Rapiscan systems

An OSI Systems Company

636SV
Mobile X-ray System

Operator Manual

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1.0		Oct. 2013	AH	New 636XR Document

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- The 636 Mobile Conventional X-ray is designed in accordance with the Ionising Radiations Regulations, IRR99 and the European Community, Radiation Protection (96/29/EURATOM).

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Revisions

With continual development of our products, Rapiscan Systems reserves the right to amend the specifications without notice.

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1 Introduction

1.1 Scope of Manual

This manual covers the basic features, operation and maintenance of the Rapiscan 636SV Mobile Security X-ray System.

1.2 General System Description

The Rapiscan 636SV Mobile Security X-ray System is a mobile security X-ray system consisting of a van, a full X-ray scanning system, Operator table, computer and monitor, auxiliary battery and power generator, and special gull-wing doors that can be raised to allow access to the X-ray system's exit and entry tunnels so that packages can be placed on the system's conveyor to be moved into the X-ray inspection tunnel and scanned.

Figure 1-1 636 SV Mobile System

1.3 Rapiscan 628XR X-ray System

The centerpiece of the Rapiscan 636SV Mobile X-ray System is the 628XR X-ray Security System.

1.4 Reference Documents

Rapiscan Supplied Reference Documents

- 92293119 Rev 1 .0 - Rapiscan 636SV Mobile X-ray System – Service & Warranty Record.
- 9278500 Rev 5.0 – RAP 6XX Series Start up Guide.

External Reference Document

- HDKBB Cummins Commercial Mobile Generator Operation & Maintenance Manual.

1.5 Types of Alert Messages

	**Danger Symbol** Indicates a hazard with a high level of risk which, if not avoided, will result in death or serious injury. This alert sign is limited to the most extreme situations.
	**Warning Symbol** Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.
	**Caution Symbol** Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury and/or equipment damage or generally unsafe practices.
	**Notice Symbol** Indicates an important notice to the reader, which does not necessarily involve the possibility of personal injury or equipment damage.

Warnings, cautions, notices, and all written instructions must be read and followed by all personnel and operators of this equipment.

Failure to follow all warnings, cautions and instructions may result in damage to the equipment or injury or death to personnel. It may also nullify any warranties.

Always follow these general safety rules and guidelines to ensure safe operation.

1.6 Product Summary

A baggage type cabinet x-ray inspection system is a machine that is specifically designed to generate x-rays in the low-to-medium keV energy region (50-200 keV) for use in security screening operations. A cabinet x-ray inspection system means the x-ray source (i.e., x-ray tube, x-ray generator, x-ray tank) is installed inside an enclosure or cabinet which, independent of existing architectural structures except the floor on which it may be placed, is intended to contain at least that portion of a material being inspected, provide radiation attenuation and exclude personnel from the cabinet interior during the generation of x-ray radiation.

Baggage type cabinet x-ray inspection systems are regulated by applicable federal and state laws. These systems are equipped with warning lights, warning labels, safety controls, safety interlocks, E-Stops and shielding materials that must be maintained, inspected, and tested routinely.

It is important only trained and qualified individuals operate this x-ray radiation emitting machine. These individuals in turn must ensure the x-ray machine is maintained in excellent condition, that all operators and individual members of the public adhere to and obey all warning labels and that all safety features are maintained operational.

This manual provides safety precautions, basic radiation safety information and operational procedures necessary to safely operate the system and to ensure the risk associated with radiation emitted by the baggage type cabinet x-ray inspection system is maintained below regulatory limits and remains as low as reasonably achievable (ALARA).

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2 Warning and Cautions

2.1 General Warnings

Warnings, cautions and instructions must be read and followed by all maintenance personnel and operators of the equipment.

Failure to do so may result in damage to the equipment and/or injury or death to personnel. It may also nullify any warranties provided by the manufacturer.

Operational and radiation safety are key factors during operation of the system.

It is vital that all operators and maintenance personnel be aware of the safety features, equipment, and procedures of the system.

Information presented in this section highlights the special attention that needs to be paid in order to keep personnel safe at all times.

No person must commit any acts that cause unsafe events on an x- ray system when it is in operation. Lifting the lead drapes for any reason when the x-ray beam is on, or exposing any part of the body to the primary x-ray beam, or covering the X-RAY ON lights or x-ray warning labels are examples of unsafe events.

Never insert your hands, arms or any other part of the body into the cabinets scanning area when X-RAYS ON. If the operator must be within the cabinets scanning area for a legitimate reason, ensure the X-ray machine is turned OFF while the operator is in this area. The operator MUST caution all material handlers about this requirement.

Ensure all safety controls, warning indicators and warning labels are functioning and in good condition before operating the unit. Replace if warning indicators are not functioning or if labels are no longer discernible prior to operations.

The baggage x-ray inspection system must be located in such a way that under conditions of use, individuals whose baggage (or other belongings) is to be screened with the x-ray inspection system must be more than 0.50 meters away from the access port openings of the cabinet while the x-ray beam is on.

