**. System will return form DMC calibration.

### **3.5 Target Acquisition**

1. Deploy the system as per procedure 2.1
2. Wait for GPS fixing or connect external compatible GPS
3. Calibrate DMC as per procedure 3.4
4. Aim the system at the target and Wake up the LRF through Menu
5. Fire LRF to get the Range and Target co-ordinates. (Always press ACK key to ensure target discrimination, if any. Refer para 3.3g)

## 4. Maintenance

### 4.1 General

This chapter describes the Do's & Don'ts, BITE and preventive maintenance tasks.

### 4.2 Dos

When the instrument is not in use:

- a) Always cover the front surface with protection cover.
- b) The "3 way switch" should be at OFF position.
- c) Clean the all the optical surfaces carefully with clean washed white muslin cloth/optical cleaning brush.
- d) Proper care should be taken during insertion /replacement of Batteries.

### 4.3 Dont's

- a) Do not touch the optical surfaces with naked hand.
- b) Do not leave the batteries in the battery compartment
- c) Do not fire the LRF when it is aimed at a target of less than 100 meters range. Else the LRF will be damaged

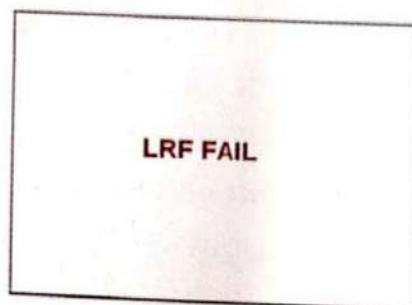
### 4.4 Integrated BITE

HHTI with LRF continuously checks the communication between various sensors. In case of any failure between these, the following messages appear on the display.

- a) **LRF Failure:** In case of communication failure between the signal processing module and Laser Range Finder, a

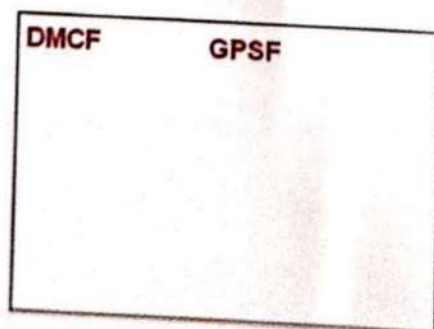


message "LRF FAIL" as shown below will pop up on the real time video.



b) **DMC Failure:** In case of communication failure between signal processing module and Digital Magnetic Compass, a message "DMCF" as shown below will pop up on the real time video.

c) **GPS Failure:** In case of communication failure between signal processing module and GPS, a message "GPSF" as shown below will pop up on the real time video.



#### 4.5 Preventive Maintenance

The TI preventive maintenance tasks are

- Visual inspection
- Surface cleaning
- Desiccator replacement

#### **4.5.1 Visual Inspection Procedure**

- a. Inspect the completeness of assembly.
- b. Check surface for loose or missing parts.
- c. Inspect surface for dents and cracks.
- d. Look through the optical elements and verify that there is no damage to the optical surface.

#### **4.5.2 Surface Cleaning Procedure**

- a. Use the brush provided in the cleaning set to remove dust particles from the optical window surfaces. Gently clean the windows using lens paper or soft absorbent cotton cloth. Never wipe a dusty lens surface with a cloth or a handkerchief. This may scratch the window and degrade the performance.
- b. Do not use solvents and chemical materials that may damage switches, optics & other parts.

#### **4.5.3 Desiccator Replacement**

It is recommended to replace desiccator at an interval of six months. This replacement should be done in a humid free environment.



## 4.6 Troubleshooting

Table 4-1: Troubleshooting of HHTI with LRF

Observation	Diagnosis
HHTI with LRF does not Power ON	<ol style="list-style-type: none"> <li>1) Check whether the battery is properly inserted.</li> <li>2) Check the battery capacity.</li> <li>3) Verify that 3 way switch is either in TI or CCD position.</li> </ol> <p>If problem continues send equipment to base workshop for repair.</p>
No real time video on internal OLED display	<ol style="list-style-type: none"> <li>1) Check whether the battery is properly inserted.</li> <li>2) Check the battery capacity.</li> <li>3) Verify that 3 way switch is either in TI or CCD position.</li> <li>4) Verify that protection cover is removed.</li> </ol> <p>If problem continues send equipment to base workshop for repair.</p>
No thermal Picture even after 10 minutes of Power On in TI Mode	Cooler may be defective. Send the equipment to base workshop for repair.
Battery Low symbol blinking	Replace the battery with fully charged battery.
Image and text through the eye piece is blurred	<ol style="list-style-type: none"> <li>1) Try to adjust the Diopter on the eye piece assembly.</li> <li>2) Verify that there is no dust, grease, oil etc. on the eye piece. If so, clean the eye piece with cleaning kit.</li> </ol>

	If problem continues send equipment to base workshop for repair.
GPSF/DMCF/LRF Fail text appears on the display	Send equipment to base workshop for repair.
NO RANGE on firing LRF	1) Align target properly with reticle before firing. 2) Verify that there is no obstruction between target and LRF. 3) Ensure that target is beyond 100 meters and not greater than 8000 meter. If problem continues send equipment to base workshop for repair.
Switches are not functioning	Send equipment to base workshop for repair.

