Xaver™ 400

NOTE: System specifications are subject to change without notice.

Table of Contents

1. Introduction

This section provides an introduction to the Xaver™ 400, a Sense Through The Wall (STTW) micro-power radar system.

1.1 System Overview

The Xaver™ 400 is a compact, lightweight and durable device designed for imaging through walls. The Xaver™ 400 provides critical real-time information on the number of people and their location as well as static non living objects behind a wall or barrier. Simple to operate, the Xaver™ 400 provides immediate mission-critical information wherever needed.

The Xaver™ 400 utilizes technology similar to that of the pioneering Xaver™ 800, but in a smaller system. The result is a significantly compact form factor optimized for use by tactical teams combining a performance level that suits the requirements of tactical operations.

***NOTE**: The Xaver™ 400 is user-safe. There is no radiation hazard.*

1.2 System Capabilities, Purpose & Use

The capabilities, purpose and use of the Xaver™ 400 system are as follows:

- **Rapid determination of presence and location of people behind walls** - The system provides the ability to determine how many people there are and their location. Furthermore, multiple people can be distinguished even while in close vicinity to one another.
- **Ability to view static objects** – Static objects are differentiated from moving objects and both are displayed simultaneously. Detection of static objects behind the wall includes locating infrastructure elements such as walls, floors, ceilings, and other large objects. This capability further enhances the user's ability to plan informed and effective operations.
- **Ability to operate with unknown structural materials** – The Xaver™ 400 provides the capability to sense through many types of walls. These include all standard types of non-metal walls such as cement block, dry wall, brick, adobe, stucco, plaster and reinforced concrete. The system cannot penetrate solid metal, however, the system can sense through metal studs and even "chicken wire" that may be embedded in the abovementioned building materials.
- **Ease of use in the field** – The Xaver™ 400's compact design is optimized for tactical operations, it weighs slightly over 3kg and is designed for real-time field decisions. The system provides its first real-time images within seconds of powering on and offers multiple frames per second enabling immediate response. Its small size and light weight enable it to be hand-carried. The system's batteries provide 7 hours of continuous operation. The primary batteries provide 4.5 hours of continuous operation and the rechargeable battery pack provides an additional 2.5 hours of operation.

***NOTE**: Current color scheme of the Xaver™ 400 is Coyote Tan*

1.3 Standard Equipment

The Xaver™ 400 system is supplied with the following equipment:

- Rugged carrying case* (Figures 1-1 and 1-2).
- Power supply with electric cord for operating the system using AC power adaptor (Figure 1-3).
- Battery charger and two rechargeable batteries (Figure 1-4).

The Xaver™ 400 carrying case is displayed in Figures 1-1 and 1-2.

Figure 1-1: Xaver™ 400 Open Case – View One

Figure 1-2: Xaver™ 400 Open Case – View Two

Figure 1-3: Power Supply

Figure 1-4: Battery Charger and Rechargeable Battery

* Actual case might be different than case shown

1.4 Technical Specifications

Table 1-1: Technical specifications of the Xaver™ 400

Spec	Description
Device type	Compact through-wall radar
Penetrable wall materials	Most commonly used building materials; Cement, plaster, brick, concrete, cement blocks, reinforced concrete, adobe, stucco and drywall (the system cannot penetrate solid metal)
Detection range	4m (13ft), 8m (26ft), 20m (66ft)
Field of view	120° in both Azimuth and Elevation
Display modes	2D plan view, 3D plan view; 1.5D (range with time history)
Frequency range	3GHz to 10GHz
Range (distance) resolution	Less than 3cm
Cross range resolution	Based on distance. Less than 1m at the 8m nominal range
Dimensions	L: 37cm, W: 22cm, D: 12cm L: 14.6in, W: 8.7in, D: 4.6in
Weight	3.1Kg, (6.8 lbs) with one set of batteries (rechargeable or primary)
Power supply	Rechargeable battery Primary batteries External power supply (100-240V 50/60 Hz)
Battery operation time (at 25°C/77°F)	Rechargeable: 2.5 hours Primary: 4.5 hours
Wireless video	Optional built-in wireless video transmitter with up to 150m (328 ft) LOS range

2. Controls, Indicators & Connectors

This section describes the Xaver™ 400 controls, indicators and connectors from the front, back and bottom views.

2.1 Front View

The following figure details the Xaver™ 400 front view.

Figure 2-1: Xaver™ 400 Front View

No.	Label	Description	Functionality
1	Radome	External casing for front of system	Protects the internal components of the system
2	Spacer	Rubber like material found on the corners of the Radome	Provides "Soft Touch" to wall for quiet wall-deployment
3	Harness	Carrying strap	Provides convenient carrying method

Table 2-1: Controls and connectors in the front view of the Xaver™ 400

2.2 Back & Side Views

Figure 2-2 details the back view of the Xaver™ 400.

