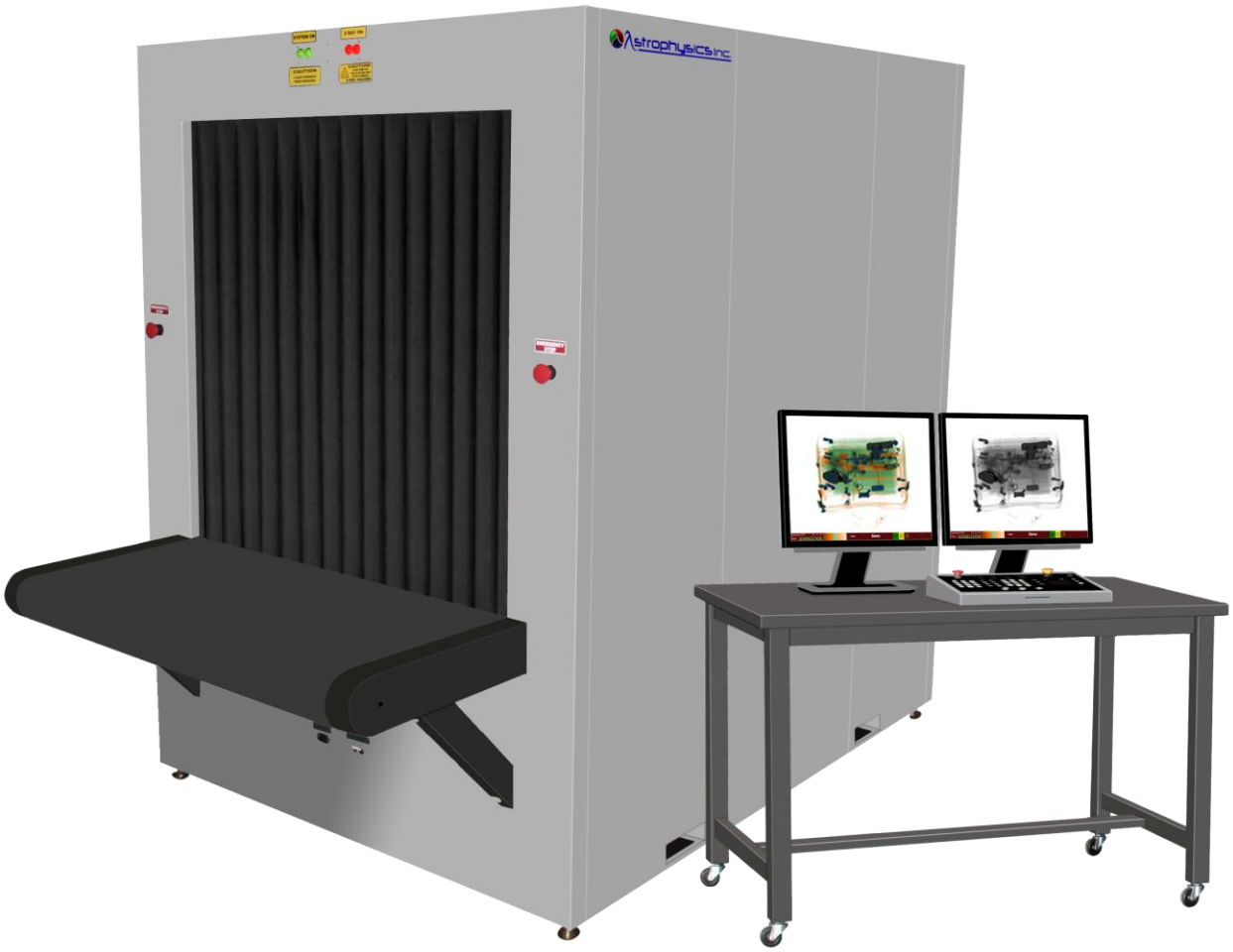
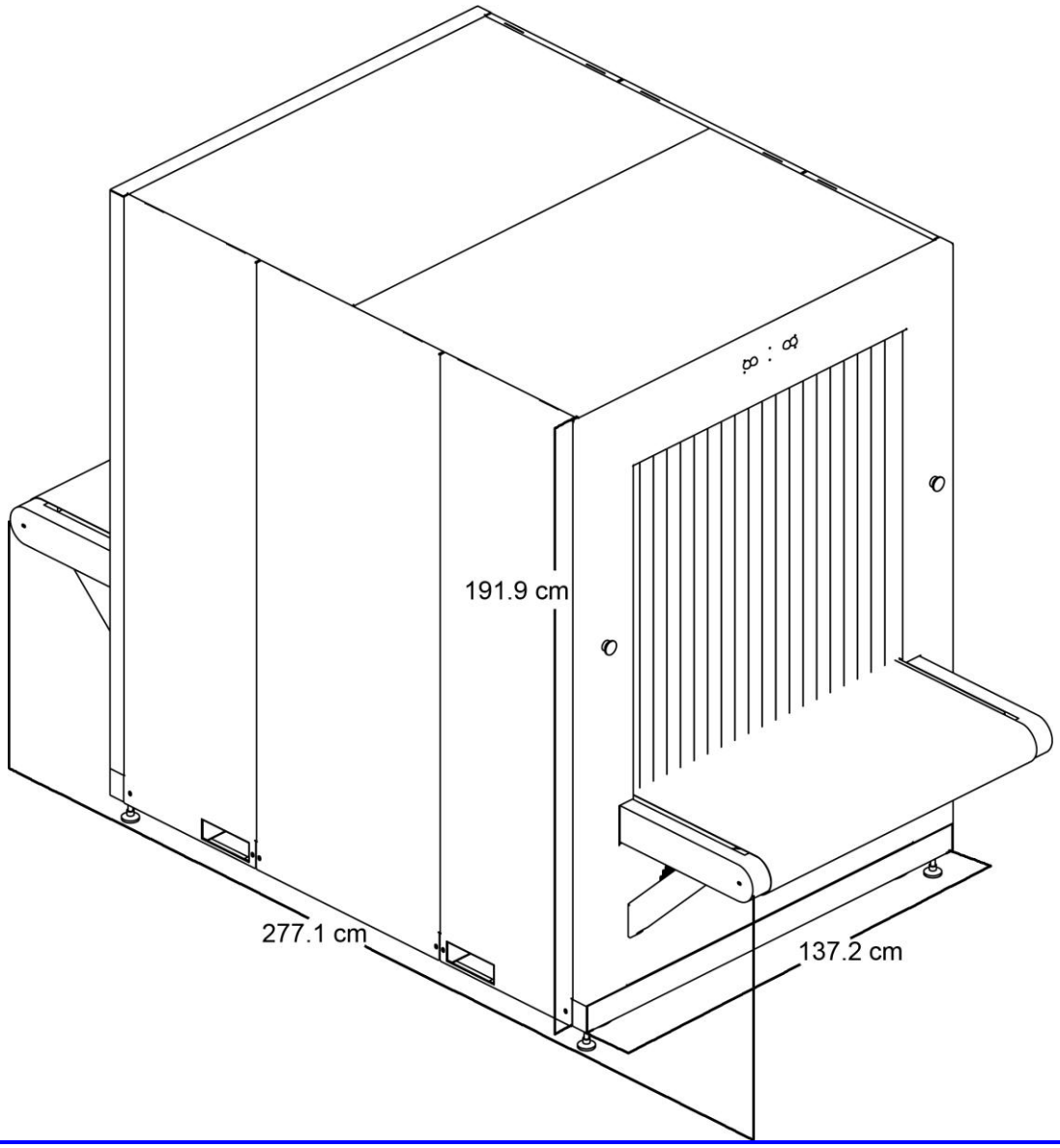
ASTROPHYSICS™