#### 4.7 Removal and Installation Procedure

This paragraph describes removal and installation procedures for the operator level replaceable items. The List of operator level replaceable items is shown in the table 4-2.

Table 4-2: List of operator level replaceable items

S.No.	Description of the item
1.	Eye Guard
2.	Protection cover
3.	Hand strap
4.	Battery Lithium Ion
5.	Shoulder strap
6.	Brow pad



## 4.7.1 Eye Guard Removal and Installation Procedures

### 4.7.1.1 Removal

While stretching the Eye Guard (2), pull it off the Eyepiece (1).

### 4.7.1.2 Installation

While stretching the Eye Guard (2) attach it to the Eyepiece (1).

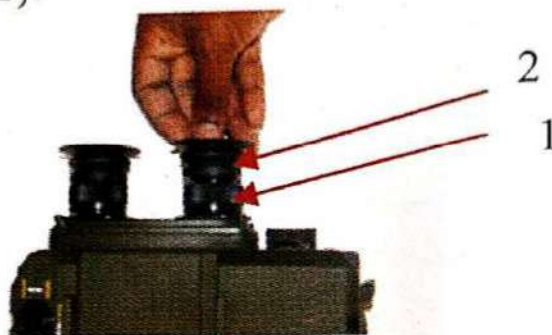


Figure 4-1: Eye Guard Removal and Installation

## 4.7.2 Protection Cover Removal and Installation Procedure

### 4.7.2.1 Removal

Hold the protection cover strap and pull the protection cover (1) from the pin (2) on housing

### 4.7.2.2 Installation

Insert the protection cover (1) to the pin (2) on housing.

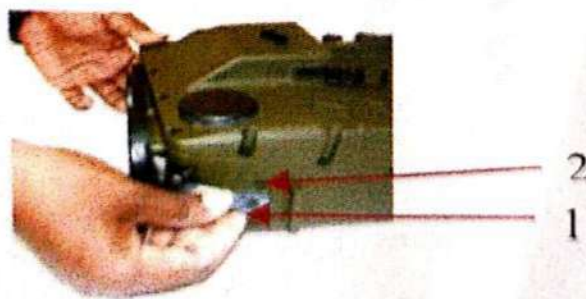


Figure 4-2: Protection Cover Removal and Installation

### 4.7.3 Hand Strap Removal and Installation

#### 4.7.3.1 Removal

Remove hand strap (1) from housing lugs (2).

#### 4.7.3.2 Installation

Place hand strap (1) into housing lugs (2).

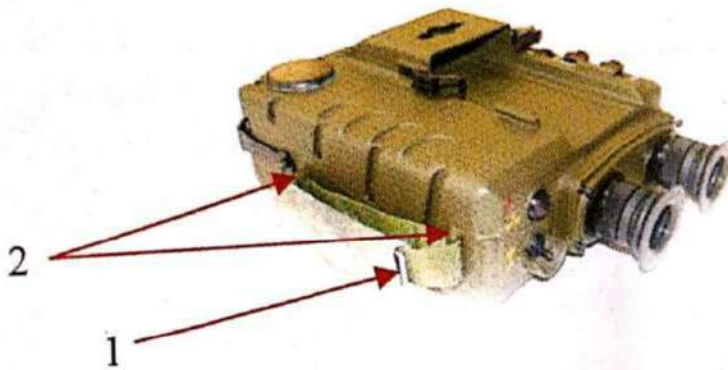


Figure 4-3: Hand Strap Removal and Installation

### 4.7.4 Battery Removal and Installation

#### 4.7.4.1 Removal

Remove the battery (1) by unclamping.

#### 4.7.4.2 Installation

Place the battery (1) in its place by clamping.

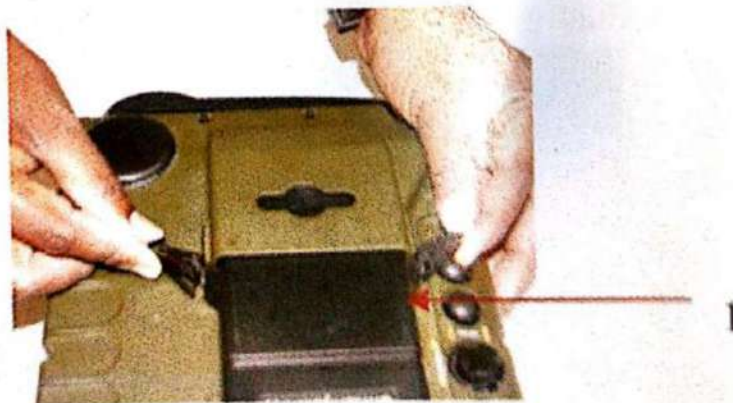


Figure 4-4: Battery Removal and Installation



#### 4.7.5 Shoulder Strap Removal and Installation

##### 4.7.5.1 Removal

- Release shoulder strap left and right tie.
- Release shoulder strap (1)

##### 4.7.5.2 Installation

- Place shoulder strap (1) in its place.
- Fasten shoulder strap left and right tie.

