



OpenVision LT-S C-arm System



Portable Video X-ray
Users Guide
V4.11 450+ 100929

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Information in this guide is subject to change without notice.

CAUTION

The OpenVision™ system produces ionizing radiation when energized and must be operated by qualified personnel who must read the Warning section of the manual before operating.

Envision CmosXray LLC cannot be held responsible for damages caused by inadequate training, misuse, or unsafe practices in the operation of the OpenVision™ System.

It is unlawful to use this equipment to intentionally expose humans or to use it for medical radiography.

NOT FOR EXPORT

Export of this product requires an export license from the U.S. Department of State, Directorate of Defense Trade Controls, in accordance with International Traffic in Arms (ITAR), Title 22, Code of Federal Regulations.

Warning

To ensure proper functioning and use of this product do not use until you read and completely understand this user's guide. It contains set-up, start-up, operating, and troubleshooting procedures.

The OpenVision™ is an industrial X-ray generator that produces hazardous ionizing radiation when energized.

It is unlawful to use this equipment to intentionally expose humans or to use it for medical radiography.

The OpenVision™ is subject to state and federal regulation and state registration. Contact your state radiation equipment regulatory office before operating equipment.

The operator of the OpenVision™ must be properly trained in radiation safety before operating the unit.

Unauthorized personnel should not have access to the OpenVision™ system. Authorized personnel should safeguard the key.

Develop and closely follow a safe operating procedure for using the OpenVision™ X-ray System.

The safe operating procedure must ensure that the general public is not exposed to radiation above the permissible limits, which are 2 mR (0.02 mSv) in any one hour.

The safe operating procedure must ensure the OpenVision™ is used within federal and state regulations.

All operators of the OpenVision™ X-ray machine should wear a personal radiation monitoring device, such as a TLD (thermo luminescent dosimeter), film badge, and a pocket dosimeter consistent with company policy and state or federal government regulations.

The OpenVision™ has no explosion proof rating and should not be used in an explosive atmosphere.

All operations should be conducted to expose the operator to radiation levels "As Low As Reasonably Achievable" (ALARA). Always use the "Low" setting for mA when hand-holding the system.

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1.0 Overview

1.1 Overview

This guide contains the operating instructions for the OpenVision™ Radiographic Imaging System when used in handheld mode of operation. Additional information is available for use with robots and accessories. The system is manufactured by Envision CmosXray LLC of Anchorage, Alaska.

1.2

The OpenVision™ System utilizes a proprietary intensified video imaging system to capture radiographic images created by the interaction of X-ray photons and a phosphor screen. These images are then displayed at the handle-mounted LCD, Head Mounted Display (HMD), portable recorder with LCD display, or any other NTSC compatible device in real-time (30 frames/sec).

1.3

The OpenVision™ System is designed for applications where the equipment and cabling will not be exposed to harsh handling or environmental extremes.

2.0 Safety and Handling

2.1 X-Ray training:

It is expected that the operator of the OpenVision™ System is properly trained and qualified to safely perform radiographic inspections. This guide does not address radiation safety requirements or radiographic inspection procedures.

2.1 General precautions:

Although the OpenVision™ System is designed for portability, the equipment is delicate and fragile. Care must be used to avoid strong vibrations or shock to the imager, X-ray tube, displays and recording equipment.

Do not attempt to open or modify imager or controller housings. Opening the imager or controller housing voids the system warranty and may expose someone to stored high voltage.

Do not allow liquids to contact any part of the OpenVision™ System.

Appropriate care should be taken to protect all cabling and connectors to ensure the reliable and safe operation of the system.

An operator must NEVER expose themselves to the direct beam of the X-ray port. See Figure 1 and Figure 3.



Figure 1 Operator should always position themselves behind the X-ray port. (See Figure 3) and use the hand grips provide.