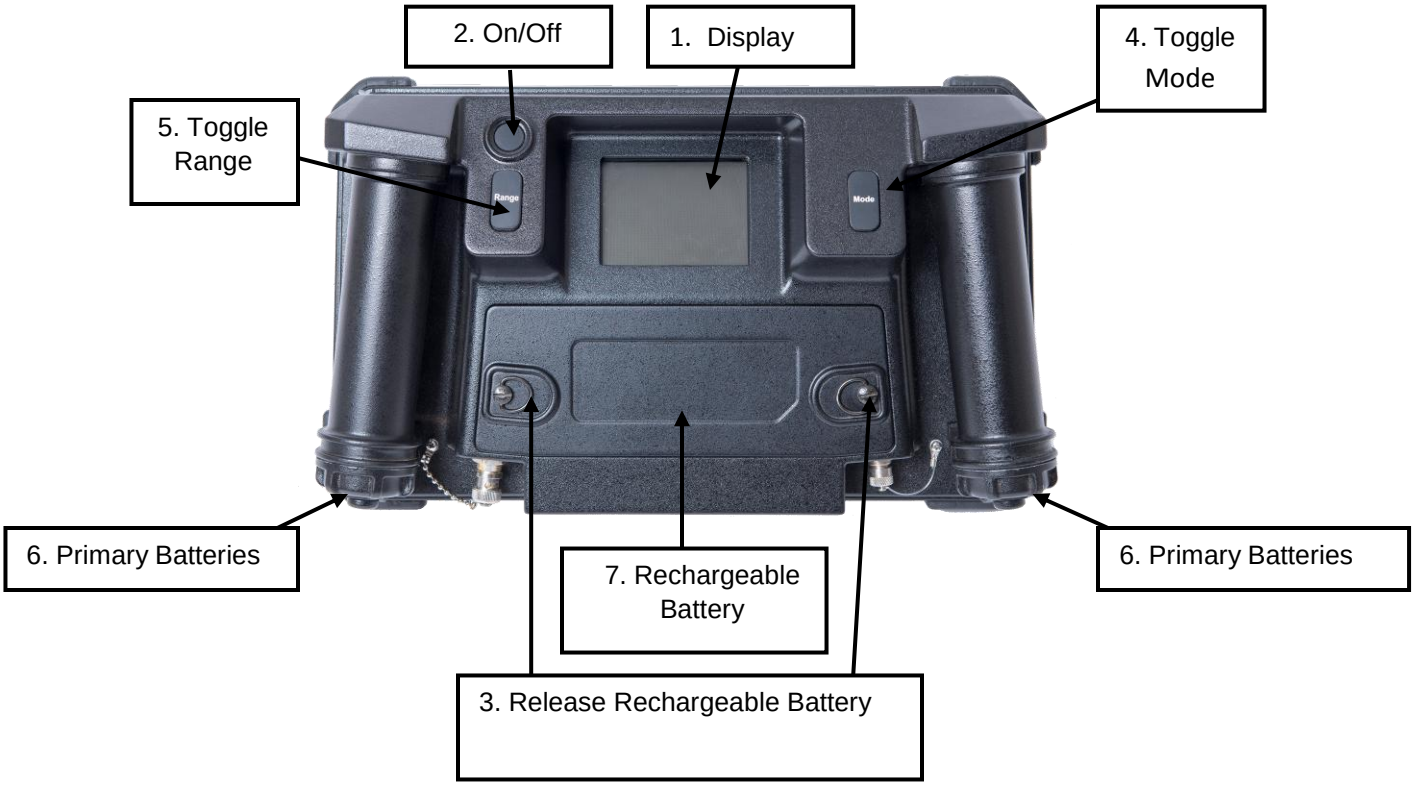


Figure 2-2: Xaver™ 400 Back View

Figure 2-3: Xaver™ 400 Side View

Table 2-2: Controls and connectors in the back view of the Xaver™ 400

No.	Label	Description	Functionality
1	Display	A 320 X 240 pixels 3.5" LCD display	LCD is protected by an anti-glare, anti-fingerprint coating
2	On/Off Button	Turns the system On and Off	Used for powering on and off the system
3	Release Rechargeable Batteries	Two metal brackets which twist to lock or unlock	Secures the rechargeable battery cover in place
4	Toggle Mode	Toggling button for different mode viewing	Allows for switching between views; Expert, High Penetration, Tracker, 3D
5	Toggle Range	Toggling button for maximum range viewing	Changes maximum viewing range between 4m, 8m and 20m (13ft ,26ft and 66ft)
6	Primary Batteries	Six (ULTRALIFE HiRate® U10017) batteries	Power sources
7	Rechargeable Battery	One rechargeable battery 10.8V/4.8Ah	Power sources

2.3 Bottom View

Figure 2-3 details the bottom view of the Xaver™ 400.