The baggage x-ray inspection system must be located in such a way that under conditions of use, members of the general public, excluding staff authorized to work with or near the system and those individuals whose baggage (or belongings) is to be screened, must be more than 2 meters away from the x-ray inspection system

Moving and/or relocating the baggage x-ray inspection system can affect components critical to safety. If the baggage x-ray inspection system is moved and/or relocated, maintenance personnel and/or other suitably qualified person(s) must test and ensure all safety interlocks are functioning properly as intended by design; examine and ensure all radiation shielding is free from structural damage (i.e., puncture, hole, dent, missing part); examine and ensure the lead clamps that hold the anode and cathode terminals onto the chassis of the x-ray tube housing assembly are positioned correctly; conduct the normal in-beam quality imaging tests and, if discrepancies exist, investigate the x-ray tube assembly, the collimator setting, and the radiation exposure parameters (tube current, high voltage, filters, etc.) for possible causes; and ensure all problems are resolved satisfactorily before the x-ray inspection system is placed into operation

The baggage x-ray inspection system must be thoroughly tested and verified by trained and qualified personnel to ensure all radiation shielding components and safety devices, including warning lights are installed and functioning, *before* the x- ray system is placed into operation.

No person must create a physical or mechanical condition that ultimately makes the x-ray inspection system unsafe to operate. Defeating safety devices, placing liquid-filled containers on the x-ray inspection system, positioning x-ray inspection systems in confined spaces for carrying out routine maintenance and operational test functions, and positioning x-ray inspection systems for use in areas exposed to rain or snow are examples of hazardous conditions.

Do not remove any conveyor covers or shrouds at any time during x- ray inspection operations. These covers are intended to prevent the insertion of any part of the body into the primary x-ray beam and to maintain radiation levels at or near the entry and exit ports of the cabinet to as low as reasonably achievable and within regulatory radiation leakage limitations.

Electric Shock Hazard: DO NOT touch electrical wire terminals by hand or with a conductive tool.

Pinch Hazard: DO NOT contact or touch the moving conveyors during operations.

The apparatus must have an earth connection. This is normally supplied through the power cord

Do not sit or stand on the conveyor, even when the system is switched off.

Do not remove any service panels during x-ray inspection operations. All maintenance must be performed by qualified maintenance or service technicians while the x-ray generator is secured.

To minimize the risk of fire, an approved type of power connector and cable must be fitted. Since different connectors are used in different countries, the safety approval varies. Following is a list of approval marks that are relevant. Do not fit power connectors that are unmarked or from unknown manufacturers

When dangerous objects such as explosives, guns or other weapons are identified in the X-ray image, follow the procedure established at your facility to safely resolve such events

Modifications to this baggage x-ray inspection system are strictly prohibited. The system owner must contact the manufacturer

The footmat must not be bypassed by placing heavy objects on it to simulate the presence of an operator. This not only damages the footmat but also, more importantly, allows an operator to keep the X-ray machine operating without an Operator being at the controls. Thus an Operator might place him or herself in danger while the machine is still operating: placing a limb, for example, inside the X-ray machine tunnel or touching the rollers while they are still rolling. Again, never place anything on the footmat other than the Operator's own weight and never do anything to circumvent the footmat.

2.2 Electrical Rating

The 636SV System is designed to function at 230V or 110V +/-10% to compensate for variations in supply voltage. Supply voltage fluctuations are not to exceed +/-10% of the nominal voltage

MODEL	VOLTAGE	CURRENT	FREQUENCY
636SV	110/230V	13/6.5A	50/60Hz

2.3 Additional Safety Equipment

Among the additional safety equipment offered by Rapiscan Systems is a safety foot mat. The conveyors and X-rays will shut down within less than a second if the operator removes his or her weight from the foot mat.

Figure 2-1 Typical 636 Mobile System Foot mat

2.4 Film Safe

Rapiscan X-ray single view systems are film safe. A comprehensive range of independent scientific tests have been performed on low to medium energy baggage X- ray inspection systems. The test films were subjected to 32 passes through the baggage X-ray inspection machine, then processed and analyzed. Copies of these documents are available from Rapiscan Systems

A short excerpt from the test results are provided below

“Over 300 films from all the major manufacturers were used in the tests. These films ranged from those typically used by holidaymakers and amateurs, such as ISO100 color negative film for prints, to high speed, high quality professional films. These ranged from ISO64 slide film to black and white film which was push processed to an exposure index of EI 3200.”

“To test the effects of multiple exposures to X-rays, several rolls of each type of film were used. Each roll was passed through the X-ray machine a different number of times, ranging from zero to 32.”

“The results showed that none of the films suffered any visible effects when viewed on a light box, even after multiple exposures to X-rays.”

2.5 Types of Alert Messages

Radiation

This symbol indicates content in this manual regarding components on the machine that emit X-ray radiation.

Risk of Danger

Consult the Operator Manual or Maintenance Manual in all cases where this symbol is used on the machine before operating or maintaining the machine.

Risk of Electric Shock

This symbol indicates content in this manual regarding hazardous voltages present when the machine is energised.

Protective Conductor Terminal

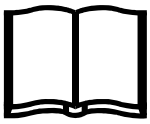
This symbol indicates content in this manual regarding a terminal which is bonded to conductive parts of the machine for safety purposes and is connected to the external protective earth or ground.