3.0 System Contents

3.1 Image Viewing Options

- Hand-held or handle-mounted 7" LCD
- Head Mounted Display
- DV Wireless Recorder with LCD

3.2 OpenVision™ System and Shipping Case Contents

- System Controller Cable – Controller to Source
- Imager Cable – Imager to Display
- Trigger Switch Cable – Controller to Arm
- X-ray Source, C-Arm, Imager, Controller w/ Strap
- Controller Key(s)
- 28V Rechargeable Lithium-ion Battery (2), Charger
- DV Recorder, Memory Card, Charger
- User Manual
- Quick Start Guide

4.0 Set-up

4.1 Set-up (See Quick Start Guide)

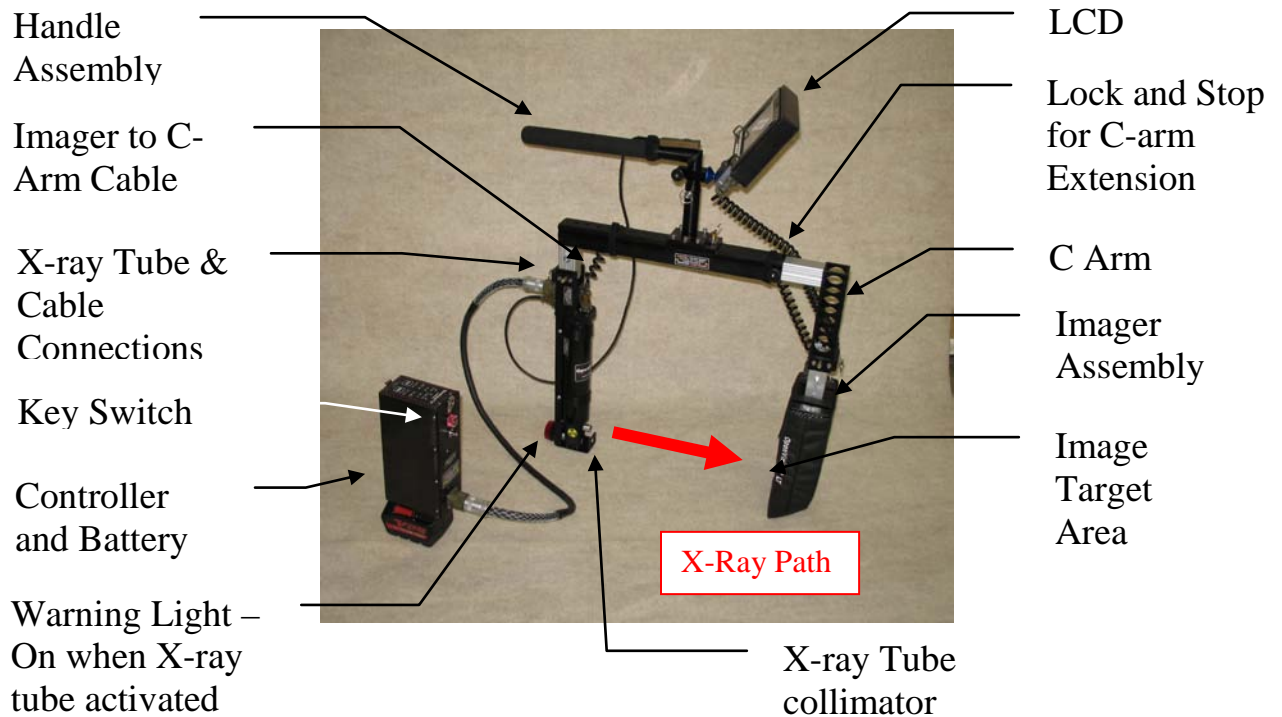


Figure 2. System components.

- Pull spring pin ring above imager and rotate to locked position.
- Pull spring pin ring above X-ray tube and rotate to locked position.
- Slide on handle – see figure for orientation of handle. Lift spring pin ring to move to comfortable position. Attach LCD to mounting ball if it is to be used. Rotate handle and LCD as needed for handling and best viewing.

D) Connect large 10 pin cable from controller to C-Arm above X-ray tube.

Note: Six pin cable connections are all interchangeable. Match male to female connections for trigger, LCD and Head Mounted Display connections. Use color coding on cable ends to assist with rapid set-up.