XIS-100X
TECHNICAL SPECIFICATIONS

Contents



Physical Specifications

PHYSICAL DIMENSIONS:

- L x W x H: 277.1 cm x 137.2 cm x 191.9 cm.
  109.1” x 54.0” x 75.6”
- Tunnel Opening (W x H) 101.6 cm x 101.3 cm.
  40.0” x 39.9”
- Max Object Size (W x H) 99.5 cm x 99.5 cm.
  39.17” x 39.17”
- Shipping L x W x H: 297.2 cm x 149.9 cm x 223.5 cm
  117.0” x 59.0” x 88.0”

- Net Weight: 982 Kgs (2166 lbs).
- Gross Weight 1299 Kgs (2864 lbs).

CONVEYOR SYSTEM

- Speed: 0.23 m/s (45 ft/min) in either (forward or reverse) direction.
- Motor Type: Sealed, maintenance free drum.
- Conveyor Type: Seamless Low Maintenance Belt.
- Load Capacity: 200 kgs (440 lbs) evenly distributed load.
- Conveyor Height: 71.5 cm (28.14").

ENVIRONMENTAL CONDITIONS

- Operating Temperature: 0^{o}C (32^{o}F) TO 40^{o} C (104^{o}F)
- Storage Temperature : -20^{o}C (-4^{o}F) TO $+60^{o}$C (140^{o}F)
- Humidity : 0 TO 95% (non-condensing)

Electrical Specifications

POWER REQUIREMENTS

- Power Requirements for 110 VAC input: 96-132 VAC, 60HZ (15-amp max.). Optional VAC voltage regulators are available for 100 VAC operations.
- Power Requirements for 220 VAC input: 183-253 VAC, 50 HZ (10-amp max). Optional VAC voltage regulators are available for 200 VAC operations.

X-RAY GENERATOR

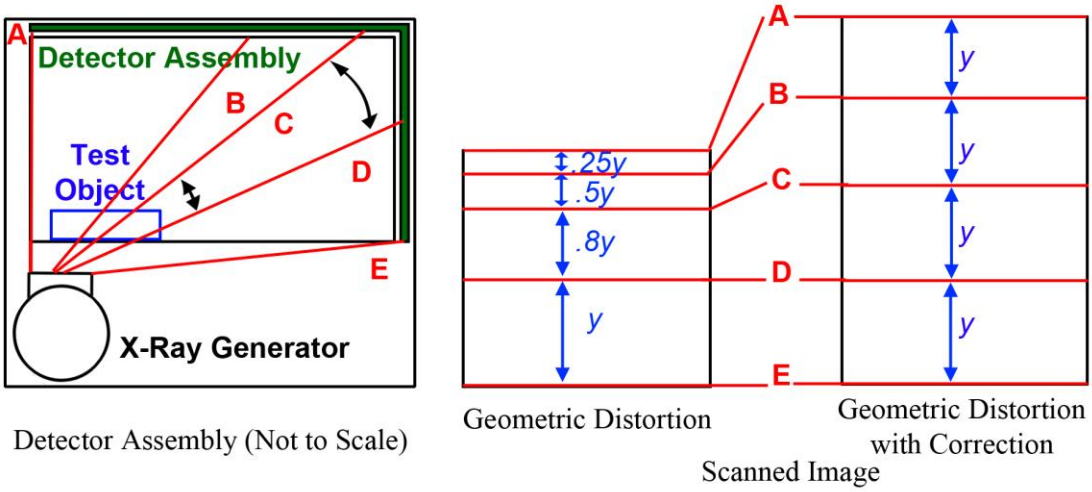
- The x-ray generator is rated at 180 kV, but operates at 165 kV.
- The x-ray tube is rated at 1.2 mA operation.
- The x-ray generator is rated for 100% duty cycle operation.
- The x-ray beam direction is diagonally upward.
- The x-ray tube uses a dielectric oil bath with forced air for cooling.
- An x-ray controller protects the x-ray generator from abnormal over-voltage and over-current operation.

DETECTION SYSTEM

- System utilizes a multi-energy (i.e. dual energy) stacked array x-ray detector assembly with total of 2304 high energy and low energy x-ray detectors.

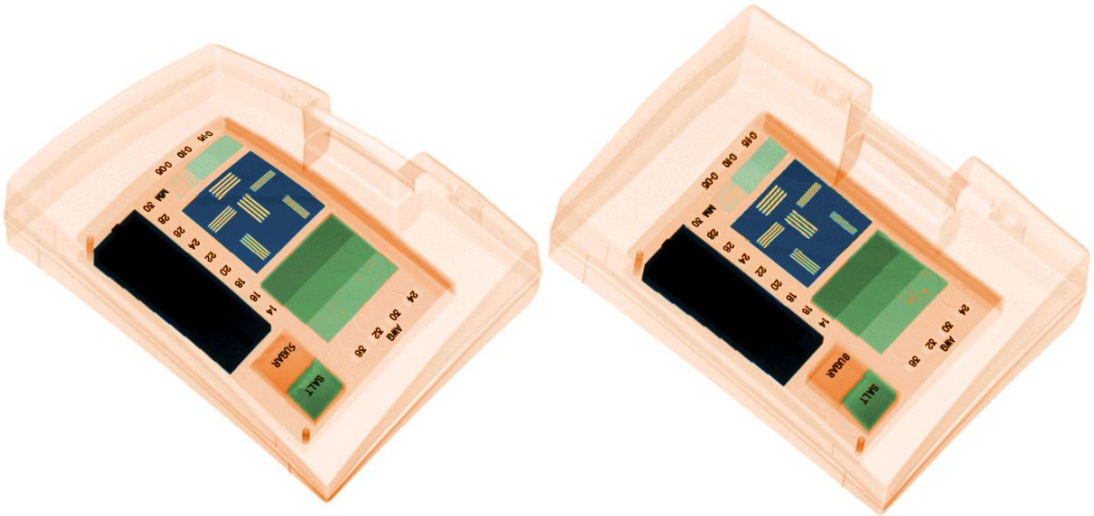
- The XIS measures and compares the transmission of *High Energy* (high frequency) and *Low Energy* (low frequency) x-rays through items that are being imaged. From this comparison, the XIS is able to determine approximate material composition.

- Detector assembly is *L-Shaped*. If left unchecked, the displayed image would present a skewed object image due to the size of the object and the variable distance from the X-ray source. As the diagram below shows, the closer the object is to the X-ray source, the more compressed the image becomes.



Detector Assembly (Not to Scale)

- XIS On-board PC automatically performs geometric correction to prevent any image skewing during the scanning process. The X-Ray client reconciles the size of the object with the distance from the X-ray source to present a uniformly thick object. As you can note on the images below, the image on the left without the geometric correction is bent, with compression becoming dramatically pronounced towards the bottom. As a result of the distortion, the image on the left is noticeably smaller then the corrected image on the right.