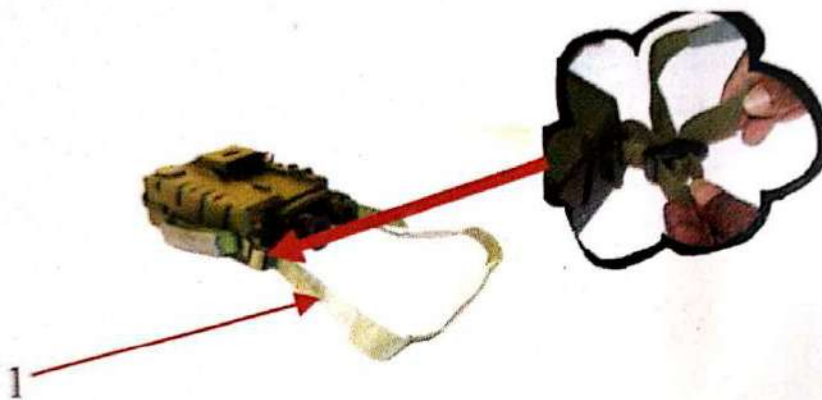


Figure 4-5: Shoulder Strap Removal and Installation

#### 4.7.6 Browpad Removal and Installation

##### 4.7.6.1 Removal

Remove the Browpad (1) from its screw shank

##### 4.7.6.2 Installation

Place the Browpad (1) in its screws shank.



Figure 4-6: Browpad Removal and Installation

## 5. Battery and Battery Charger

### 5.1 Battery

The battery used to power on the HHTI with LRF is a 14.8V, 5.5Ah Li-ion rechargeable battery.

### 5.2 Operating Instructions of Battery

1. Before first usage of the battery, charge the battery by using the supplied Battery Charger.
2. Before battery insertion/removal, make sure that the HHTI with LRF 3 way Switch is in OFF position.
3. Do not short circuit the battery.
4. Do not burn up or throw out batteries.
5. Do not attempt to open the battery pack.
6. Do not store/charge batteries beyond specified temperature limits.

### 5.3 Battery Charger



Figure 5-1: Battery charger

The Battery Charger is specifically designed for charging of Li-Ion batteries only. It takes input from AC Mains (90 to 250V) or DC power supply (24 to 32V). Two batteries can be charged simultaneously. Each station has an individual indication (LED



type), which gives useful information on the state of battery mounted on the station.

## 5.4 Operating instructions for battery charger

### a) Charge Status indicator

Each charging station has a dedicated Red LED to indicate the charging status.

Table 5-1: Battery charging indication

Process	LED Status
No battery	OFF
During Charge	Blinking
Charge Complete	ON

### b) Charging procedure

- After Power on, Green LED will be ON and both the station Red LEDs are in OFF condition.
- Now insert battery in any of the station, then the LED of that station starts blinking to indicate that the battery is under charge.
- After the battery is completely charged, the LED glows continuously.
- Now the battery can be removed.

**Note:** Battery Charger is for indoor use only. While powering the battery using AC mains, ensure that AC/DC selection switch is in AC Mode. While powering the battery using DC, ensure that AC/DC selection switch is in DC Mode.

## 5.5 TROUBLE SHOOTING

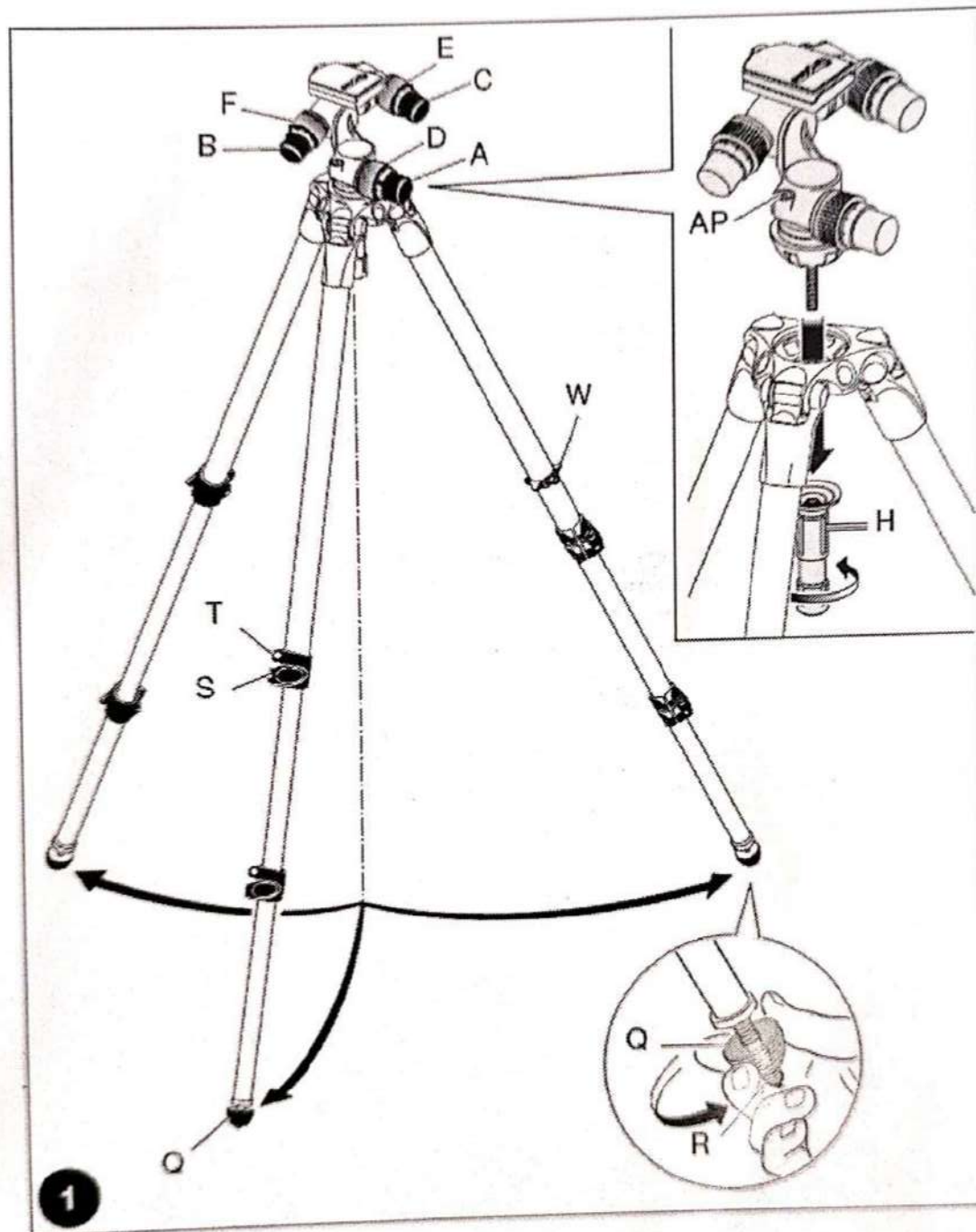
Table 5-2: Battery charger troubleshooting