E) Connect coil cable from imager to X-ray tube if not already attached. The cable maybe left on for storage.

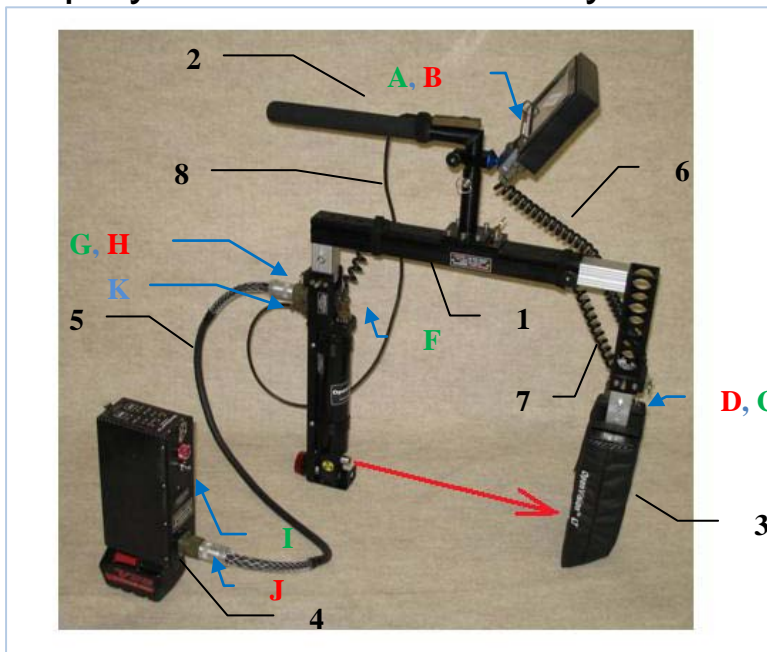
F) Connect display(s) See following matrix of connection options.

G) Connect trigger cable to the remaining 6 pin connector on the X-ray tube or to the back of the LCD. (A or G)

H) Slide battery onto the bottom of the controller and lock into place.

I) Visually confirm that the lead collimator is in place at the X-ray tube port. See Figure 3.

Video Device and Trigger Connection Matrix - There are three video channels available. Connecting multiple displays to one channel may result in poor image quality.



Cable Connections

Connection Location	Cable	Purpose
A	8	6 pin - Trigger – Option 1
B	6	6 pin – Imager/Control to C
C	6	6 pin – Imager/Control to B
D	7	6 pin – Imager/Control to F
E		BNC Video to external device
F	7	6 Pin – Imager/Control to D
G	8 or 6	6 Pin – Trigger – Option 2 or alternative LCD Connection
H	5	10 pin – Main Control
I		6 pin - Head Mounted Display
J	5	10 pin – Main Control
K		BNC Video to external device

Part/Cable:

1. OpenVision System
2. Handle & LCD
3. Imager
4. Controller
5. Controller cable
6. LCD 6-pin coil cable
7. Imager 6 pin coil cable
8. Trigger cable

* Any six pin cable can be connected to any corresponding six pin male/female connector.

Configuration	Channel 1 - Connect - G, I, K	Channel 2 – Imager 6 pin at C	Channel 3 – Imager BNC at E
HMD + Wireless DVR	HMD - I	Wireless - C	
LCD + Wireless DVR	LCD - G	Wireless - C	
HMD + LCD	HMD - I	LCD - C,	
HMD + LCD + DVR	HMD - I	LCD - C,	DVR with RCA to E or K.