No Geometric Correction **Automatic Geometric Correction**

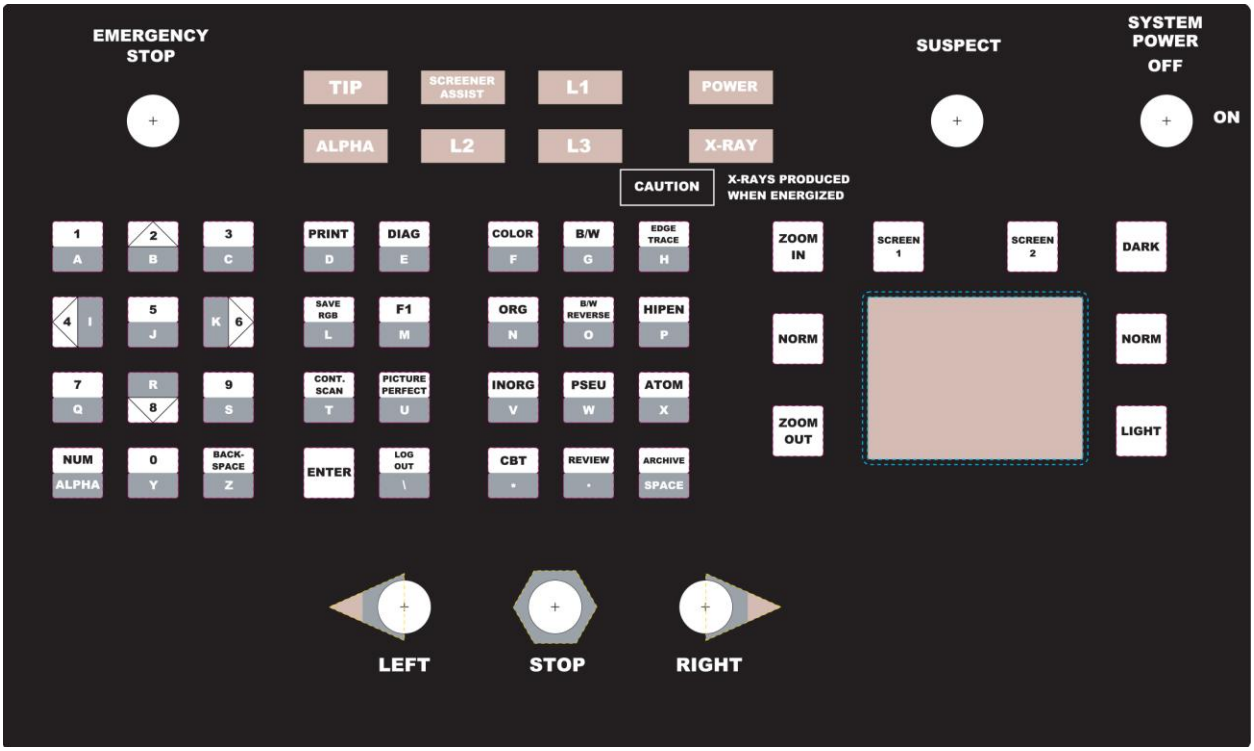
- X-ray detector assembly uses scintillating crystals and high-gain electronic amplifiers.
- The X-ray detector scans and displays the entire image without any corner cutoffs.

Interface Specifications

ONBOARD PC:

- Processor: Intel Core II DUO Technology, 3.0 GHz.
- Memory: 2.0 GB RAM,
- Storage: 160 GB HDD
- Graphics Interface: SVGA Graphics Adapter with 256 MB Video RAM
- Operating System: Windows XP Pro
- Expansion Ports: Multiple USB Ports.
- Uninterruptible Power Supply (UPS) to maintain power to PC and electronics in case of power outage. UPS is programmed to initiate PC shutdown after a pre-defined time has elapsed at which time it turns itself off in order to preserve its battery. Once power is restored, UPS restarts without human intervention and then the PC restarts normally.

ADVANCED OPERATOR CONTROL PANEL



- Ergonomic, alphanumeric design with touch pad mouse and multiple buttons dedicated to all the different image manipulation options.
- Controlled by a key switch to enable operation of control panel.
- Lights displaying the status of the machine, and a speaker that can be used for audible alarms.
- Mounted on Remote Operator Workstation along with Monitors.

MONITORS

- Two 19" high resolution, low radiation, ergonomic, LCD color monitors
- Each monitor has an image resolution of 1280 x 1024 pixels.
- Monitor One displays color imaging, enhanced organic material separation imaging, and enhanced inorganic material separation imaging.
- Monitor Two displays B&W (black on white) imaging, reverse B&W (white on black) imaging, and pseudo color imaging.

Imaging Technology

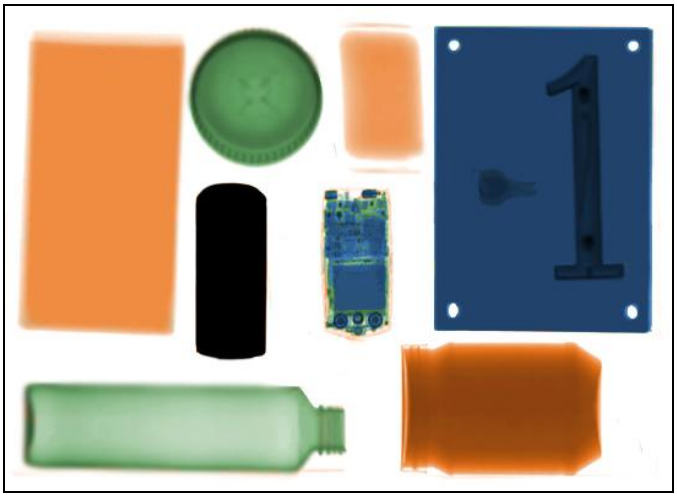
PERFORMANCE CHARACTERISTICS

- Wire Resolution: 40 AWG typical / 38 AWG standard
- Simple Penetration: 39 mm typical / 37 mm standard
- Spatial Resolution: 1.0 mm horizontal / 1.3 mm vertical
- Organic/Inorganic Material Discrimination: The system is capable of discriminating between organic and inorganic materials as measured by the ASTM F792-88 Test Piece - Test #7.
- Organic Differentiation: The system is capable of classifying organic material masked by 0.48 mm of steel as measured by the ASTM F792-88 Test Piece - Test #9.

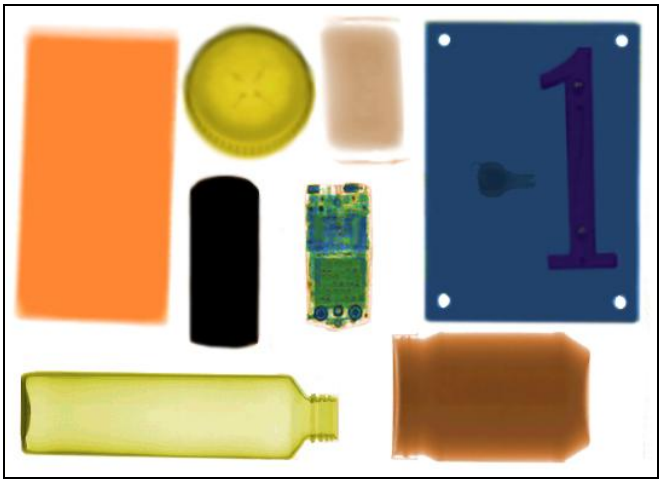
IMAGE MANIPULATION OPTIONS:

- 6 Color Atomic Display: The default display option utilizes atomic number analysis and assigns colors based on their respective densities.