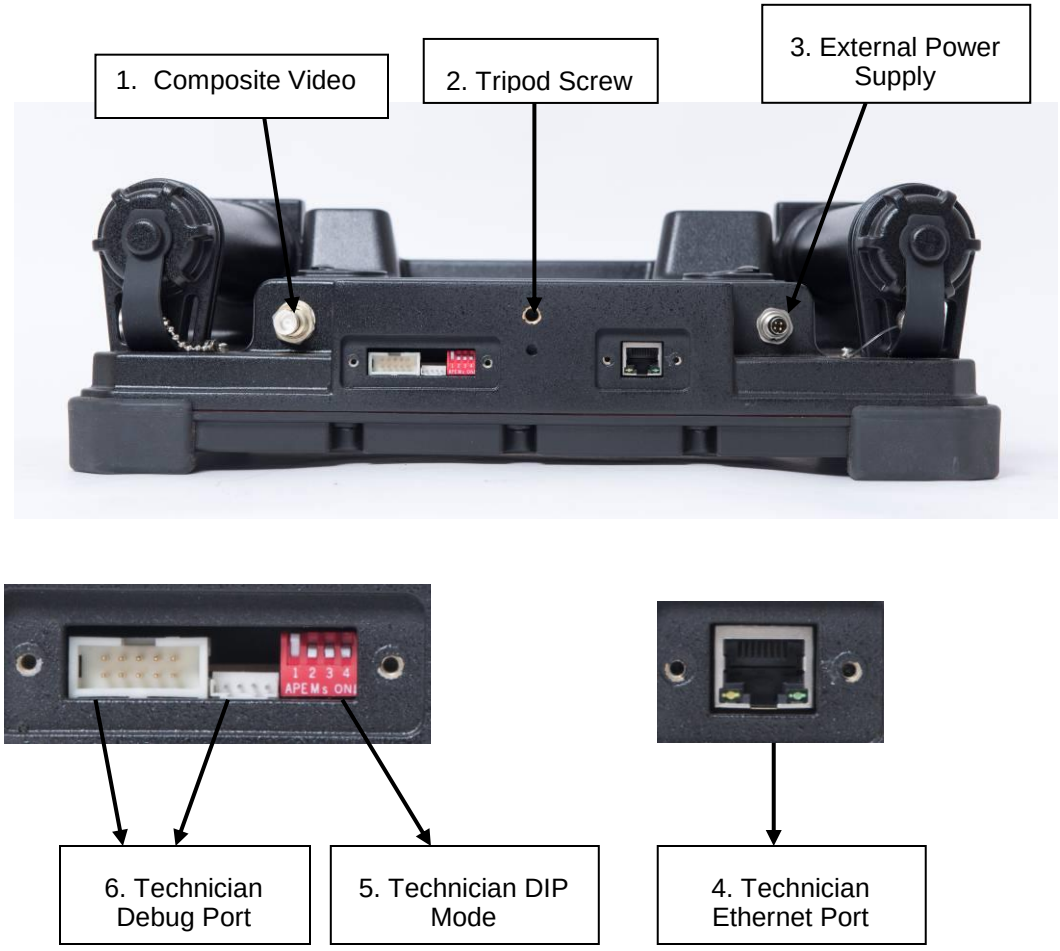


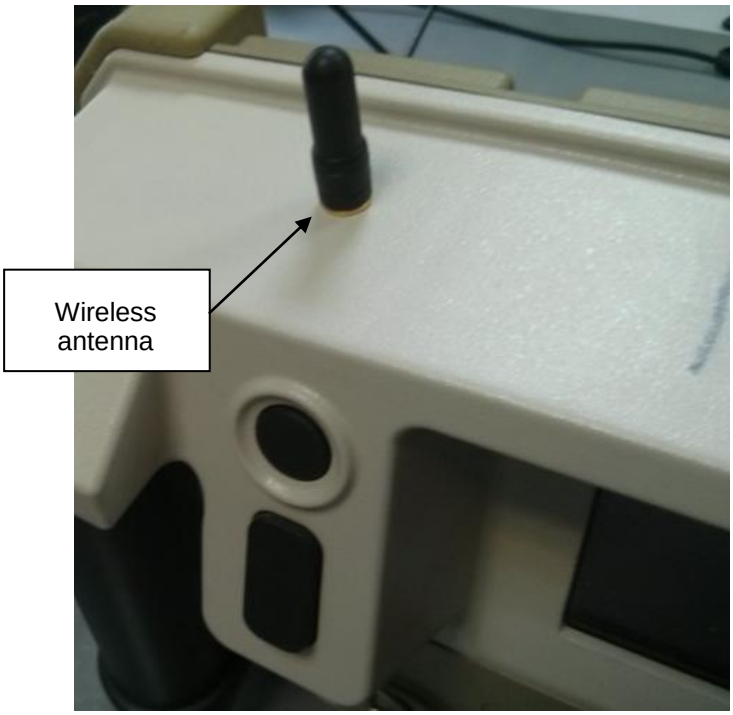
Figure 2-3: Xaver™ 400 Bottom View

Table 2-3: Details of controls and connectors in the bottom view

No.	Label	Description	Functionality
1	Composite Video	A female BNC connector which is used as a composite video output	Enables various applications like transmission, recording, projection. personal monitor or goggles
2	Tripod Screw	¼" Female internal screw thread	Enables the system to be attached to a tripod or other mechanical device
3	External Power supply	100V to 240V Direct current, output 15VDC	Enables operation of the system from a power outlet. The power supply can also be used to charge the rechargeable battery while in the system
4	Technician Ethernet Port	RJ45 connector	Enables connection to a PC for control and monitoring of the system as well as firmware upgrades.
5	Technician DIP Switch	Four DIP switches which set the system operating modes	SW1- FCC Mode SW2- LCD on/off SW3- Video transmitter on/off SW4- Video transmitter channel select A or B
6	Technician Debug Port	A 10 pin header used for technician configuration and analysis of the system	In normal mode of operation this connector and the technician DIP switches are covered with a metal plate

2.4 Wireless Display/Control*

The Xaver™ 400 can be supplied with an optional wireless remote viewing and control optional module. Systems that support this wireless option will have an external wireless antenna on the top side of the device as can be seen in the following image:



This Equipment uses the following Antenna and may not be used with other antenna types of higher gain:

Mfg.: SAMWOO electronics P/N SMAP-900-1

Type: a ¼ wavelength monopole helical antenna with 0 dB gain

Gain: 0 dBi

This Antenna is permanently attached with glue by Camero-Tech Ltd. before being shipped to customers.

1. The wireless viewing and control module uses the following frequencies:
   - Channel A: 906 MHz.
   - Channel B: 914 MHz.
2. The module is controlled by two DIP switches:
   - SW3 turns the transmitter on and off
   - SW4 controls the frequency channels: A or B

***NOTE**: The system channel can be seen in the figure below on the bottom left side of the Video Monitor display.*

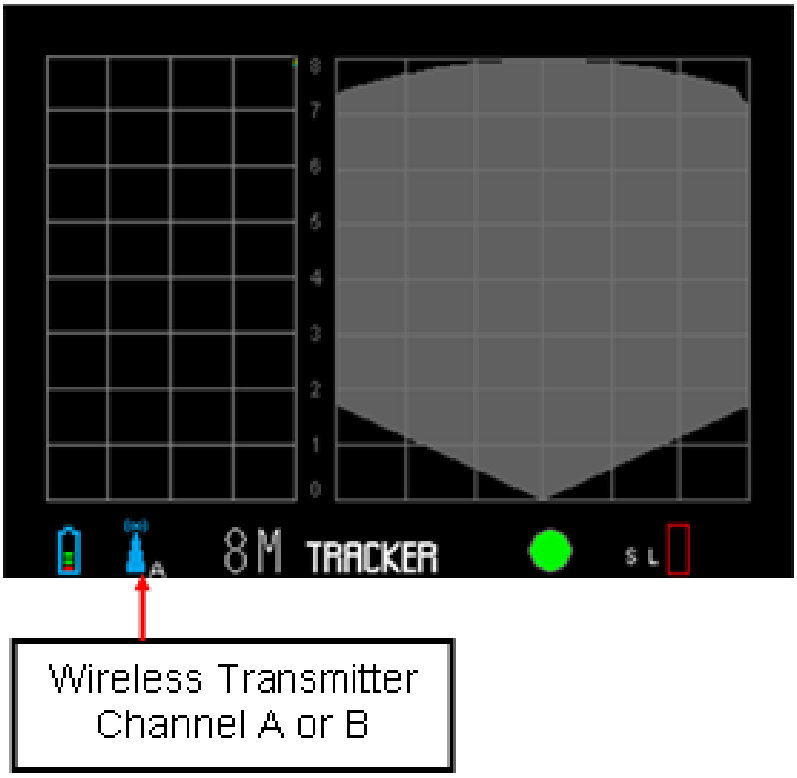


Figure 2-4: Wireless Transmitter Icon

The wireless transmitter icon will be gray while the system is "out-of-network" and blue while the system is connected to a XaverNET USB dongle.

Note: The Normal frequencies on the wireless remote viewing for the US Market will be between 906MHz - 920MHz.

* This feature is optional and is provided according to user specifications.

2.5 External Power Supply Operation

To operate the system using an external power supply, connect the DC cable to the external power supply connector which is located on the right side of the bottom panel.

- When operated using AC power, a plug icon ( ) appears on the LCD.
- The external power supply is displayed in the following Figure 2-5.

Figure 2-5: External Power Supply

***NOTE**: The pins in both connectors (indicated by red boxes in the figure above) should be connected gently.*

2.6 Battery Setup

The Xaver™ 400 system can operate with two kinds of batteries:

- **Primary**
- **Rechargeable**

2.6.1 Primary battery:

⇨ **To insert the primary batteries:**

1. Open the two grip covers by unscrewing the battery housing cover caps which are located at the base of each grip. (see Figure 2-6)