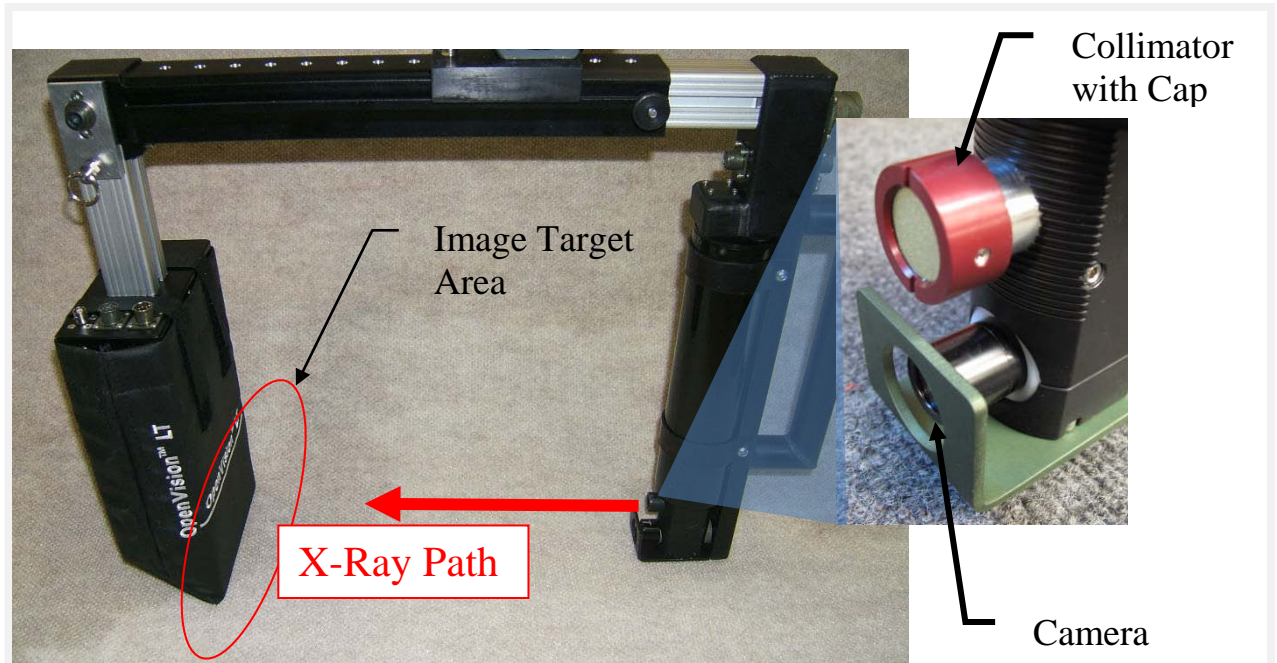


Figure 3. Xray Source and Imager Target

- J) Place key in switch and turn on:
- Display(s) will show video image from the camera that is adjacent to the port of the X-ray tube.
 - Controller will cycle through settings, beep and display Low kV and Low mA settings.

CAUTION – INSPECT TUBE AND COLLIMATOR ALIGNMENT PRIOR TO EACH USE. MISALIGNMENT OR MISSING COLLIMATOR WITH CAP WILL REDUCE IMAGE QUALITY AND MAY INCREASE IONIZING RADIATION EXPOSURE TO OPERATOR. SEE SPECIFICATIONS. CONTACT MANUFACTURER FOR ASSISTANCE IF UNIT IS DAMAGED OR REPAIRED BY SOMEONE OTHER THAN MANUFACTURER.

OpenVision™ LT Sling Attachment

The sling included with OpenVision system is designed for use with the C-arm and the optional Imager Extension Arm kit. To assist with carrying the system, attach the sling to the eye bolt in the C-arm handle and adjust the sling length for the operator.

The LCD mount and eye bolt can be turned over for a left or right handed operator.



5.0 Start Up

See Quick Start Guide with system for Preventive Maintenance Checks and Services List

5.1 Warm Up – Not required. If tube arcs, perform the following complete warm up procedure.

- One minute Low kV/Low mA.
- One minute Medium kV/Medium mA.
- One minute High kV/Low mA
- One minute High kV/Medium mA
- Two minutes High kV/High mA

If temperature is less than 32F, warm up if unit has been off for more than one hour with one minute on Low kV/Low mA and one minute on Medium kV/Medium mA. Insure safe perimeter is maintained during warm up.