Z-Number	Material Type	3-Color	6-Color	Examples	Possible Threats
0-8	Organic	Orange	Brown	Wood, Oil	C-4, TNT, Semtex
8-10	Low Inorganic	Orange	Orange	Paper, Alcohol	Cocaine, Heroin
10-12	High Inorganic	Green	Yellow	Glass	Propellants
12-17	Light Metals	Green	Green	Aluminum, Silicon	Gunpowder, Trigger Devices
17-29	Heavy Metals	Blue	Blue	Iron, Steel	Guns, Bullets, Knives
29+	Dense Metals	Blue	Violet	Gold, Silver	High-Value Contraband
-	Impenetrable	Black	Black	Lead	Shielding for Above Threats



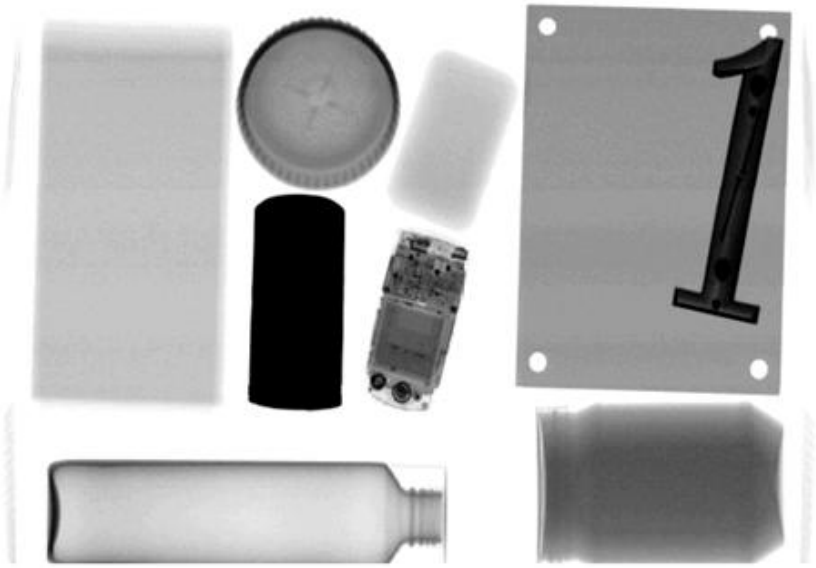
3 Color Software



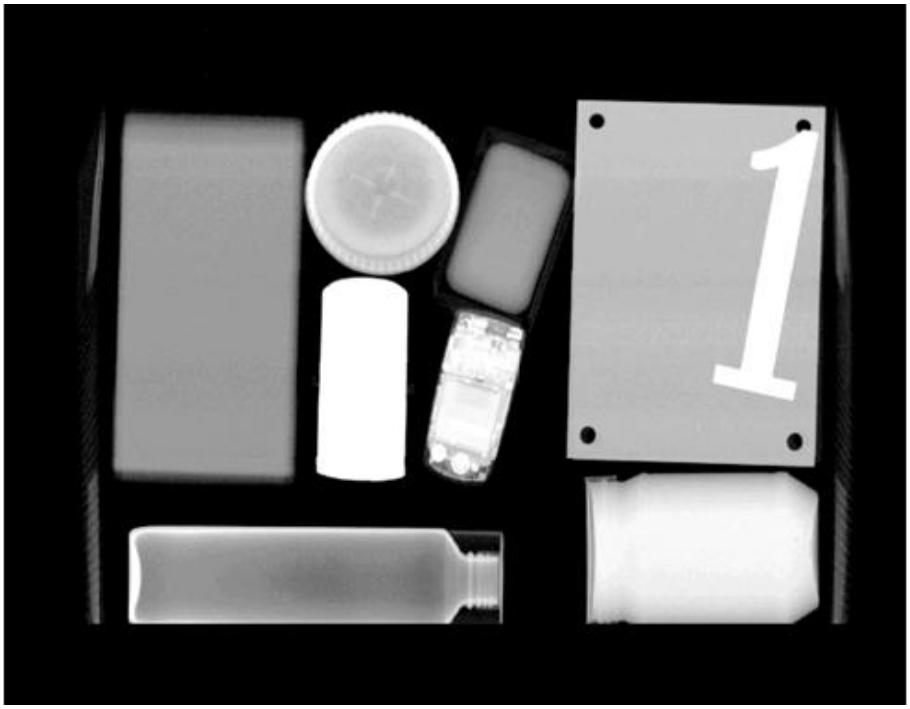
6 Color Software

From left to right, top to bottom:

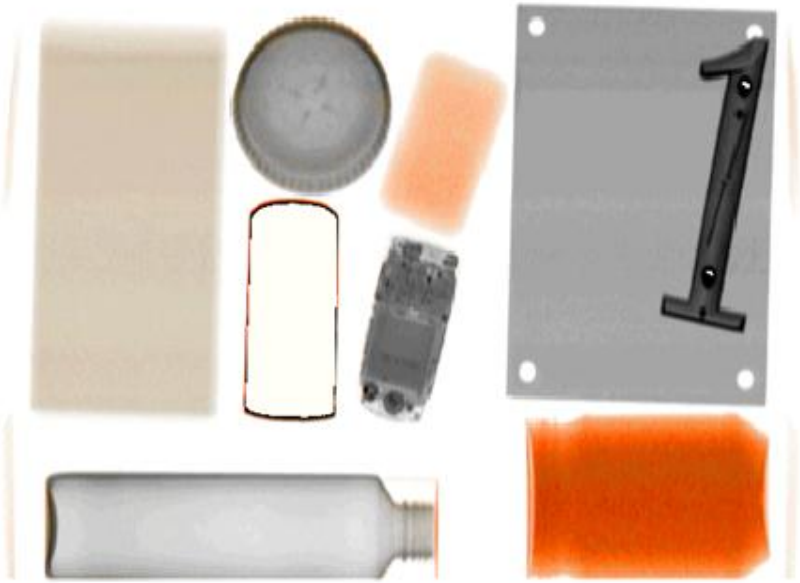
Stack of paper, ashtray, bar of soap, sheet of metal, set of keys #1 sign (silver), lead curtain, cell phone, glass bottle and peanut butter.