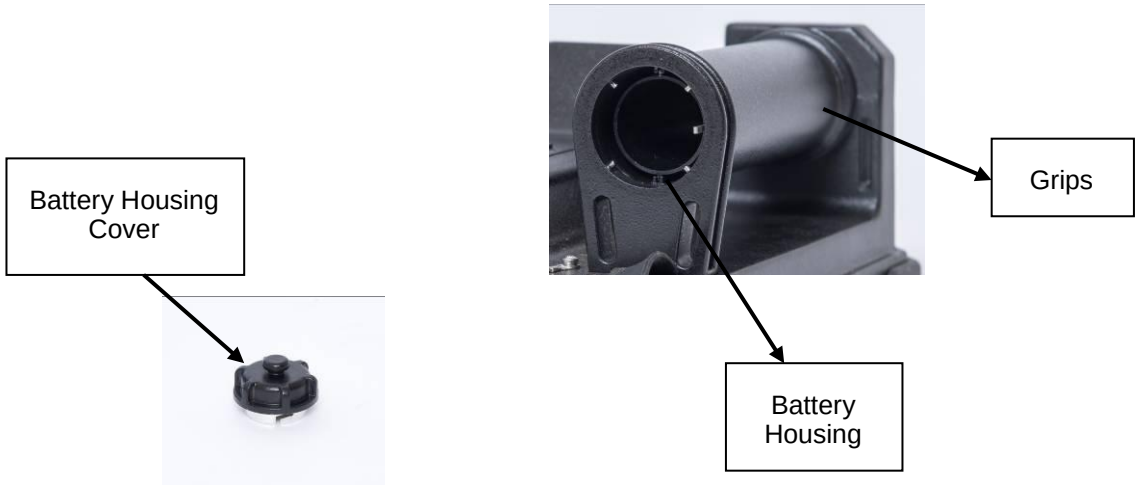


Figure 2-6: Battery Housing Cover

2. Insert 3 batteries in each grip with all "+" signs facing the battery covers. (Approved battery is ULTRALIFE HiRate® U10017 see Figure 2-7).
3. Make sure the covers are closed properly and tightened to prevent water and dust from entering the system.

Figure 2-7: ULTRALIFE HiRate® U10017 Battery

NOTE: Standard C-cell batteries will not work in the Xaver™ 400

2.6.2 Rechargeable battery:

⇨ **To install the rechargeable battery:**

1. Turn the cover brackets counter clock-wise and lift the cover outwards.
2. Slide the rechargeable battery into the battery cover housing, making sure the battery is installed as displayed in Figure 2-8.

   Pay attention to the battery connector location groove on the battery cover. (See Figure 2-9)

Figure 2-8: Battery Housing

The Xaver™ 400 battery connector is displayed in Figure 2-9 below.

Figure 2-9: Xaver™ 400 Battery Connector

The rechargeable battery has a level indicator. The battery is full when all 5 bars appear on the indicator screen as seen in Figure 2-10 below.

Figure 2-10: Battery Level Indicator

***NOTE**: After each battery change it is recommended to activate the Xaver™ 400 system to make sure the change was successful.*

2.7 Battery Charger Operation

Insert the battery into the charger and check the color of the status LED lights:

- Flashing Green light: The battery is charging
- Solid Green light: The battery is fully charged
- Flashing Red light: The battery level gauge is in need of recalibration
- Solid Red light: Error (contact technician)
- Flashing Blue light: The battery is in calibration mode
- Solid Blue light: The battery has finished calibration

The Battery, Charger and AC/DC adaptor are displayed in Figure 2-11 below.

Figure 2-11: Battery Charger, Adaptor and Rechargeable Battery

2.8 Battery Operation

The following scenarios are relevant for battery operation.

- The system can charge the battery while both ON and OFF.
- Full recharge time after complete battery-discharge is 165 minutes (i.e. no bars remaining on rechargeable battery level indicator).
- When connecting the external power supply to the system, the system will only draw power from the external power supply (i.e. no power will be drawn from either battery).
- When disconnecting the external power supply, the system will return to draw power from the batteries (either from rechargeable or primary).
- The system can be powered separately by either primary or rechargeable batteries and by both simultaneously.
- The rechargeable battery is the default battery used by the Xaver™ 400 system. (i.e. when both rechargeable and primary batteries are inserted, the system will exhaust power from the rechargeable battery before proceeding to draw power from the primary batteries). Upon depletion of rechargeable battery, the icon for primary battery power will appear for displaying the status of the primary batteries.
- To operate the system via primary batteries only, do not insert a charged rechargeable battery (a depleted rechargeable battery will not circumvent the use of primary batteries).
- **To maximize and extend battery life, charge the rechargeable battery to at least 50% capacity after depleted** (charging the rechargeable battery to less than 50% may cause accelerated deterioration in battery capacity).

3. System Operation

This section describes the procedures for system preparation and operation.

3.1 System Setup

System setup procedures are as follows:

- **System Power-Up and Operation**
- **System Shut-Down and Packing**

3.1.1 System Power- Up and Operation

⇨ **To power up and operate the system, perform the following steps:**

1. Unpack and remove the Xaver™ 400 system from the carrying case.
2. Turn the system On (Push On/Off button for a few seconds).
3. Hold the system upright using both grips and point the system towards an open space (open space of at least 50cm / 20-inches between the system and any object) until the no focus icon  disappears.
4. Hold the system grips with two hands. If possible, lean the system against the wall (as close as possible) in order to reduce interference that may be caused by moving objects located behind the system (the "mirror effect").
5. Wait for the rotating Acquisition Indicator  to turn solid green  . Once the Acquisition indicator is solid green the system images are available for interpretation.
6. If you cannot attach the system to the wall, you can work in stand-off position. Make sure to stabilize the system – if required use a tripod or a monopod.
7. You can rotate the system clock wise to a vertical mode (90°). This will enable you to view a 2D side view enabling view of the height of an object. When operating in vertical mode the system must be set to either Expert or High Penetration mode.
8. The system can be powered from an external power supply, rechargeable battery or six primary batteries.

3.1.2 System Shut-Down and Packing:

To shut down the system, press the On/Off button for 2 seconds. The system will perform an automatic shut-down procedure. Once the system has shut down, lay the system back in the carrying case, close the case and lock the case latches.

4. Screen Interface

This section describes the screen interface, basic operation functions and the system menus.

4.1 Screen Layout

The following subjects are detailed in the sections below:

- **Display areas**
- **Display grid**
- **System direction, distance and dead zone**

4.1.1 Display Areas

The screen is comprised of the following (see Figure 4-1)

- **1.5D view:** Displays the "Range Over Time" providing a history of the motion
- **2D view:** Displays a 2D "Top Down" view (and 2D side view in "Vertical Mode")

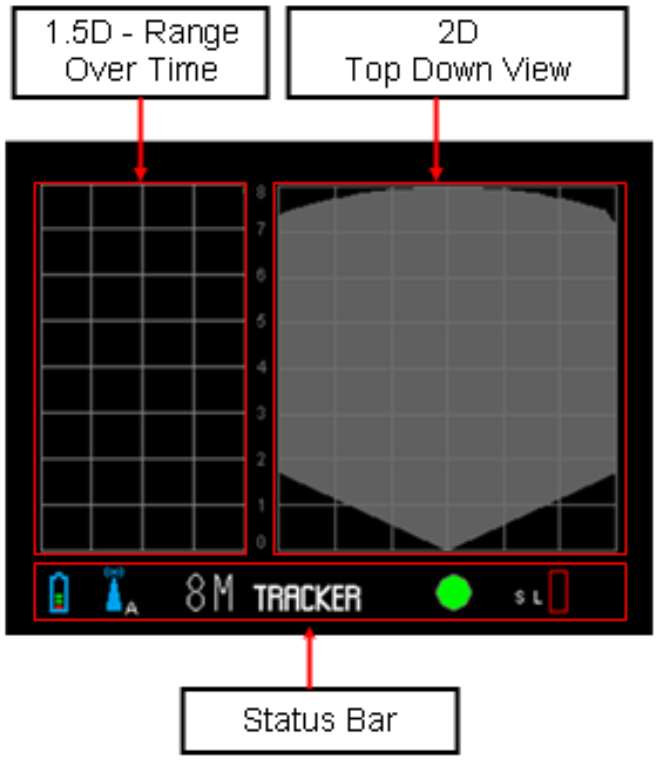


Figure 4-1: Display Areas

- **Status Bar:** For a detailed description of the status bar, refer to Figure 4-2 and table 4-1 following.