Observation	Diagnosis
LED does not glow on 'Power ON'	Check Mains. Check Fuse. If found defective replace.
Battery charger works on DC input but does not work on AC mains	SMPS is faulty. Send battery charger to Workshop.
Station LED does not glow after battery insertion	Check if terminal contacts are loose and if not check with other battery. If problem continues send battery charger to Workshop.
Station LED glows continuously but battery does not charge	Check if terminal contacts are loose and if not check with other battery. If problem continues send battery charger to Workshop.

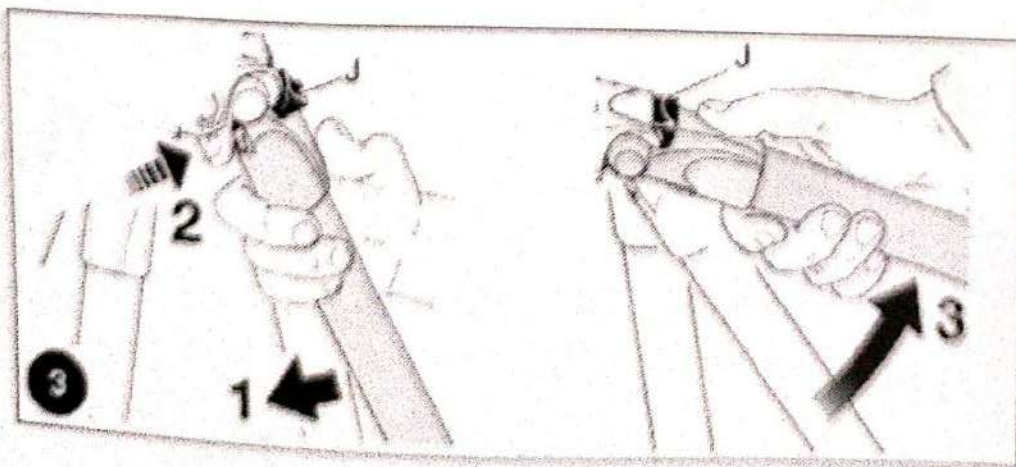
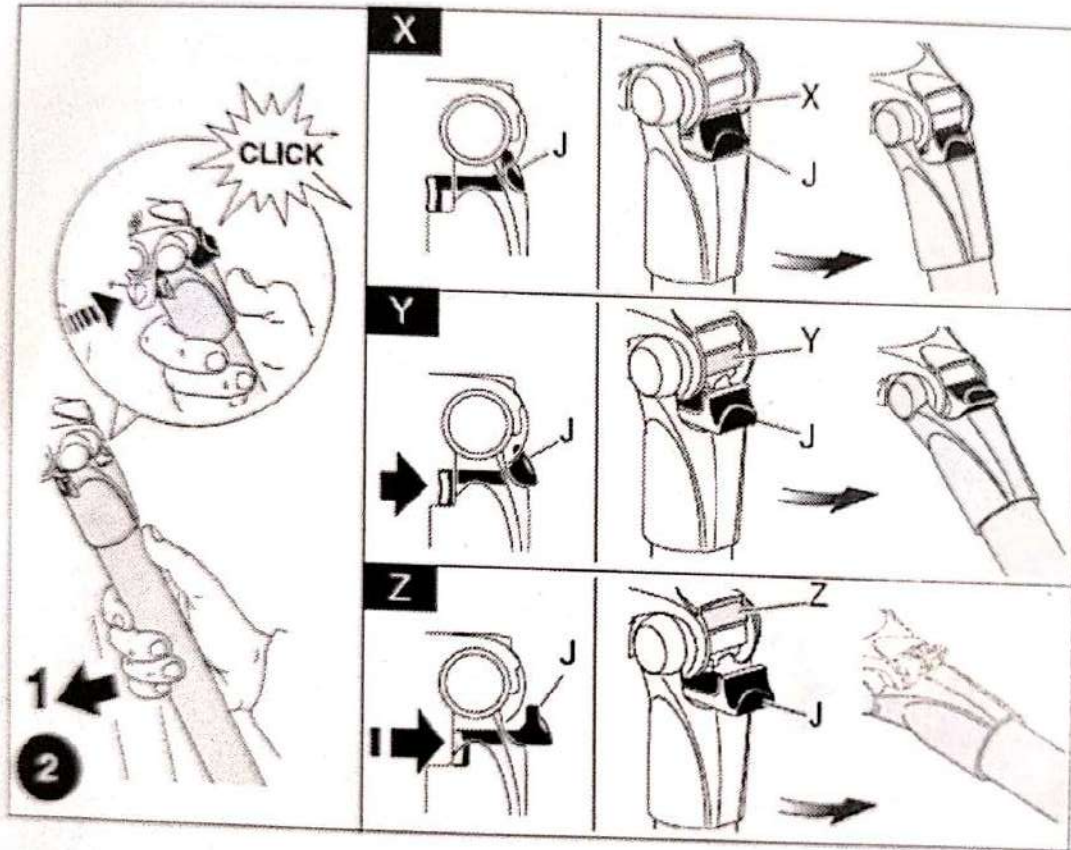