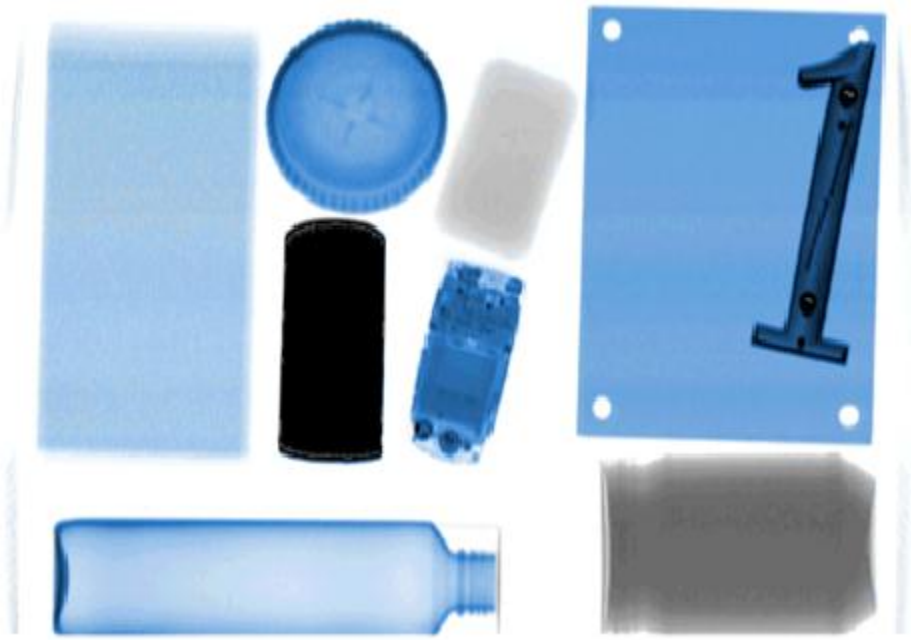
- Black and White: This option provides a standard grey scale display of the image.



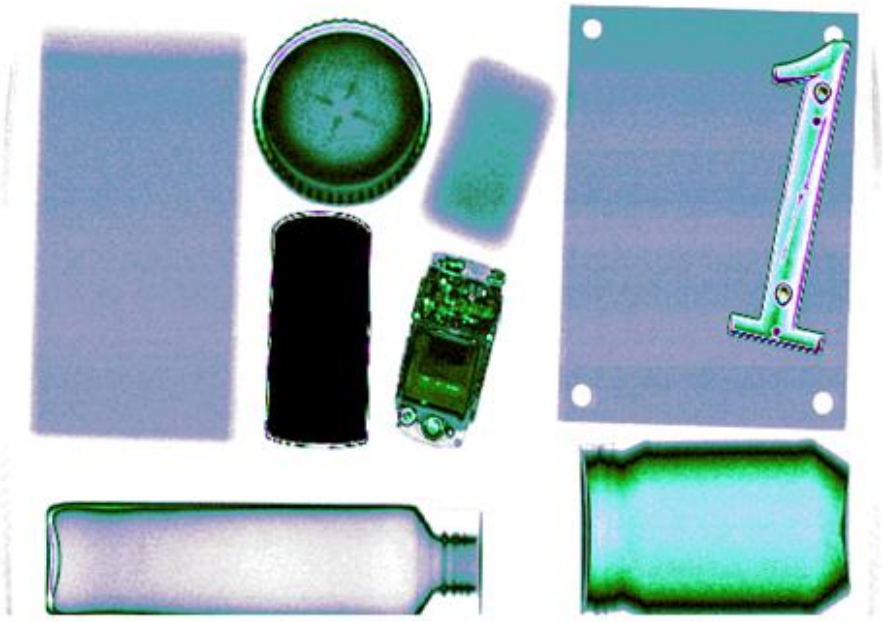
- Reverse Black and White: This option provides a reverse grey scale display of the image.

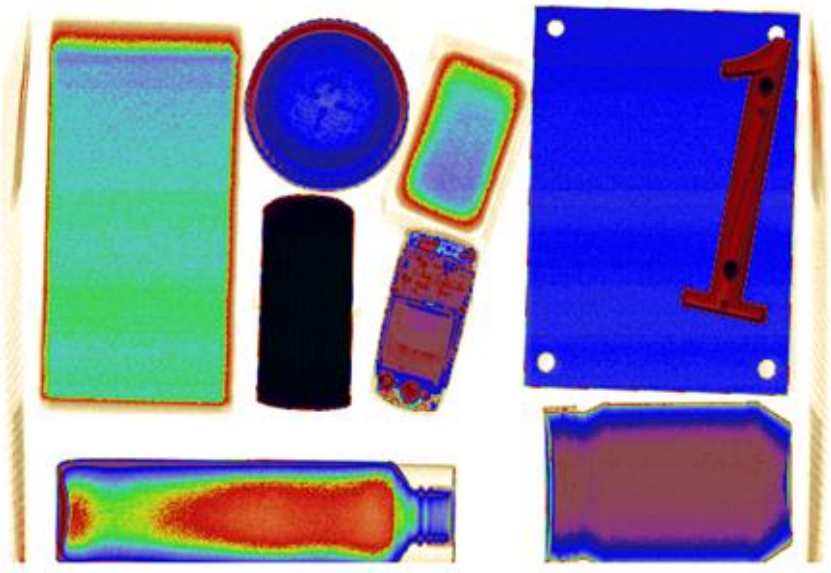


- Organic Emphasis: This option emphasizes the organic portions of the image by highlighting the organic areas in orange and displaying the rest of the image in grey.

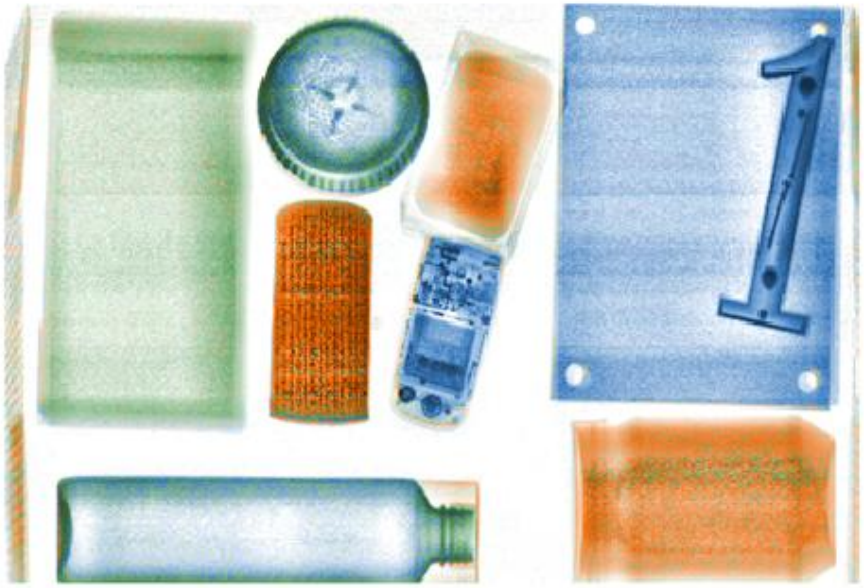


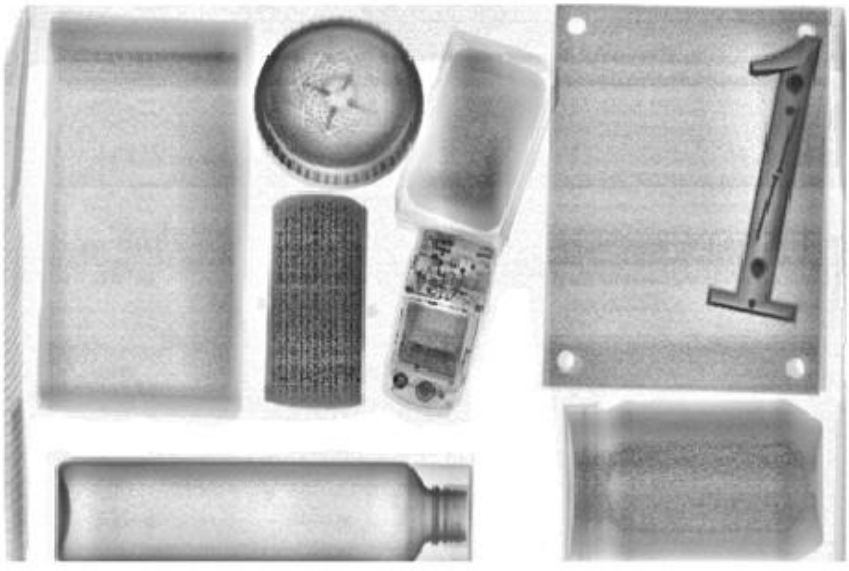
- Inorganic Emphasis: This option emphasizes the inorganic portions of the image by highlighting all of the inorganic areas in blue and displaying the rest of the image in grey.