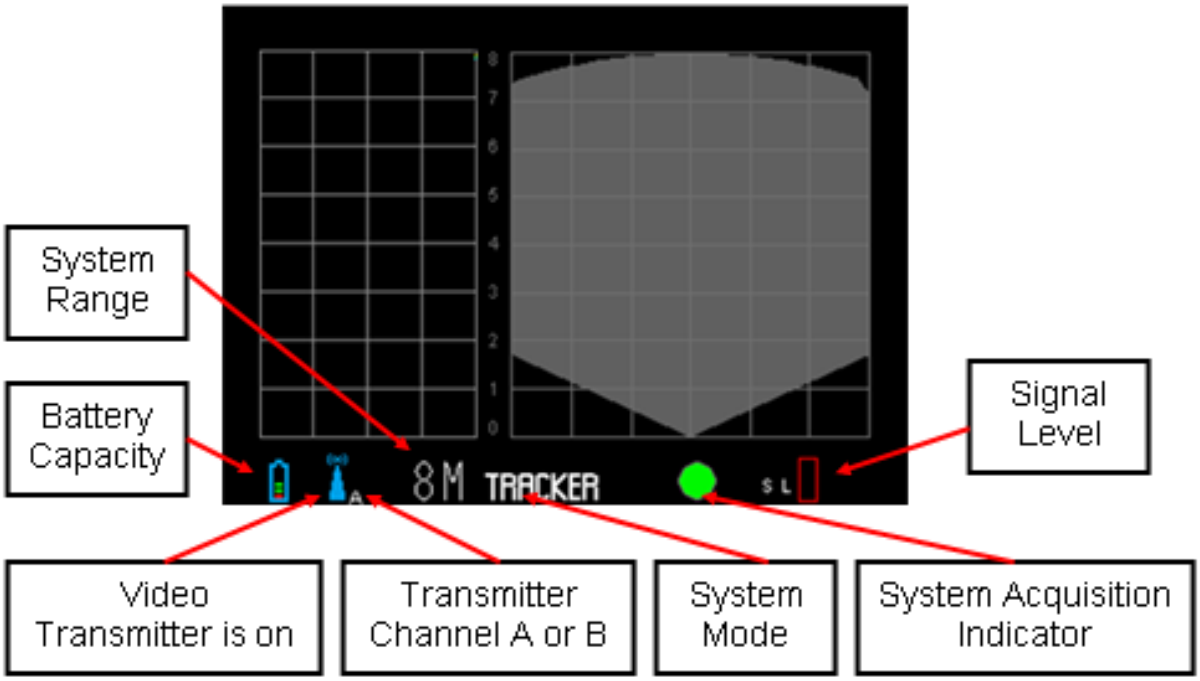


Figure 4-2: Status Bar

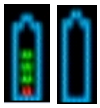
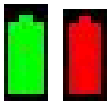
No.	Description	Icon
	System range options	
2	Operational modes	
3	Rechargeable battery level indicator	
4	Primary battery level indicator	
	System is connected to external power source	
	Video transmitter is on	
	Channel A or B	
	Signal level	
9	System acquisition indicator	
0	System not in focus	
11	System error/shut down code	

Table 4-1: Status Bar icons

4.1.2 Display Grid

The grid that appears on the screen enables the user to measure both the distance of the objects and the speed at which they are moving.

- The left side of the grid is the 1.5D "Range over Time" section.
  - The horizontal axis measures time; each cell across represents 5.5 seconds. There are 4 cells in the 1.5D section representing a total of 22 seconds.
  - The vertical axis measures the distance of the object from the Xaver™ 400 system; each cell represents 1 Meter.
- The right side of the grid is the 2D section displaying the objects from a "Top Down" view (or 2D side view in "Vertical Mode").
  - The vertical axis of the 2D view, measures the distance of the object from the Xaver™ 400 system. Each cell represents one square meter. This grid is used for measuring object location, and motion patterns

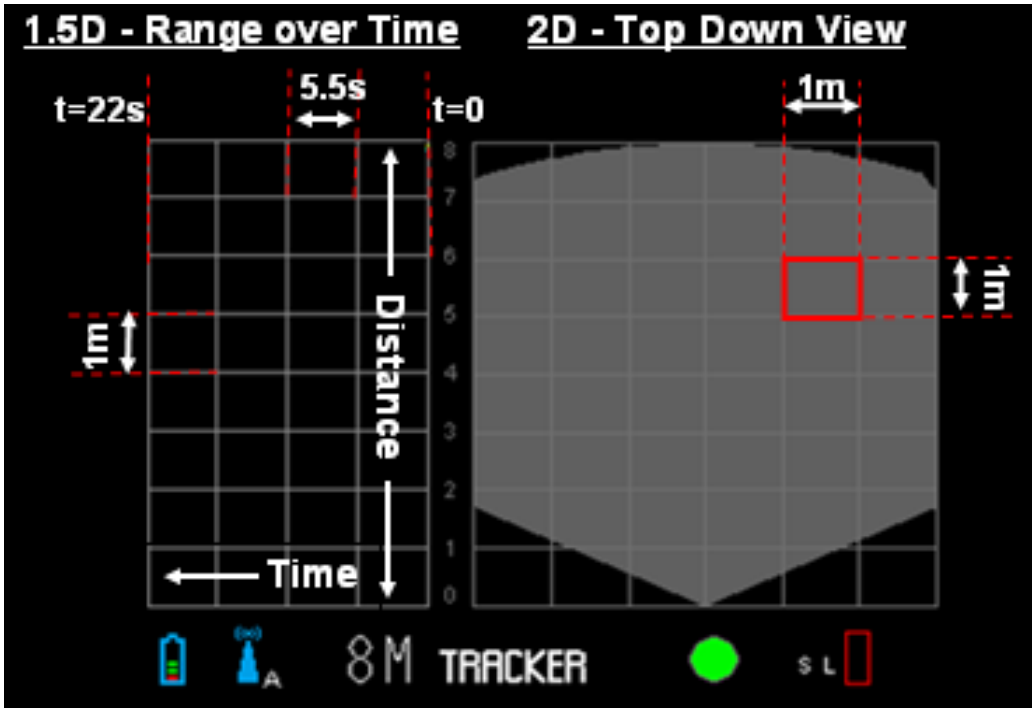


Figure 4-3: Display Grid

4.1.3 System Direction, Distance and Dead Zone

The two corners indicated in Red are the system's dead zones (areas outside the 120° coverage angle), wherein the system cannot view objects. In order to cover the system dead zones and view objects within these dead-zones:

- Move the system back a few meters to ensure coverage of system dead zones. (this will allow the system angles to cover the previous system dead zones)
- Apply Xaver 400™ to adjacent or opposite wall to cover system dead zones as result to the previous location of the system.
- Move the system to another position along the distance of the same wall to cover previous system dead zones.