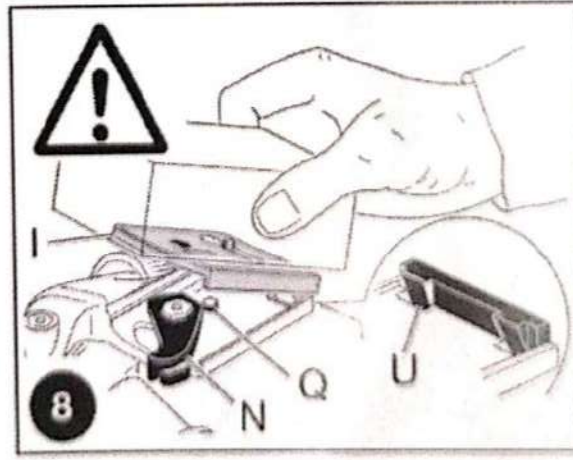
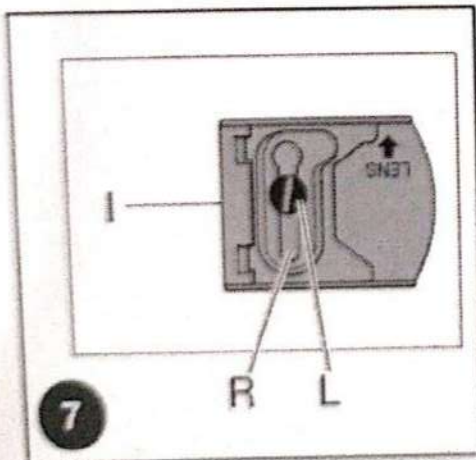
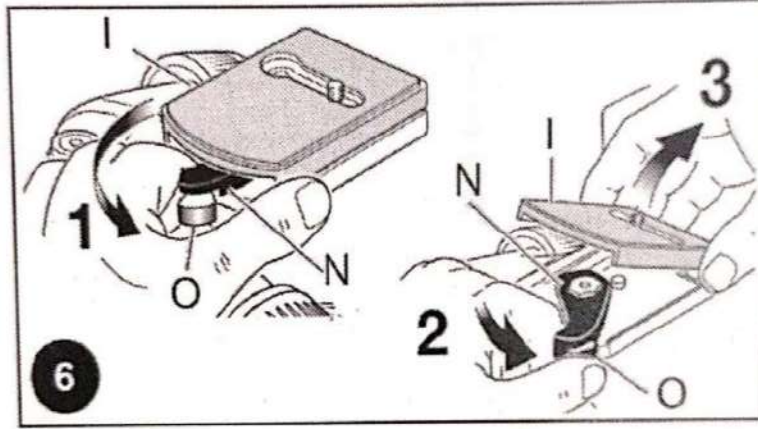
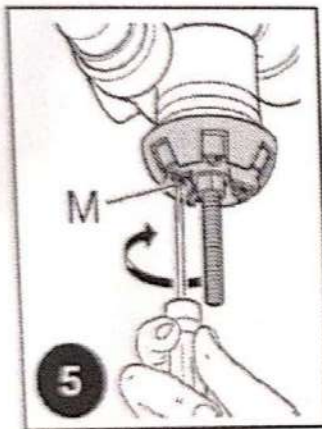
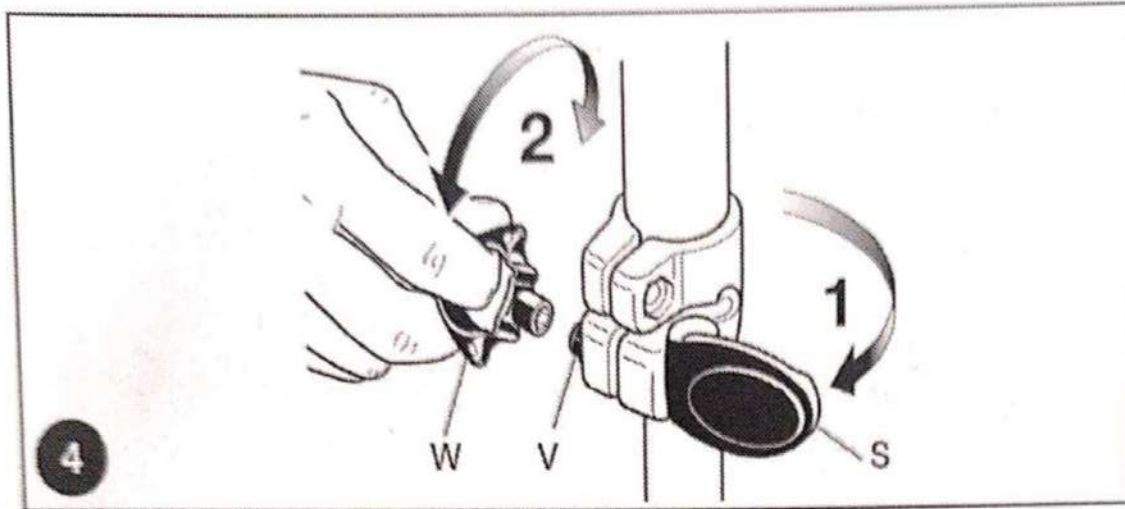
# APPENDIX – A