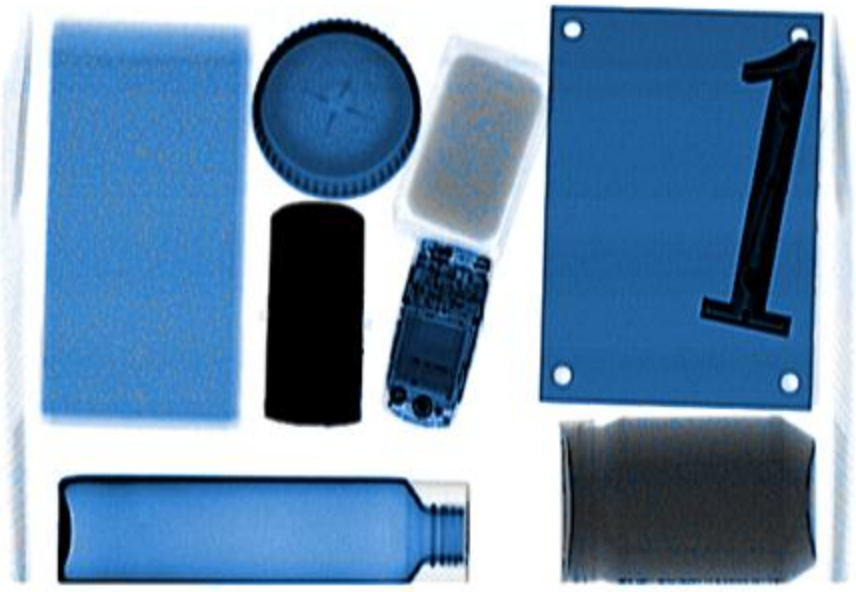


- Pseudo Color: This option applies multiple color palettes to produce unique images. The operator may scroll through available color options using the contrast button on the control panel.

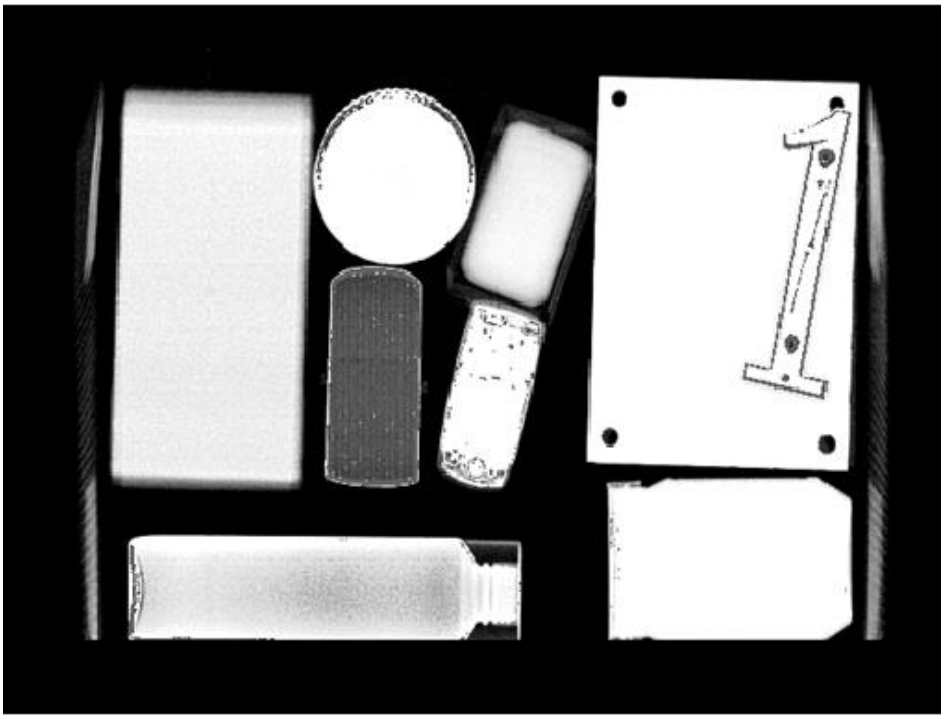




- Picture Perfect: This option automatically analyzes and normalizes an image so all areas of the scanned image are visible to the operator. When picture perfect is activated, an image containing multiple, layered objects will become very clear for identification. This feature can be utilized in both color and black and white mode.



- Edge Enhancement: This option instantly enhances the outline and shape of each individual item in the screened image so operators have an easier time assessing threats.



- Hi-Penetration: This option instantly increases the penetration level to maximum for immediate clarification in dense objects.

- Zoom: The XIS system is capable of continuous zooming from 2x to 32x. Operators can zoom the images on each monitor independently of the other monitor. Additionally, the XIS Control Panel Touch pad permits operators to pan the image up and down while the conveyor is active. Lastly, the XIS System features a 9 Quadrant Zoom based on the numeric keypad on the Operator Control Panel. This zooming function divides the screen into 9 sections, with the location of each number in the keypad corresponding to the location of the quadrant. This function permits operators to quickly jump and zoom in on individual quadrants for fast threat identification.

- Contrast: Operators can adjust the contrast and penetration power of the XIS System at the push of the button to either lighten or darken an area for improved image assessment.

- Real Time Image Manipulation: Please note that all image manipulation occurs in real time, and immediate response can be expected at the push of a button. Operators can change color modes, change Intensity Level, Zoom In Zoom out an Pan, change to Edge Enhancement mode and change to High Penetration mode without stopping the conveyor belt (except in picture perfect) and independent of each Monitor

ADDITIONAL FUNCTIONS:

- Atomic Number Selection: When operators use the touchpad mouse to drag select an area on a scanned image, the XIS System will display the atomic number for that region. This option permits operators to accurately identify material groups and assess threat objects. The Atomic number displayed will be accurate to within 0.2 counts.

- Automatic Image Archive: The XIS System automatically archives the last 50,000 images scanned. When the capacity is reach, the system will start deleting oldest images to make room for the newest images. Additionally, the PC will always attempt to ensure an available storage space of 10 GB on startup.

- Auto Centering: The XIS System automatically centers all images scanned regardless of their location during the screening process. The centering function ensures that there are no corner cutoffs or image clipping.

- Density Alert: The XIS System automatically highlights impenetrable areas with red dots to alert operators of potential contraband hiding behind the impenetrable areas.