Anti-Static

This symbol indicates content in this manual regarding anti-static electricity precautions that should be used to prevent damage from occurring to components on the machine.

Lifting Hazard

This symbol indicates content in this manual regarding components on the machine that should not be lifted or moved without assistance.



Book Symbol

This symbol indicates a reference in this Manual to document(s) that should be read, which may include manuals from OEMs. This symbol is also used to highlight definitions inserted into the text.

Book Symbol

The CE mark is the official marking required by the European Community for all Electric and Electronic equipment that will be sold, or put into service for the first time, anywhere in the European community

2.6 Drugs and Food

There are no known adverse effects of radiation absorbed dose to food or pharmaceuticals which are conveyed and inspected by a baggage X-ray inspection system used for security screening. The radiation absorbed dose received by objects scanned by most systems, including the Rapiscan Systems baggage x-ray inspection system, is 1 millirad or less.

The minimum radiation dose used in food irradiation for food preservation or destruction of parasites or pathogens is 30,000,000 millirad. For further information on the limits on radiation used for food inspection or food irradiation see Title 21 CFR 179 and/or contact FDA's Center for Food Safety and Nutrition or the United States Department of Agriculture Food Safety Inspection Service.

An additional reputable resource is the World Health Organization (WHO). Below is a summary excerpt of their research on this subject of irradiation:

High-dose irradiation: wholesomeness of food irradiated with doses above 10 KGy, a joint FAO/IAEA/WHO study group. Geneva, Switzerland, 15-20 September 1997

"On the basis of the extensive scientific evidence reviewed, the report concludes that food irradiated to any dose appropriate to achieve the intended technological objective is both safe to consume and nutritionally adequate. The experts further conclude that no upper dose limit need be imposed and that irradiated foods are deemed wholesome throughout the technologically useful dose range from below 10 kGy to envisioned doses above 10 kGy"..

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3 Radiation Safety Requirements for Safe Use

IMPORTANT:

This section is not intended to be a substitute for an approved radiation safety course, which is required to be reviewed or administered by the appropriate radiation protection regulatory authority, their approved designee or by the system manufacturer.

Radiation emitting devices are regulated machines which may require regulatory licensing or registration.

It is the System Owner's responsibility to determine and/or obtain any required licensing or registration through the applicable radiation protection regulatory authority.

The 636 Mobile System is a Non-Intrusive Cargo Inspection System specifically designed to generate low-to-medium energy (6MeV Maximum X-rays) for use in screening operations.

This section provides requirements and guidance necessary to ensure the radiation risks associated with operating this system remains negligibly low (i.e., the same as the risks from unavoidable, natural background radiation levels).

Specific responsibilities for the owner of the system, operator and maintenance personnel are provided, as well as, information on safety procedures, standards, surveillance and monitoring.

This approach is in accordance with the 1990 International Commission on Radiological Protection (ICRP) objectives (1) to prevent the occurrence of deterministic effects (those for which the severity of a biological effect increases with dose and for which a threshold may occur) and to reduce the incidence of stochastic (random) biological effects to acceptable levels.

While it is well known ionising radiation can be harmful, the beneficial uses of ionising radiations continue to be utilised in a variety of applications in medicine, industry, research and consumer products.

Regulatory agencies worldwide recognise the widespread applications of ionising radiation; the International Commission on Radiological Protection (ICRP) has recommended a system of radiological protection which, when followed, will ensure the risks from ionising radiations remain low.

In this context, the system must be and have been designed and constructed to conform to regulatory standards, and persons who install, use and maintain them **must** know the hazards inherent with such systems and adhere to recommended procedures.

If radiation risks are to remain low, personnel at every facility where the system(s) are installed must maintain strict adherence to the responsibilities charged to them.

3.1 System Owner

The ultimate responsibility for the radiation safety of the system, operators and the general public rests with the owner.

The system owner must ensure the system(s) meet all applicable radiation safety standards. In every facility where a system(s) is in use, the system owner or designee is responsible for:

- Ensuring the system(s) is positioned in a location for its intended use
- Ensuring all operators and support personnel have received training on the proper operation and radiation hazards relevant to the system(s) installed (prior to using the system)
- Ensuring the training program is reviewed by the appropriate radiation protection regulatory authority
- Prescribing radiation safety guidelines, safe operating and emergency procedures, and making readily available a copy of these guidelines, procedures and applicable regulatory standards for use and reference by operators and support personnel
- Implementing a method of verification, supervision and periodic review to ensure all operators and support personnel have read and understood the relevant parts of the applicable guidelines, operating and emergency procedures, regulatory standards and operator and radiation safety training before operating the system

- Establishing a maintenance and inspection program, taking into account the age and frequency of use of the system, which ensures all safety devices and components critical to radiation production and shielding are routinely checked and the defective parts replaced or repaired
- Ensuring trained maintenance personnel or designated contracted service engineers utilise a properly functioning and appropriately calibrated ionization-chamber or equivalent survey meter to perform radiation measurements when certain maintenance functions and other safety checks are required
- Conducting prompt investigations of all radiation incidents, accidents and/or unsafe events, and ensuring the results of this investigation, if applicable, are reported to the appropriate radiation protection regulatory authority and the manufacturer of the system
- Determining the appropriate corrective measures following radiation incidents, accidents and/or unsafe events and ensuring such measures are implemented effectively.