***NOTE**: Do not use more than one (1) Xaver400™ system in the same vicinity as systems may interfere with each other.*

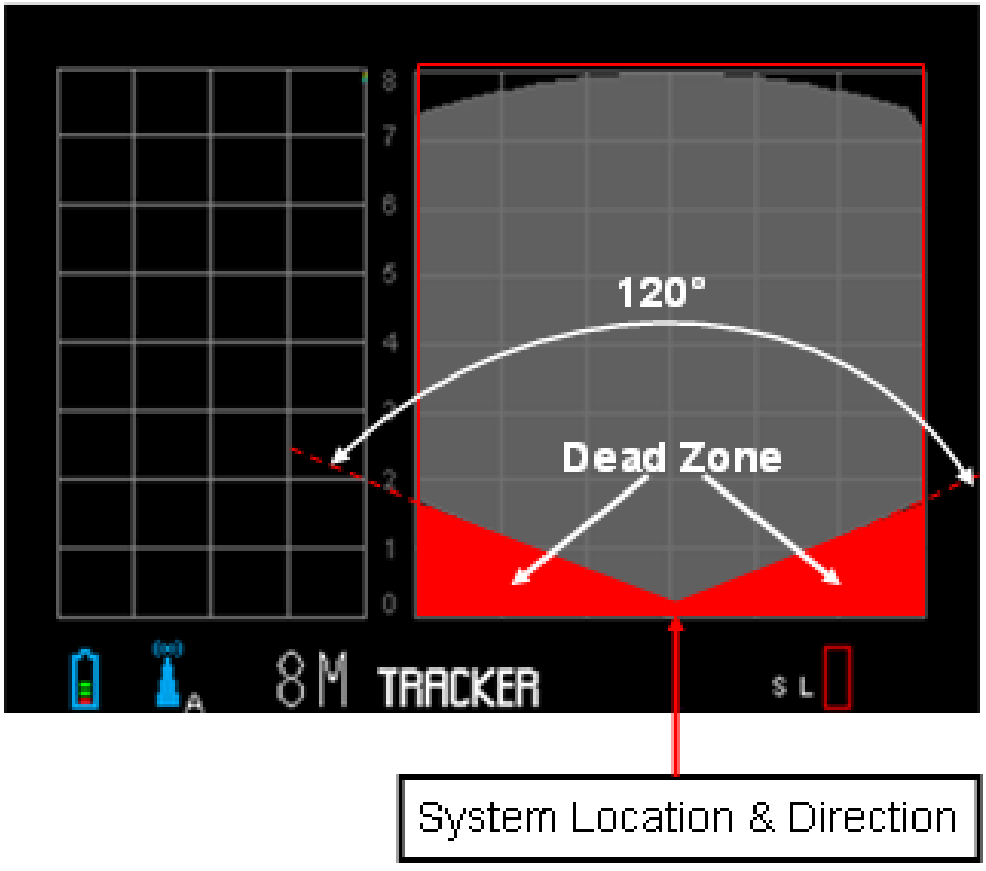


Figure 4-4: System Dead Zone

4.2 Xaver™ 400 Menus

The following figure and table detail the Menus.

Figure 4-5: Xaver™ 400 Menus

4.2.4

No.	Label	Description
1	Toggle Range	This button controls the maximum viewing range of 4m, 8m and 20m (13ft, 26ft and 66ft)
2	Toggle Mode	This button controls the different viewing modes of Tracker, Expert, High Penetration and 3D.

Table 4-2 details the Xaver™ 400 Menus

4.2.5 Xaver™ 400 Optional Ranges

⇨ The optional maximum viewing ranges on the system are 4M, 8M and 20M (13ft, 26ft and 66ft) for all the viewing modes. The display grids in these modes will change accordingly.

- 4M: used for viewing up to 4M from system and provides enhanced penetrability when wall is highly attenuative.
- 8M: Default range, used for most deployment scenarios.
- 20M: used predominantly in standoff deployment when wall deployment is not possible or not desired.

4.3 Xaver™ 400 Modes & Screen Shots

The system has three maximum ranges: 8m, 4m and 20m (13ft ,26ft and 66ft) and three operation modes: Tracker, Expert and High Penetration. These are detailed in the following figures.

- **Tracker Mode:** This mode is the "default" mode and is displayed when system is powered up. See Figure 4-6
  - When a moving or living object is identified by the Xaver™ 400 an outlined square with cross-hairs will mark the identified target. Different targets will be tracked by different square colors.
  - Static objects appear in Grey.

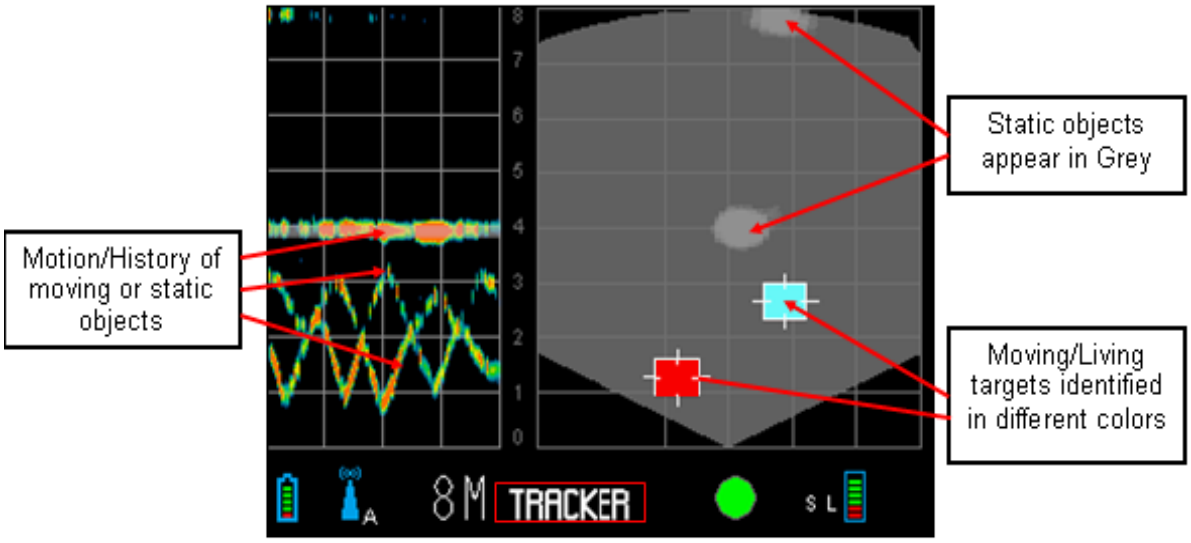


Figure 4-6: Tracker Mode in 8M Range

- **Expert Mode:** This mode displays the location and distinction between moving and static objects without Tracking. (see Figure 4-7 and 4-8).
  - Static objects appear in Grey
  - Moving or living objects appear in Green.