## TRIPOD USAGE INSTRUCTIONS

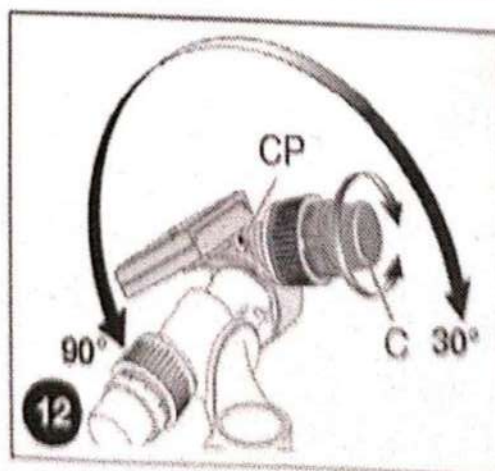
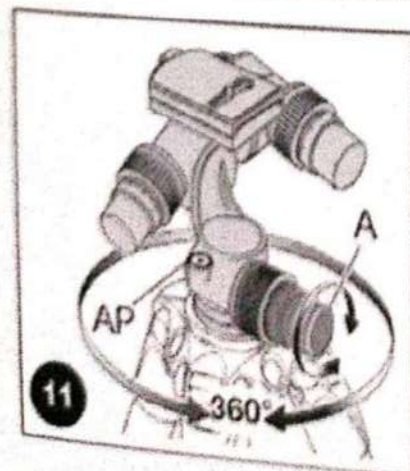
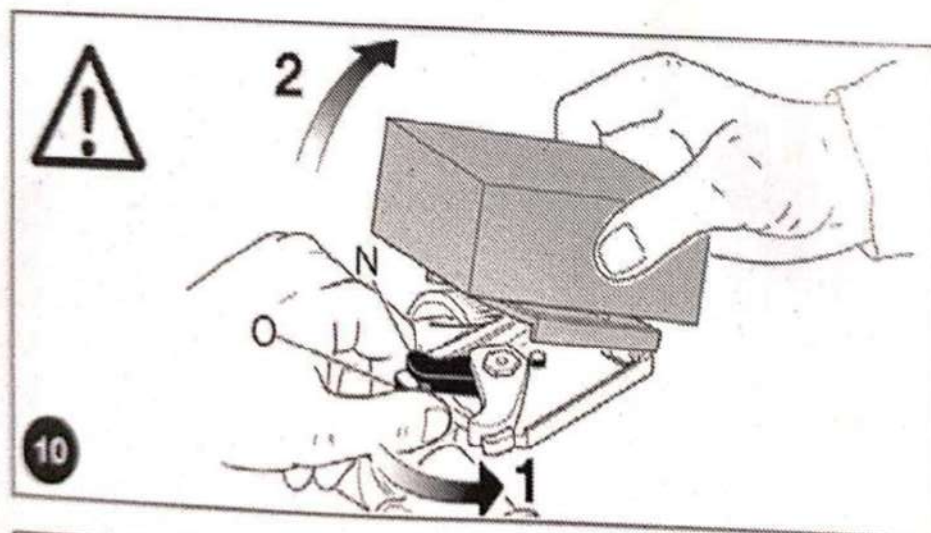
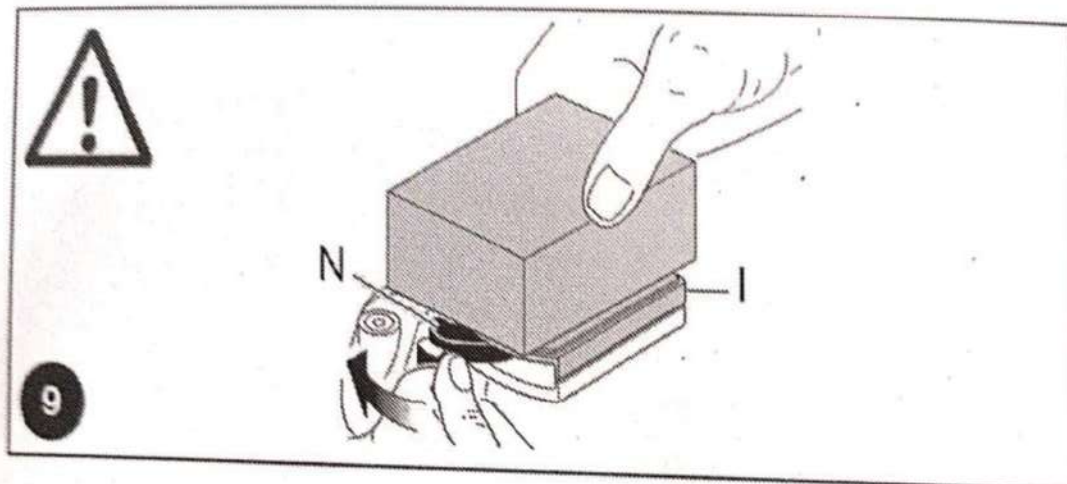