3.2 System Operators

All operators must:

- Receive training, authorised by the system owner or designee, on the operation and radiation safety relevant to the system(s) intended for use
- Demonstrate competence in the operation of the system and a working knowledge of safe operational procedures to the system owner or designee
- Read and understand all applicable radiation safety guidelines and proper operating procedures prescribed by the system owner or designee and by the appropriate radiation protection regulatory authority before operating the system
- Secure the operation of the system, if any radiation incidents, accidents and/or unsafe events occur and immediately notify the system owner or designee of such conditions; and
- Acknowledge persons who operate this system are responsible for carrying out the work in a safe manner in order to ensure their own protection and that of others.

3.3 Maintenance Personnel

All personnel responsible for the maintenance of the system(s) must:

- Attend and successfully complete a course, which:
  - Is authorised by and acceptable to the system owner or designee or the system manufacturer
  - Covers the operation, maintenance, repair and radiation safety hazards relevant to the system(s)
  - Has the radiation safety part reviewed or administered by the appropriate radiation protection regulatory authority or the manufacturer.
- Provide the system owner or designee with an explicitly written report of any imminent or foreseen user and/or operator procedure or action that can cause a radiation accident and/or unsafe event as soon as such a procedure or action is identified
- Respond and investigate promptly all user and/or operator reports of the all system malfunctions, device and component failures, emergencies, etc., and resolve the problem(s) satisfactorily before the system is used
- Acknowledge maintenance personnel are responsible for carrying out the work in a safe manner consistent with the guidance presented in this section in order to ensure their own protection and that of others.

3.4 Installation Requirements and Commissioning Tests

Systems must be used in a manner that will minimise the number of people in close proximity in an effort to maintain all personnel external radiation dose to as low as reasonably achievable (ALARA).

The following recommended requirements should be applied to all facilities:

- Every system should be located in such a way that under conditions of normal use, no individual outside the Operational Controlled Area boundary shall receive more than 0.50 µSv of dose equivalent in any one hour (duty cycle and occupancy factors may be used to determine compliance) and no individual shall receive more than 1 mSv of ambient dose equivalent in any one year.
- Every system must be thoroughly tested and the Operational Controlled Area shall be verified by trained personnel to ensure all radiation emitting critical components and safety devices, including warning lights and emergency stops, are installed and functioning, before the system is commissioned for use
- Every system shall be tested to ensure the reference effective dose per screening is less than 0.025 µSv per screening

The Rapiscan 636 Mobile X-ray System when operated with the CabScan option and operated in Low Mode (Default) at an average vehicle rate of 5-12 km/h (3-5 mph), a single scan (1 screening) is approximately 6-8 seconds at X-ray photon energies of 40 keV (Low Mode) and with a Half Value Layer (HVL) of greater than 1.0 mm AL, the reference effective dose per screening to all vehicle occupants is less than 0.05 µSv/screening.

3.5 Surveillance and Maintenance

The reliability and safety of any system decreases with age and use because of component wear.

To ensure safe and reliable operation after a system(s) are installed, the system owner or designee must establish and enforce a suitable maintenance program that accounts for the age and frequency of use of that system.

Surveillance Guidelines:

Subsequent to the commissioning tests and before any system is used; trained personnel must undertake the following procedures:

- Test, verify and document all safety devices (interlocks, switches, warning lights, indicators, and emergency stops) are functioning as intended
- Examine and verify all radiation shielding are free from structural damage that could compromise barrier protection.

Maintenance Guidelines:

It is not possible to provide guidance in this section for all scenarios that could cause unsafe events.

When such events occur, the guidelines below should be followed:

- Moving and/or relocating a system can affect components critical to safety.

If a system is moved and/or relocated, maintenance personnel and/or other qualified contracted service engineers must observe the following procedures:

- Test and ensure all safety interlocks are functioning properly as intended by design
- Examine and ensure all radiation shields are free from structural damage
- Conduct the normal in-beam quality imaging-tests and, if discrepancies exist, investigate the accelerator assembly, accelerator beam alignment, detector alignments and collimator alignment
- Ensure all problems are resolved satisfactorily before the system is used.

3.6 Radiation Protection Surveys

A radiation protection survey is intended to establish the system functions according to applicable performance standards and is used and maintained to provide maximum safety to all individuals:

- Systems must be surveyed regularly.

  While the frequency of surveys depends on the regulatory jurisdiction in which the system operates, the minimum survey frequency must be **annually**
- The owner is responsible for determining the regulatory required minimal radiation survey requirements
- Surveys must be performed by trained personnel familiar with the type of radiation survey meter to be used, the use and limitations of the survey meter, knowledge of the applicable regulatory performance standard limitation for radiation emission leakage, and by trained personnel who possess an understanding of the units of measure and the meaning of the results of the survey
- Survey reports must include an identification of the system revealing the system manufacturer, brand name, model number, serial number, operating parameters and year of manufacture
- After a system has been decommissioned, all reports of surveys, accidents, radiation exposure incidents and system misuse must be retained for a period of at least three years by the system owner or designee at the facility at which the system was last operated.