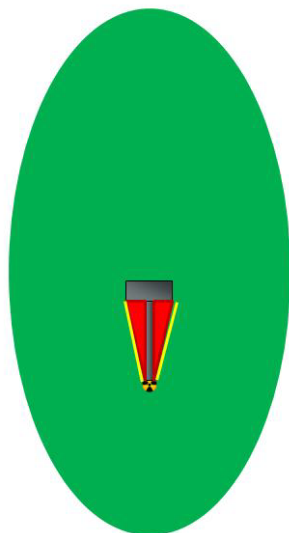
5.2 Start Up

Orient the C-arm so that the object to be inspected is between the X-ray tube and the imager. Place the imager in the farthest position from the operator. See figure 1.

Confirm kV and mA on “Low”, and Key Switch “ON”.

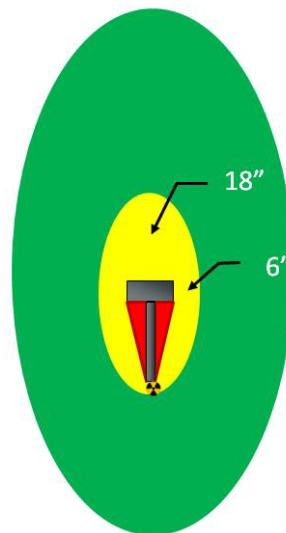
Clear personnel from the Red and Yellow areas as shown here:

Radiation Zones for Handheld OpenVision LT



Low kV Low mA

- <2mR/hr exposure
- 2mR exposure in 15 mins
- 2mR exposure in <1 sec



High kV Low mA

- <2mR/hr exposure
- 2mR exposure in 15 mins
- 2mR exposure in <1 sec

The C-arm includes a spring pin that will restrict how far the C-arm can open. This restriction limits the projected X-rays as shown above. Opening the C-arm beyond the pin stop will increase the dose beyond the imager extend the yellow zone to 35ft in high kV Low mA. Additional site control may be required.



To energize X-rays, press the trigger switch. The image will change from live video (from the camera adjacent to the port of the x-ray tube) to live X-ray video from the imager. A delay of approximately 4 seconds will occur while the X-ray generator ramps up to the selected kV and mA.

Move the C-Arm around the object to be inspected. Release trigger to adjust kV as necessary to view the object, or to meet an inspection specification. Always use the lowest kV and mA setting which will still provide an acceptable image. (ALARA) Release trigger as soon as inspection is complete to limit radiation dosage. See radiation zone figure and limit on time.

WARNING – Use only Low mA for hand-held applications to limit operator exposure. Use of medium and high mA may improve image quality for robot and remote applications. When triggered in medium and high mA settings, a constant audible alarm will sound.

Notes:

Audible Alarm: If required for site conditions the alarm can be silenced: During start up, hold the Kv and Ma switches down until three beeps are heard to silence the audible alarm until restarted.

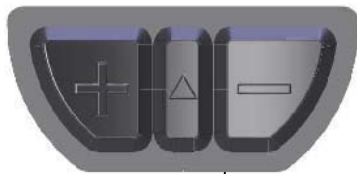
Handle Extension: Extend arm width by loosening thumb screw and extending arm gently until arm reaches stop. Lock in position to avoid bearing damage. Handle can be moved to full extension by lifting spring pin but using beyond the spring stop will increase radiation beyond the imager.

5.3 Image Adjustments

The LCD and Head Mounted Display (HMD) include contrast and brightness adjustments to optimize image appearance. Adjust LCD with controls on front of LCD by turning the Contrast or Brightness knobs.

Adjust HMD as follows:

User controls located on back of 450+ Head Mounted Display



Mode Control



Controls on Back of HMD – cable anchor not shown.

The Head Mounted Display (HMD) for NDT OpenVision™ systems clamps to a hard hat and can be adjusted to each operator.

An integrated trigger is located on the HMD cable that will activate the X-ray source and switch the video from the targeting camera to the X-ray display.