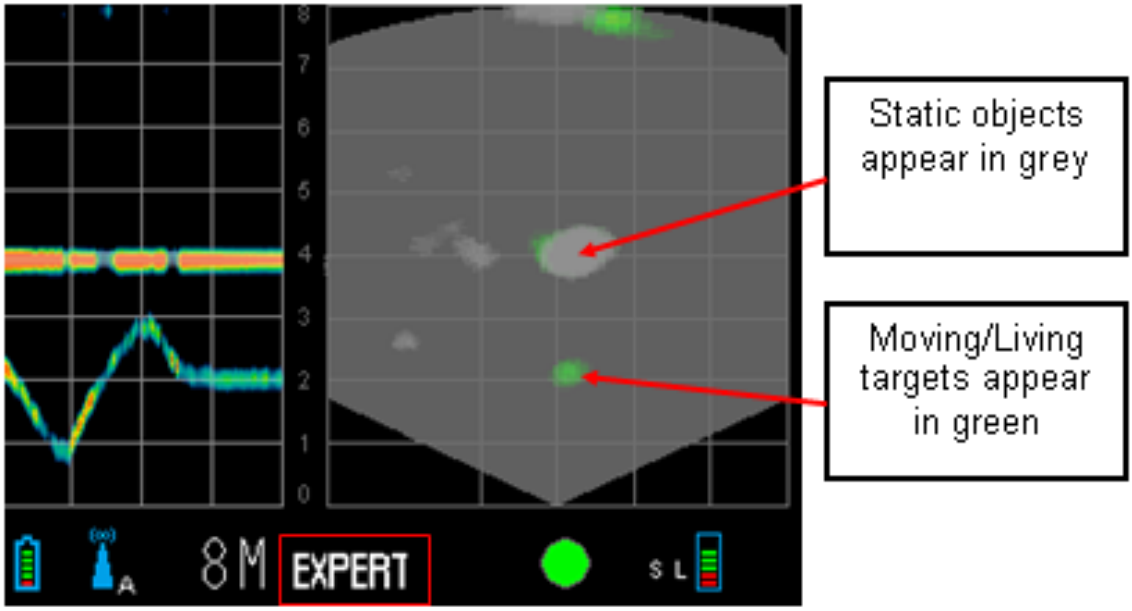


Figure 4-7: Screenshot at 8M range of one living target (Expert Mode)

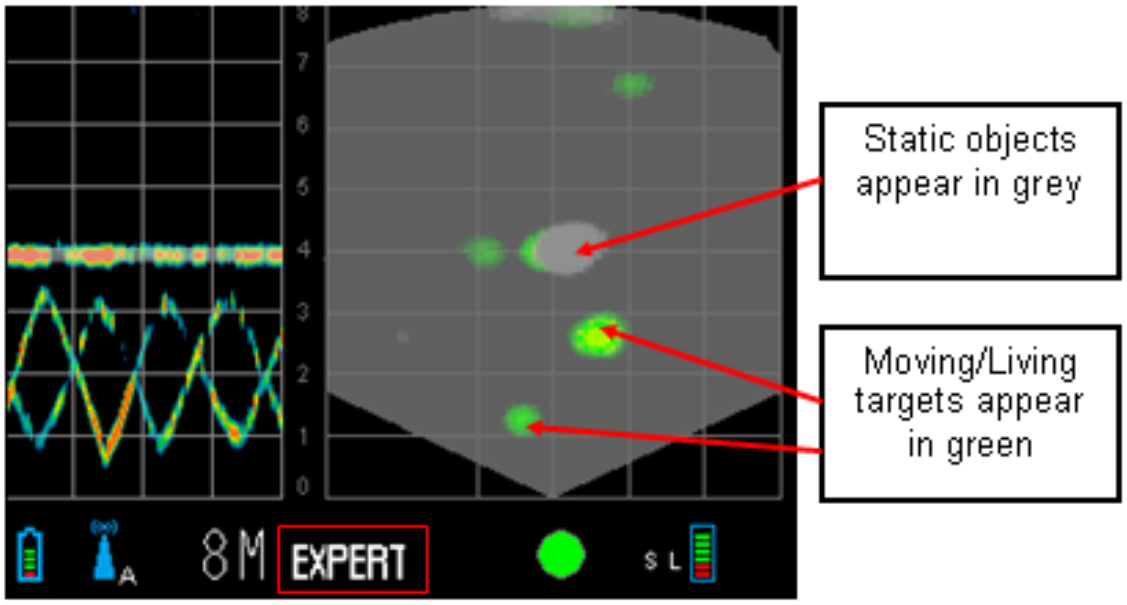


Figure 4-8: Screenshot at 8M range of two living targets (Expert Mode)

High Penetration Mode: This mode displays 1.5D (range over time) only. High Penetration mode is used to improve interpretation for highly attenuative walls, in situations of signal interference or when the view is highly cluttered (see Figure 4-9).

1.5D (same as in Expert Mode) appears on the whole display.

High Penetration can be used in 4M, 8M and 20M ranges.