3.7 Safe Operating Guidelines

Even though operational systems may conform to the requirements set out in the applicable regulations and performance standards and preventive maintenance programs ensure safety and reliability; improper use may lead to unnecessary external radiation exposures and accidents.

To reduce this possibility, the following minimum guidelines apply to all facilities:

- No person must commit any acts that cause unsafe events on a system when it is in operation

  Entering the controlled area for any reason when the system is generating X-rays, or exposing any part of the body to the radiation beam, or covering/disabling the system status indicator warning lights, audible warning alarms or warning labels and signs are examples of unsafe events.

  Appropriate written safety warnings must be **legible** and in **clear view** at the point where individuals and/or items and materials are initially presented for screening.
- No person must create physical or mechanical conditions that ultimately make the system unsafe to operate. Defeating safety devices are examples of hazardous conditions
- Operators and support personnel must forbid unauthorised individuals from remaining near a system during operations longer than is warranted.

3.8 Understanding Radiation Measurements

When radiation is measured, different terms are used based on whether you are:

- Measuring radiation emitted from a radiation source
- Measuring the radiation dose absorbed by an individual
- Measuring the risk an individual may suffer biological effects from exposure to radiation.

Following are definitions of common terms used in reference to radiation.

International System of Units (SI)	Système International d'Unités / International System of Units (SI) is the international standard set of units of measurement set by the 11th General Conference on Weights and Measures in 1960.
Exposure	Exposure is a measure of the ability of electromagnetic radiation, such as X-rays, to produce ionization in air. There is no SI unit defined for exposure. The traditionally used unit of exposure is the Roentgen (R). A micro-Roentgen (µR) is one millionth of a Roentgen (R).
Absorbed Dose	A measure of the amount of energy absorbed or deposited per unit of mass. The unit Rad (R) can be applied to all types of radiation and is defined as the deposition of 100 ergs of energy in one gram (mass) of any material. The SI unit of absorbed dose is the Gray (Gy). 1 Gy= 100 Rad.
Dose Equivalent	A measurement that expresses, on a common scale for all ionizing radiations, the magnitude of radiation effects likely to be incurred by exposed persons. Dose equivalent is computed by multiplying the absorbed dose in Rad by a Quality Factor (QF).
Quality Factor (QF)	An energy dependent factor which relates: • The amount of radiation effects likely to be incurred by persons exposed to the type of radiation absorbed, to the amount of radiation effects from the same dose of X-rays. • The QF is one (1) for X-rays.
Roentgen Equivalent in Man (REM)	A unit of measurement for dose equivalent, computed as: • 1 Rem = 1 Rad × QF For X-rays (where the QF is 1): • 1 Rad of exposure results in 1 Rem of dosage. A Rem is a large amount of radiation, so the milli-Rem (mRem), which is one thousandth of a Rem, is often used for the dosages commonly encountered, such as that from medical X-rays or background sources. A micro-Rem (µRem) is one millionth of a Rem.
Sievert (Sv)	The SI unit of dose equivalent, defined as: • 1 Sv = 100 Rem In security equipment, a more applicable unit is the micro Sievert (µSv), which is one millionth of a Sievert (Sv). • 1 µSv = 100 µRem

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4 628 Mobile System Overview

The 628 is a mobile X-ray system. It has an easy low loading conveyer and has large tunnel access for the X-ray screening of large baggage and parcels.

The 628 enables detection of:

- Explosives
- Weapons
- Contraband
- Organic and Inorganic Material

4.1 Standard Features

The Standard Features of the 628 are:

- Multi Energy Imaging (4 colour)
- View Previous/Next Bag
- Manual Image Archive
- Configuration Image Processing Keys
- Baggage Counter
- Date/Time Display
- Search Indicator
- UPS Uninterrupted Power Supply
- Remote Workstation
- Flat Panel Monitor.

4.2 Standard Image Processing Functions

The Standard Image Processing Functions of the 628 are:

- Crystal Clear
- Black and White
- Organic/Inorganic Stripping
- Inverse Video
- High Penetration
- Pseudo Colour
- Low Penetration
- Variable Edge Enhancement
- Variable Colour Stripping
- Variable Gamma
- Variable Density
- Dynamic Continuous Zoom and Panning
- Fixed Zoom (64x).

4.3 Vehicle Specifications

Nomenclature	Physical Specification
Dimensions	Length: 6,839 mm (269.21 in) Width: 2,420 mm (95.28 in) Height: 3,266 mm (128.58 in)
Tunnel Size	1000 mm (W) x 1000 mm (H) (39.4 x 39.4 in)
Conveyer Speed	0.20 m/sec (39.4 ft./min.
Conveyer Load	165 K (365 lbs) evenly distributed
Conveyer Height	346 mm (13.6 in)
System Power	115/230 VAC plus or minus 10%, 60/50 Hz