- Image Review: The XIS System permits operators to review the last 100 images scanned in the XIS System. The operator may pick any one of the images that were scanned, and then either move forward and backward from that point.

- Image Processing. The XIS System performs continuous automatic image optimization (adjusting for contrast and gamma), and also image enhancements (geometric distortion correction) to produce an accurate and sharp image. The XIS System utilizes 24-bit real time image processing to accomplish this.

- Save Image (RGB): Operators can manually save multiple images to a different folder on the XIS System. This permits operators to pick and choose which images he/she wants to review later with a PC, or print the image.

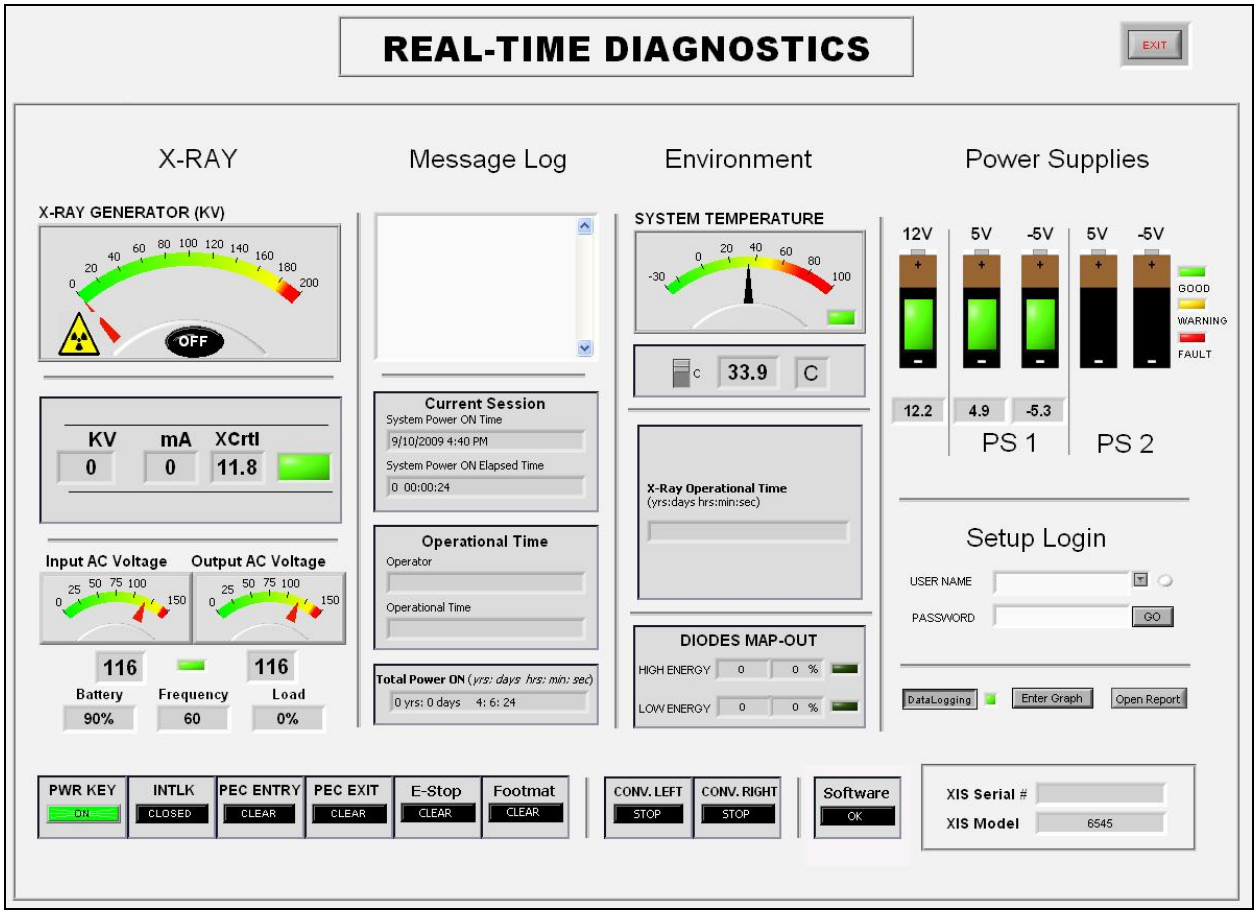
- Image Annotation: This option allows operators to draw a frame around a suspect area a scanned image and enter three alphanumeric letters for reference. Operators can then save the image for later review, or transmit the image to a Supervisor Workstation or Suspect Search Station for secondary review.

- Continuous Scanning: This option allows operators to by-pass the photo-sensors located at the ends of the tunnel and enable the X-Ray generator to be excited as soon as the conveyor belt starts moving. This function allows operators to scan very long objects without image distortion and cutoff.

- Computer Based Training: The XIS System features an operator training program with a pre-scanned image library containing various normal and threat images. After this feature is activated, the software will start scrolling both normal and threat images, giving operators time to identify the threat by pushing the 'Suspect' button the control panel. If the Operator misses a threat, the system will stop and flash the image. The Software is not meant to score the operator, but merely train him/her on possible threats that might appear in the system.

- Print: The XIS System features a print function that allows operators to print the current image at the push of a button. Though the XIS System does not include a printer, it is compatible with most modern day printers with a USB connection. Customers may also request a specific printer for their XIS System.

- Continuous Real-Time Self Diagnostic:



Continuous Diagnostics Software Display

- The XIS System is equipped with a self diagnostic system and display which permits operators to view the following information:

    - Internal Power Supplies
    - Environmental Temperature

- AC Voltage and UPS Monitoring
- X-Ray Generator Power
- Power Key
- Interlock Switch
- Emergency Buttons
- System Power On / Elapsed Time
- Operator Time.
- Total Power On Time
- Diode Map Out.

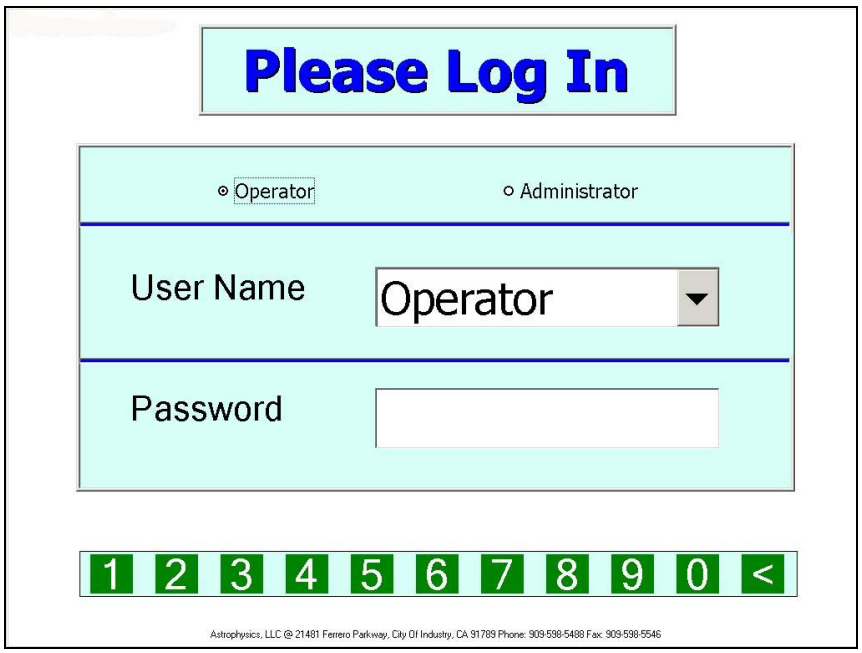
- Additionally, the Continuous Diagnostics Software Display also features a message log so the system may notify the operator of any potential failures or errors.