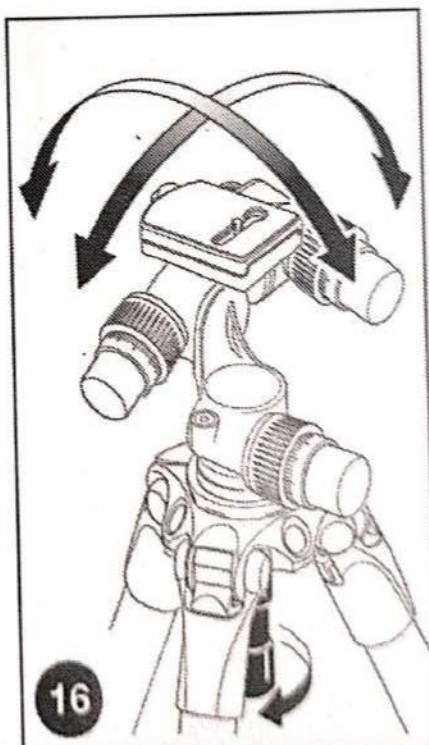
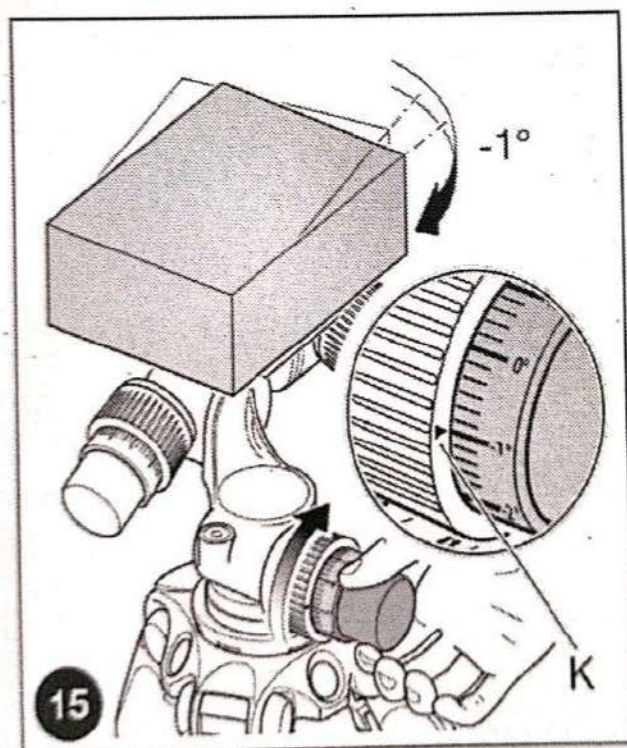
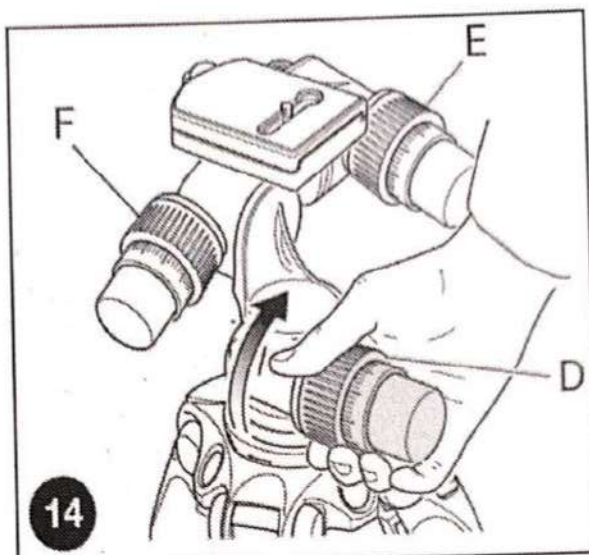
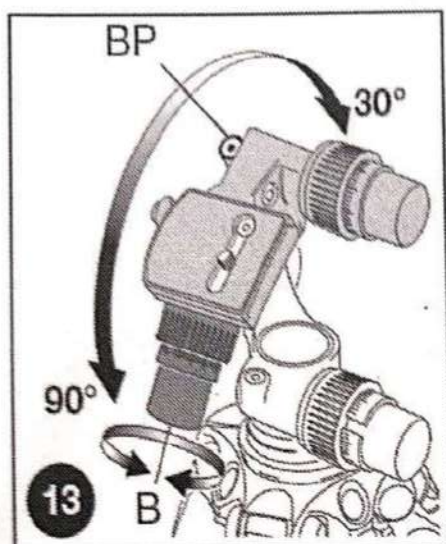














## SET UP OF TRIPOD

Open the 3 tripod legs.