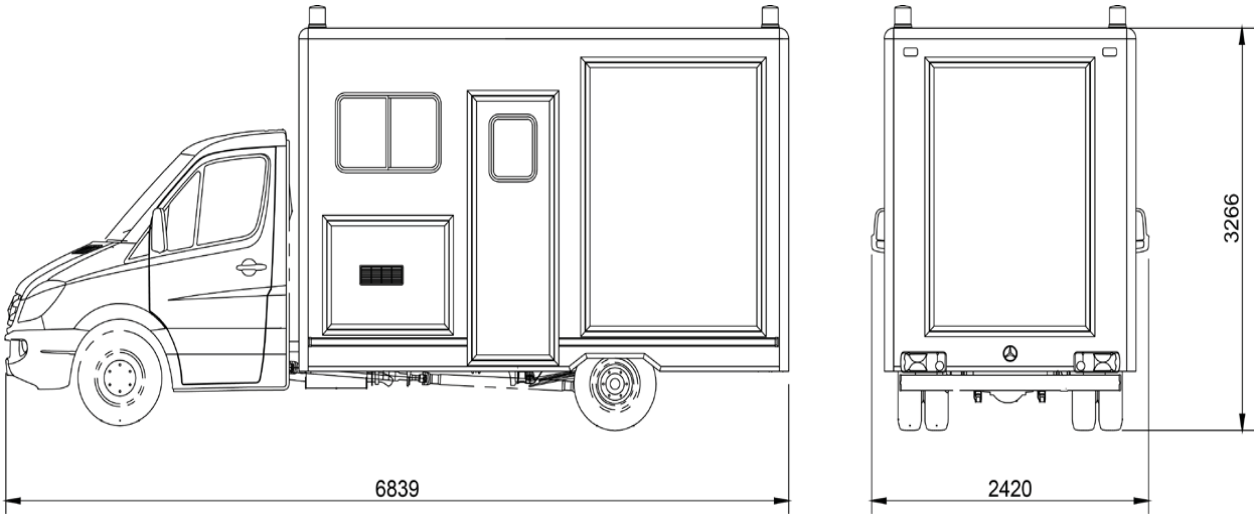

Figure 4-4-1 636 Mobile System Cabin

X-Ray Generator and Image Performance

Nomenclature	X-Ray Generator and Image Performance
Steel Penetration	28 mm guaranteed: 30 mm typical
Wire Resolution	38 AWD guaranteed, 40 AWG typical
Material Separation	Low Z, Medium Z, High Z to 0.5 Z accuracy
Generator Cooling	Sealed oil bath with forced air
Anode Voltage	Operating at 160 kV
Tube Current	1.0 mA
Orientation	Vertically Downward

Operating Environment

Nomenclature	Operating Environment
Storage Temperature	-20°C to 50°C
Operating Temperature	0°C to 40°C
Relative Humidity	5 to 95% non-condensing

4.4 System Deployment Requirements

In order to maintain a consistent image quality, the following requirements should be adhered to:

- The cab must be parked on an even surface
- The system is designed for operating use outdoors but it is not recommended for use during adverse weather conditions which include rain, hail, sleet or snow
- Do not use during high winds as this may disturb the lead safety curtains

4.5 Long-Term Storage

When not in use, it is recommended that the 636 Mobile System is stored in a temperature controlled environment.

When temperatures fall below -20ºC (-4ºF) or rise above 50ºC (122ºF), the shore supply must be connected and the system left powered up, even when the system is not in use, to minimise the risk of damage due to extreme temperature exposure and reduce system initialisation time.

During storage the vehicle and all X-ray subsystems should be started up and run for a minimum of 90 minutes every 5 days.

If stored for more than one week the SF_6 Gas bottle should be turned off.

The hydraulic system should be visually checked every 7 days to identify any hydraulic leaks

4.6 Driver's Cabin

The Driver's Cabin is located at the front of the vehicle.

It has an air conditioner, heater and adjustable seats for personnel comfort.

The cabin is equipped with all of the controls and indicators normally found in a large truck (steering wheel, accelerator and brake pedal, etc.).

These controls are not detailed in this manual and information about them can be found in the Mercedes Sprinter Operator's Manual provided by the OEM.

The Driver's cabin is also equipped with the following systems:

- Two-way Radio (Optional)
- Thermostatically Controlled 2 kW Electric Cab Heater, for engine off operation (Optional)
- Air Conditioning (AC) and Dehumidifier unit, for engine off operation (Optional).

Figure 4-2 Driver's Cabin

4.7 Two Way Radio, Optional

It is an industrial grade two-way radio system that provides communications with the Operator's Cabin and Ground Marshalls.

Figure 4-3 Operator's Two Way Radio

4.8 636 Van

The M636 Mobile X-ray system is built onto a Mercedes Sprinter (or equivalent). The standard features of the Truck are:

No.	Description	No.	Description
1	Driver's Cockpit	**8**	Access Doors
2	Fire Extinguishers	**9**	Conveyer Doors
3	Generator	**10**	Shore Power Outlet
4	Generator Controls	**11**	Air Conditioner
5	Modulator	**12**	Electronics Cabin
6	HB2500 Heat Pump	**13**	Emergency Stop
7	Access Panels	**14**	Installed Monitor/Keyboard Assembly