XIS Interface Task Bar

- Baggage Counter: The XIS Interface screen features a baggage counter.

- Date/Time Display: The XIS interface screen features a date / time display.

- Operating Mode Display: The XIS Scanning Screen displays a task bar indicating the image manipulation mode the operator is currently in.



XIS System Login Screen

- Multi-Tiered Security: The XIS System interface features a multi-tiered security with different levels of accessibility and unique programmable passwords for each individual operator and administrator.

Health and Safety

APPLICABLE HEALTH AND SAFETY REGULATIONS

- USA FDA for cabinet X-ray Systems (Federal Standard 21-CFR 1020.40)
- Health and Safety at Work Act 1974 - Section 6, amended by the Consumer Protection Act 1987
- U.S. Federal Aviation Administration Standards “Use of X-Ray Systems” (Federal Standards 14 CFR 108.17 and 14 CFR 129.26).

SAFETY FEATURES

- External radiation leakage of less than 0.1mR/Hr (1µsv/hr) as measured in contact with outer panels. Radiation leakage measurements are performed with a scatter block device in path of the x-ray beam to identify the worst-case radiation leakage.
- Two “Emergency Stop” buttons are placed on each side of the X-Ray machine, and one additional “Emergency Stop” button located on the Operator Control Panel.
- *Power-ON* and *X-ray ON* indicator lights are located at both ends of the x-ray inspection tunnel and on the Operator Control Panel.
- Interlock switches are located on critical access panels. The interlock switches disables conveyor belt operation and x-ray generation when a critical panel is opened or removed.
- Circuit breakers that disconnect power from the main AC input into the XIS if the unit becomes overloaded
- A key-switch that requires that a key be inserted and turned to the “ON” position to power up and operate the XIS unit.
- Prominent labels that warns users to not insert any part of their body when the x-rays are produced.
- All XIS Systems are protected by a minimum of 2 layers of lead curtains on both the entry and exit portions of the inspection tunnel. The lead curtains prevent harmful radiation from escaping the X-Ray tunnel.

Optional Software / Accessories

SOFTWARE

- Threat Image Projection Software: TIP is an important training software for all operators and administrators. The software operates by inserting various threat objects into objects scanned by the operator. When a threat object is detected, operators can push the 'Suspect' button on the control panel to identify the threat. If the operator fails to identify a threat, the system will stop and the image will flash on the screen to warn of the missed threat. TIP permits administrators and trainers to improvise various baggage and cargo to evaluate the skill of each operator in detecting and identifying threats and insure the operator is constantly focused on the screen. The TIP software may be enabled and disabled from the administrator menu, as to not disrupt the standard screening process.

Screener Assist

- Screener Assist Software: The Screener Assist Software is a real-time programmable detection tool designed to aid operators in threat assessment and identification. Operators can define the atomic numbers that they are searching for (i.e., guns) using the utility included in Screener Assist. The Software will then proceed to draw ellipses around any areas with the atomic numbers that the operator specified. Up to four different atomic number ranges may be specified, and the Screener Assist software will actively search for these ranges in real time during the screening process.

- Localized Language Support: Multiple languages are offered and may be set as the default operator interface language (Arabic, Chinese, English, French, Italian, Japanese and Spanish are available; additional languages available on request).

- Remote Diagnostics: The remote diagnostic software allows operators to connect the XIS-System to the factory floor for maintenance, diagnostics, and troubleshooting.

HARDWARE

- Extended Roller Beds: The XIS System may be supplemented with extended roller beds for longer clearance and larger objects. Additionally, the Roller beds may be motorized as a secondary option.

- 24" LCD Monitors: The XIS System can be upgraded to dual 24" LCD monitors for super large and sharp image display as oppose to the standard 19" LCD Monitors.

- Radiation meter: Customers may choose from Multiple Radiation Meters to perform on-site checks for possible radiation leakage and ensure the health and safety of all present.

- System Drape: The System drape is an additional cover for the XIS System when the unit is not utilized. The cover protects the system from potentially damaging particulate accumulation.

- Line Conditioner: The line conditioner contains a voltage stabilizer that serves as a buffer between the localized power source and the XIS system. The stabilizer protects the XIS system by compensating for unpredictable energy spikes and abrupt drops in power. It also includes an EMI (Electro Magnetic Interference) filter to minimize electrical noise.

- Footmat: The Footmat is an additional safety interlock system to ensure that the operator is present at the designated location during the XIS System operation. Unless the operator places his/her foot on the mat, the system will not function.

- Custom Paint: Customers may specify a particular paint scheme or additional artwork to ease placement of the XIS System into existing facilities.

- Test Bags: Customers may choose from multiple ASTM and Test Bags to perform on-site checks for consistency and reliability of units after repeated scans. The ASTM Test kits serve as a baseline for which the performance of multiple units may be evaluated.

- Tropical Kit: The Tropical Kit add-on mounts additional fans and desiccants within the XIS System so the unit remains unaffected in areas with high precipitation and humidity.

- Polar Kit: The Polar Kit add-on mounts a heating pad on the generator in order to keep the XIS System within the optimal operational temperature in areas of extreme cold.

- Desert Kit: The Desert Kit add-on mounts additional fans within the XIS System so the unit remains within the optimal operational temperatures in areas of extreme heat.

- Suspect Search Station:

    - The XIS Suspect Search Station is an integrated workstation featuring the latest Astrophysics PC and software revisions designed to address any potential threat objects that may pass through the initial screening process by serving as a secondary image analysis and manipulation station.

    - At the touch of a button, the operator of an XIS X-Ray Inspection System can send a suspect image to a reviewer at the Suspect Search Station via an Ethernet or local area network connection. The reviewer can then utilize the image manipulation tools and help the operator conclusively identify potential threat objects. Operators can continue screening more objects while the reviewer conducts a detailed examination and manipulation of the suspect image. In this configuration, the Search Station minimizes the amount of time necessary to scan multiple objects without sacrificing any security.

    - The Search Station includes a Dell PC, dual 19” (upgradeable 24”) LCD Monitors, operator control panel, and worktable.

Suspect Search Station

- Supervisor Workstation:

    - The XIS Supervisor Workstation is an integrated workstation featuring the latest Astrophysics PC and software revisions designed for Administrators and supervisors to monitor the screening process of multiple XIS Systems.

    - When the workstation is properly configured and connected to a local connection, administrators can monitor the activities of all Remote and Suspect Workstations to ensure operators stay focused and alert. By displaying the desktops of all networked operators on the Supervisor Workstation Monitor, administrators can view exactly how each operator screen and manipulate scanned images and intervene if necessary. The workstation also permits Administrators to access all linked XIS Systems remotely to revise the accessibility of operators, add / remove operators, set passwords, and schedule shift schedules.

    - The Supervisor Workstation includes a Dell PC, dual 19" (upgradeable 24") LCD Monitors, keyboard/mouse, and worktable.

Supervisor Workstation