Do not over tighten the arm adjustment or the arm will be damaged. An additional cable anchor at the back of the hardhat is recommended to keep

the cable from pulling on the display and interfering with arm movement

- On/Off** Connect 450+ to the six pin connector on top of the imager or on the C-Arm above the tube. Press and hold the Plus & Minus buttons simultaneously for two seconds and the display will turn Off or back On. Turn Off the controller during normal shutdown.
- Brightness Adjustment** Press once or press and hold the Plus button to increase luminance. Press once or press and hold the Minus button to decrease luminance.
- Contrast Adjustment** Press the Mode button for one second to change from luminance mode to contrast mode. Press once or press and hold the Plus button to increase contrast. Press once or press and hold the Minus button to decrease contrast.
Press the Mode button for one second to change from contrast mode back to luminance mode.
- PAL/NTSC Mode** Before connecting to C-arm, press and hold the Plus and Mode buttons simultaneously and connect 6 pin cable. Release the Plus and Mode buttons and the display will toggle input modes (PAL to NTSC, or vice versa).
- Orientation** Press the Mode button and then connect 6 pin cable. Release the Mode button and the display will rotate 180 degrees.

6.0 Shutting Down

6.1 Shutdown

Turn off and remove the key at the controller. The system is now ready to be dismantled. Locate the system in a secure area to avoid unauthorized use.

7.0 Troubleshooting

7.1 Troubleshooting

Problem: Light on the X-ray tube blinks momentarily when key switch is turned on.

Solution: This is a normal feature to show that the X-ray on light will function properly.

Problem: Light on the x-ray tube blinks repeatedly when X-ray trigger is pressed.

Solution: Battery is low. Replace / Recharge the battery.

Problem: No output, unit does not turn on.

Solution: Check all connections. Check battery condition.

Problem: LCD Display too dark or too light in center.

Solution: Adjust brightness and contrast. Start with brightness at 50% of full scale and contrast at 40% of full scale. Adjust further for best image.

Solution: Adjust kV and mA to increase or decrease X-ray flux and power.

WARNING – Use only Low mA for hand-held applications to limit operator exposure. Use of medium and high mA may improve image quality for robot and remote applications. When triggered in medium and high mA settings, a constant audible alarm will sound.

Problem: Low X-ray output or misaligned image.

Solution: Inspect collimator and tube head for damage, misalignment or debris blocking collimator. Visually confirm focal spot is visible at bottom of collimator by removing cap. Clear debris if required and rotate tube. Tighten locking screws to secure parts in position and replace cap. If parts are damaged or missing contact Envision for parts or service.

Problem: Head Mounted Display image is rotated 180 degrees or split.

Solution: Adjust image rotation and NTSC/PAL settings. These can be accidentally changed during system assembly if power is applied when the HMD is attached. The HMD is not damaged and easily reset following the steps on the previous page 16.

8.0 Specifications

8.1 Specifications

imaging area:	4"x 6" field of view, continuously moveable
dimensions:	Adjustable for 15" to 30" between x-ray tube and imager. A stop limits extension 5" to limit dose to surrounding area. 21" throat depth.
acquisition time:	Real-time NTSC video (30 frames per second)
energy:	40/55/70 Kv, .1/.2/.3 Ma with 60R/hr output at 70kV .3mA setting, 12" from port. Beam adjusted and collimated to 4x6 imaging area at 20" frame opening. Approximately 18 degrees horizontal and 12 degrees vertical, (28 degree beam without collimator in place.)
spatial resolution:	250 micron (0.010")
weight:	C-arm: 17.5 pounds including imager and X-ray tube Extended handle: tube Controller: 5 pounds including 7" LCD 6 pounds including battery and shoulder strap
temperature:	Operating: Imager and tube: -30°F to +120°F ambient. Storage: -30°F to 150°F
display:	7" LCD Military-grade head mounted display
recording:	PV700 Digital video wireless recorder/display with 4Gb SD Card. TFT LCD display.
packaging:	All components housed in a wheeled Pelican field case, 18 x 29 x 12 inches, shipping weight 72 pounds.

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