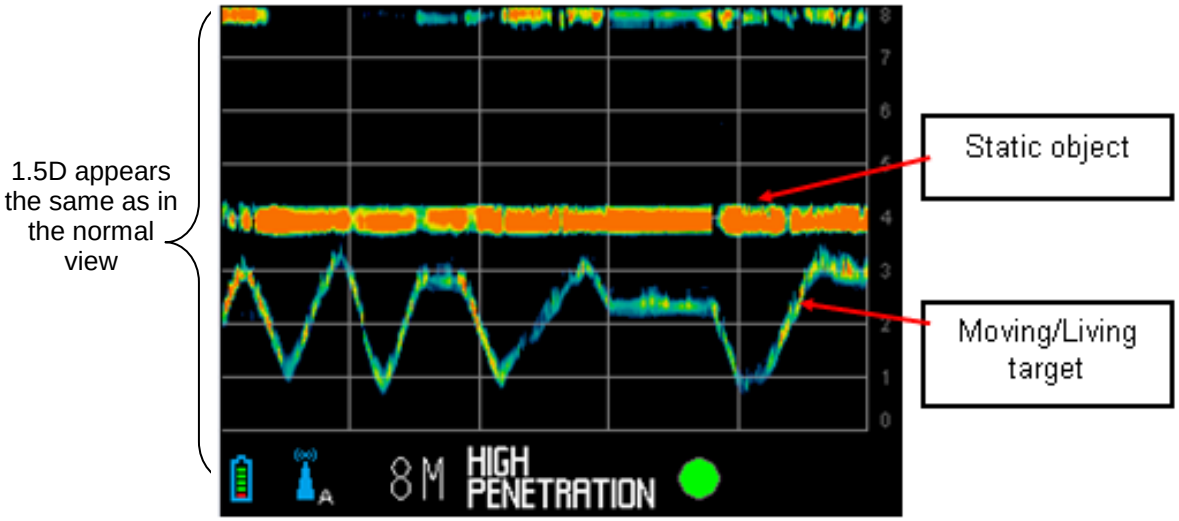


Figure 4-9: Screenshot of High Penetration Mode

Optional 3D Mode: This mode displays location and size of moving objects in a **3D** view, assisting in status recognition when needed.

- Static objects appear in Grey**.**
- Moving objects appear in green.
- Moving objects artificial shadow appears in yellow.

Figure 4-10: Screenshot of **3D Mode**

- **Night Mode:** User display lighting can be adjusted to the minimum required to be visible by an operator. In this mode the display will not be visible from a distance of more than 20 meters at night. The system can be switched between day/night-mode as follows:

When the system is shut off, hold down the right (mode) button with your right thumb, turn the system on by pressing the On/Off button and immediately hold down the left (range) button. The logo screen will come up. At this point you can release both buttons.

The system will stay in this mode even when you turn it off and on again.

The only way to switch between the modes is by repeating the described process.

- **Freehand Mode:** The Xaver™ 400 can be operated in freehand mode away from the wall.

When operating in freehand mode it is recommended use the Expert viewing mode.

It is important to keep the system as steady as possible while working in freehand mode.

Please note that while operating in freehand mode there may be a reduced level of image quality that may result with difficulty detecting static living objects.

5. Troubleshooting

This section provides a list of possible system problems that you may encounter while operating the Xaver™ 400 and the suggested solutions.

4.4 5.1 Operational Troubleshooting

The following table describes the problems and solutions.

Problem	Cause	Solution
Screen does not turn on	Batteries are empty	Replace primary batteries and / or charge the rechargeable battery (see chapter 3.1.4).
	DIP switch #2 set to “LCD Off”	Set DIP switch #2 to “LCD On”.
	System is in Night Mode	Switch system to Day Mode (see section 4.3)
System does not charge the rechargeable battery	Power cable not connected properly	Check that power cable is connected securely to power input and sign appears. 
System not in focus 	System is not calibrated	Hold the system steady in open space (at least 50cm from nearest object) until the red icon disappears. If problem continues restart system.
	System error	System will automatically shutdown. Manual restart is required. If problem continues, contact Camero Technician.

4.5

4.6 5.2 Imaging Troubleshooting

The following table describes the problems and solutions.

Problem	Cause	Solution
Objects appear in 1.5D (range over time) but not in 2D display	Signal too low or object moving too fast to track	Change from Tracker to Expert Mode
Periodic curves appear in 1.5D (range over time)	Slight signal interference	This phenomena will not interfere with detection - occurs when no object is detected
View is cluttered	Wall attenuation is high (causing low signal level)	Relocate system position for better signal
		Change mode to High Penetration
		Change range to closer maximum range (4M or 8M accordingly)
No targets are shown by the system	System may not be calibrated	Point system to free space, wait for Acquisition Indicator to rotate and then to turn solid green
	Objects are in “Dead Zones”	Relocate system position to cover “Dead Zones”
		Switch to standoff positioning away from the wall
	Objects are not reflecting back to the system or shadowed by another static or moving object	Relocate system position
		Position the system higher up on the wall
	Room may be empty	Relocate system position and alternate modes to verify
	Signal is too low (check Signal Level)	Change to Expert Mode or High Penetration Mode

FCC Notice

THIS DEVICE COMPLIES WITH PART 15 OF THE FCC RULES. OPERATION IS SUBJECT TO THE FOLLOWING TWO CONDITIONS.

(1) THIS DEVICE MAY NOT CAUSE HARMFUL INTERFERENCE, AND (2) THIS DEVICE MUST ACCEPT ANY INTERFERENCE RECEIVED, INCLUDING INTERFERENCE THAT MAY CAUSE UNDESIRED OPERATION.

Warning: Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules.

These limits are designed to provide reasonable protection against harmful interference in a residential installation.

This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications.

However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

—Reorient or relocate the receiving antenna.

—Increase the separation between the equipment and receiver.

—Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

—Consult the dealer or an experienced radio/TV technician for help.

This Equipment uses the following Antenna and may not be used with other antenna types of higher gain:

Mfg.: SAMWOO electronics P/N SMAP-900-1

Type: a ¼ wavelength monopole helical antenna with 0 dB gain

Gain: 0 dBi

This Antenna is permanently attached with glue by Camero-Tech Ltd. before being shipped to customers.

Operating Restrictions:

Operation of this device is limited to purposes associated with law enforcement, fire fighting, emergency rescue, scientific research, commercial mining, government agencies, or construction. Parties operating this equipment must be eligible for licensing under the provisions of Code of Federal Regulations: CFR 47 Part 15 Subpart F. Operation by any other party is a violation of 47 U.S.C. 301 and could subject the operator to serious legal penalties.

IMPORTANT NOTE:

The Camero Xaver400 is considered UWB imaging device and is subject to FCC Coordination requirements under the CFR Tile 47 Chapter I, Sub chapter A, Part 15, Subpart F , Section 15.525. As such it is the responsibility of the users of these systems to submit the following information to the FCC prior to use of these systems.

The users of UWB imaging devices shall supply operational areas to the FCC Office of Engineering and Technology, which shall coordinate this information with the Federal Government through the National Telecommunications and Information Administration. The information provided by the UWB operator shall include the name, address and other pertinent contact information of the user, the desired geographical area(s) of operation, and the FCC ID number and other nomenclature of the UWB device. If the imaging device is intended to be used for mobile applications, the geographical area(s) of operation may be the state(s) or county(ies) in which the equipment will be operated. The operator of an imaging system used for fixed operation shall supply a specific geographical location or the address at which the equipment will be operated.

This material shall be submitted to Frequency Coordination Branch, OET, Federal Communications Commission, 445 12th Street, SW, Washington, D.C. 20554, Attn: UWB Coordination.

The operator shall comply with any constraints on equipment usage resulting from this coordination.