Figure 4-4 Driver's Cockpit

4.9 Generator

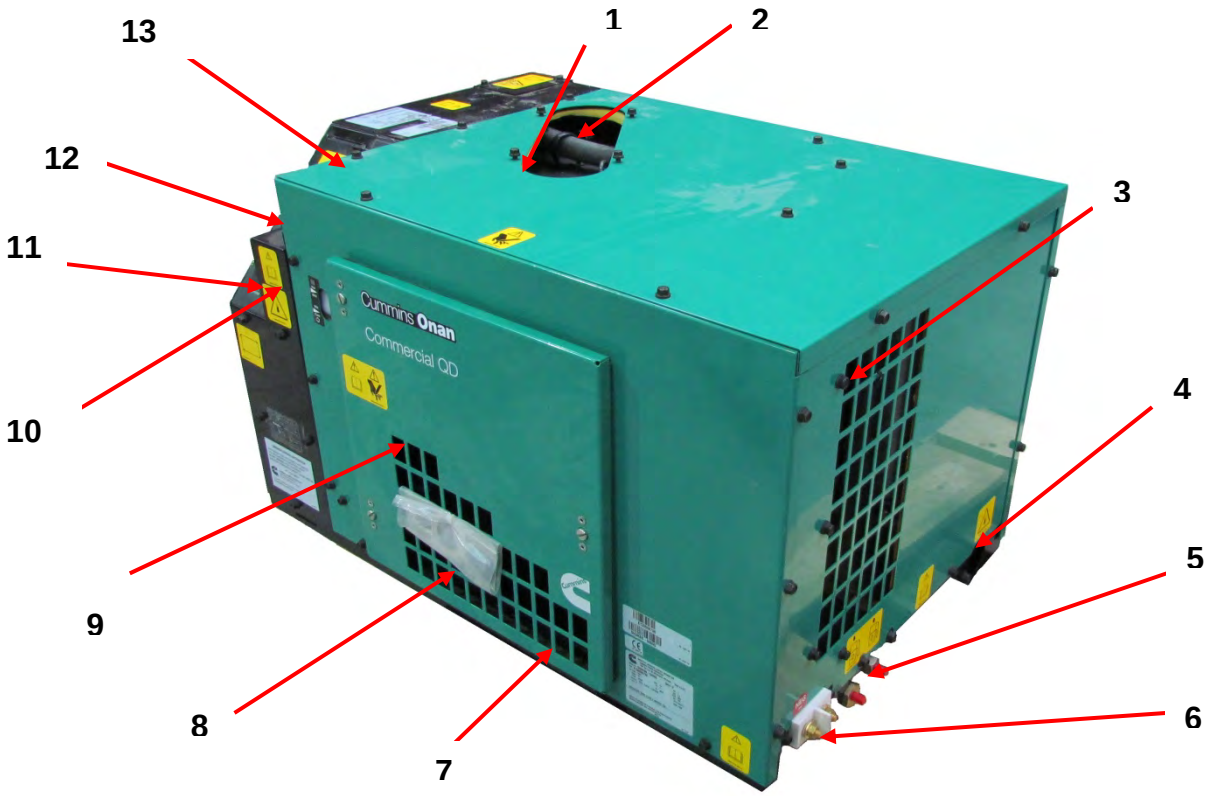

Figure 4-5 Generator and Controls

No.	Component Description	No.	Component Description
1	AC Output & Remote Control Connections	8	Air in for Cooling, Combustion and Ventilation
2	Lifting Eye Cover (Removed)	9	Access for Oil & Air Filters
3	Hot Air Out (End and Bottom)	10	Coolant Level Check
4	Exhaust Tailpipe Exit End, Back & Bottom	11	Control Switch
5	Fuel Connections	12	Oil Fill
6	Battery Connections	13	Access to Coolant Pressure Cap
7	Access Below for Oil & Fuel Filters and Oil & Coolant Drain Valves		

4.10 Generator Remote Control Panel

This panel allows the operator to ‘Start/Preheat’, or ‘Stop’ the generator engine locally and also to monitor engine status from the Operator Panel.

The status of the generator engine is displayed by ‘Flash Codes’ which are displayed by a LED located next to the ‘Start, Stop / Preheat’ rocker switch, as follows:

- Starting: Rapid Flashing
- Engine Running Normally 0 Flashes
- High Temp. 1 Flash
- Low Oil Pressure 2 Flashes
- Shutdown (See Generator Manual) 3 Flashes
- Excessive Cranking 4 Flashes
- No Run Water Flow 7 Flashes

Figure 4-6 Generator Remote Control Panel

4.11 HB 2500 Air Conditioning Unit (ACU)

This machine has been designed and built to be installed on vehicles in order to improve the internal temperature. When the weather is hot it supplies cool and dehumidified air; when the weather is cold it supplies hot air without however replacing the vehicle's original heating system. In both cases the air temperature is adjustable.

The standard features of the HB 2500 Heat Pump are:

- Time Programming
- Purifies and dehumidifies the air, cools or warms
- Receiver Panel
- Three adjustable blower speeds
- Multi-functional remote control.
- Data/Identification Plate

Description of Operation

Cool Air

The refrigerant, by changing physical state from liquid to gas, heats or cools the components through which it passes The evaporator that has been made cold by the internal air blown by the fan It comes out cooled and dehumidified. This action over time creates a reduction in the temperature inside the vehicle.

Hot Air

The refrigerating cycle is reversed by the 4-way valve switching over Tthe internal coil changes from evaporator to condenser, thereby heating the air passing through it. The system is equipped with a heating element that increases the efficiency of the heat pump at low temperatures.