To adjust the height of the tripod, each leg has telescopic extensions that can be released by rotating lever “S” on the locking collar “T”. When the required height is achieved, lock lever “S”.

### FEET 1

The tripod has rubber feet “Q” with retractable spikes “R” for external use.

### LEG ANGLE ADJUSTMENT 2 3

Each leg can be set at 3 spread angles (X - Y - Z) - see figure 2

To change the angle on a leg, close the leg towards the centre slightly, press button “J” to select the new leg angle, and then open the leg.

The angle of each leg can be adjusted independently of the other two legs.

The last position allows to achieve the floor level.

### LEG LOCK TENSION ADJUSTMENT 4

If the telescopic leg extensions slip even after having tightened the locking lever “S”, the locking tension will need to be adjusted.

In order to do this:

- release lock lever "S"
- turn the screw "V" clockwise using the special key "W" provided on one of the tripod legs.
- Normally a third of a turn will be sufficient to achieve the correct locking tension.

## MAINTENANCE 1

In order to replace locking collar "T" (fig. 1), please use a flathead screwdriver (not supplied with product).

## MOUNTING AND REMOVING THE HEAD FROM LEVELLING HALF BALL 5

Mount the head on the plate at the top of the leveling half ball via the 3/8" mounting screw (screw head clockwise). Then with a small screwdriver (not included), tighten the three set screws "M" up against the base of the head, **taking care not to force them**. This feature works to prevent the head unscrewing accidentally.

To remove the head, loosen the set screws "M" and unscrew the head from the column (counter-clockwise).

## MOUNTING THE HEAD ON A TRIPOD 1

To mount the head on tripod head see fig. 1:

- place the head into the tripod bowl,
- screw grip "H" up against the bowl, but do not tighten it
- hold grip "H" and level the tripod head using the spirit



level "AP" as a reference

--tighten grip "H" fully to lock head to tripod

## REMOVE QUICK RELEASE PLATE FROM HEAD

6

The lever "N" is equipped with a safety button "O" to prevent the measure instrument plate "I" from accidentally being released.

To release the measure instrument plate "I":

--pull the locking lever "N" in the direction indicated by the arrow (fig. 6) until it will go no further

--hold lever "N" in the above position and at the same time press button "O" (fig. 6)

--this allows lever "N" to rotate further thus releasing the measure instrument plate "I"

## ASSEMBLING MEASURE INSTRUMENT ON PLATE

7

Fix the measure instrument onto the plate "I" by screwing home the measure instrument screw "L" into the measure instruments' threaded hole WITHOUT APPLYING FORCE.

The screw "L" slides along the slit "R" allowing you to align the measure instrument lens with the plate "I" and there by choose the best balance position.

Note: The screw "L" has a groove in the head to enable them to be tightened with a coin

## MOUNTING THE MEASURE INSTRUMENT ON THE HEAD 8 & 9

Insert the measure instrument plate "I" (fig. 8) into the dovetail sides "U" on top of the head and then press plate "I" downwards until locking lever "N" clicks and closes.

Make sure that plate "I" (fig. 9) is fully locked by pushing lever "N" all the way to the left side and checking that the measure instrument is fitted securely

## REMOVE THE MEASURE INSTRUMENT FROM THE HEAD 10

Whenever the measure instrument needs to be removed from the head, hold the measure instrument securely in one hand while operating locking lever "N" and safety lever "O" with the other.

## FINE ADJUSTMENT 1 11 12 13

Use the following control knobs (fig. 1)

"A" = Pan

"B" = Tilt

"C" = Leveling

Fine adjustment is made by simply rotating the control knobs (fig. 11, 12 and 13). The design of the geared mechanism enables the measure instrument to be set in position without the need to lock off once the required angles are achieved

## RAPID ADJUSTMENT 1 & 14

Use the following control rings (fig. 1)



“D” = Pan

“E” = Tilt

“F” = Leveling

Rapid adjustment can be made by using a hand to rotate the control wheel (“D”, “E”, and “F”) through  $90^\circ$  following the arrows (fig. 14). While holding the control wheel open, the measure instrument can be rapidly deployed with the other hand to the desired position.

Release the control ring to lock the head in position. The head is supplied with 3 spirit levels: “AP” for panning (fig. 11), “CP” for vertical portrait format (fig. 12) and “BP” for horizontal position (fig. 13).

## GRADUATED VERNIER 15

Each Control Knob is provided with a “graduated vernier” that can be used for measure small-angle rotations.

One complete turn of the knob produces a rotation of 6.545 degrees, and the scale is engraved every 0.1 degrees.

The ring, where the graduated vernier is engraved, is free to rotate over knobs “A”, “B”, “C”.

Before to start the small rotation rotate ring until align the arrow “K” with  $0^\circ$  position. Now grip knob “A” (or “B” or “C”) and start rotation: It’s possible to read the angle on the graduated vernier (be careful not to touch the ring during rotation in order to maintain correct reading).