Figure 4-7 HB 2500 Air Conditioning Unit

4.12 HB 2500 ACU Components

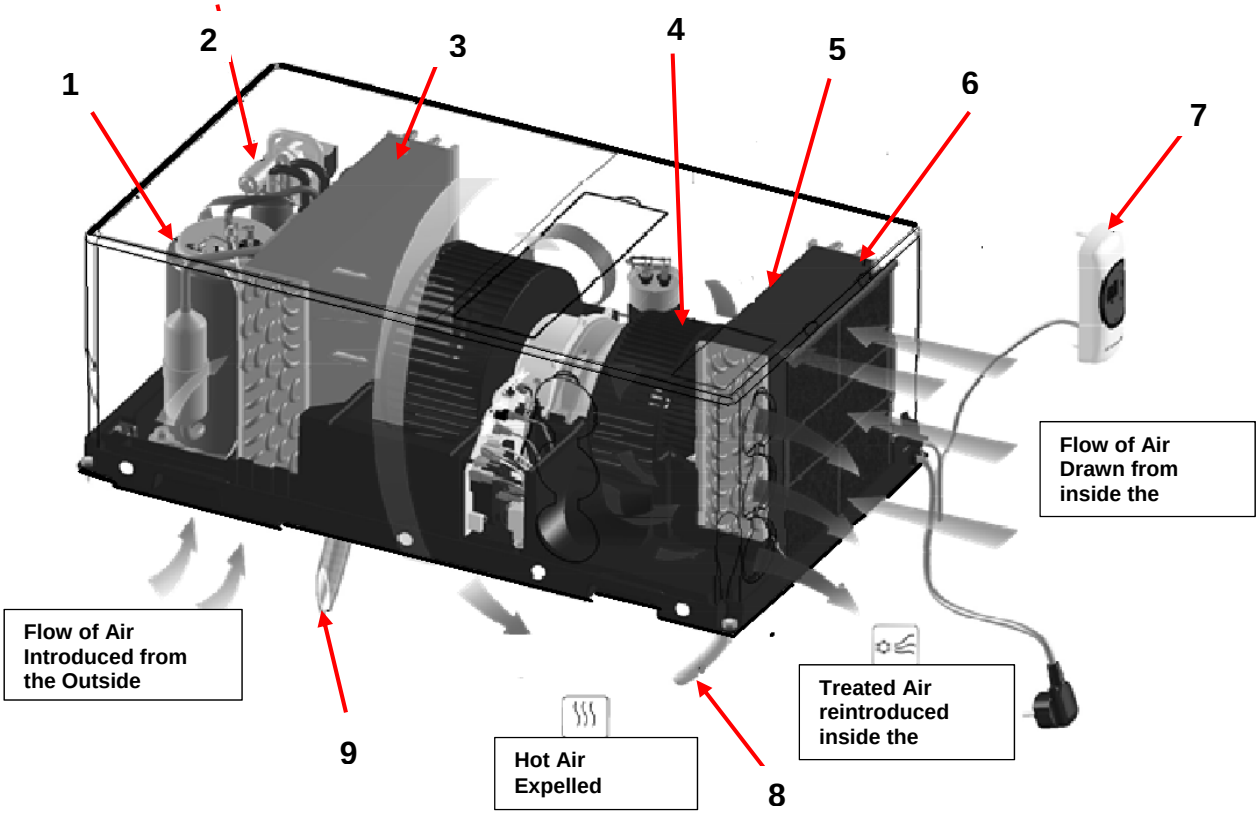

Figure 4-8 ACU Components

No.	Component Description
1	Compressor
2	4-way Switchover Valve
3	Condenser
4	Fan
5	Heating Element
6	Evaporator
7	Remote Panel
8	Condensation Drain
9	Condensation Drain in Heat Pump

4.13 HB 2500 ACU Remote Control

The HB2500 has a remote control that can change the Mode of the unit by aiming directly at the receiver unit and making the necessary selection.

Figure 4-9 ACU Remote Control

No.	Description	No.	Description
1	Change Mode	8	No Function
2	Temperature Selection – (Minus)	9	No Function
3	Fan Speed	10	Clock Setting
4	Timer ON	11	No Function
5	Night Mode	12	Timer OFF
6	No Function	13	Temperature Selection + (Plus)
7	No Function	14	ON/OFF

4.14 HB 2500 ACU Receiver

The receiver panel is composed of a display and four LEDs of different colours. The display switches on whenever it receives pulses from the remote control to display the temperature setting; after a few moments the ambient temperature is displayed and then it switches off.

Figure 4-10 ACU Receiver

No.	Component Description	Component Function
1	Yellow LCD	On = Timer Mode, Flashing = Vent is suspended
2	Signal Receiver	Receives the signals from the Remote
3	Red LED	Shows Power On
4	Blue LED	Shows Night Mode
5	Display	Shows the Temperature
6	Green LED	Shows the Compressor is working

4.15 636SV X-Ray System

The standard features of the X-ray system contain:

- X-ray Unit
- Roller Bed
- Emergency Stop
- Workstation
- Electronic Control Unit

X-Ray Unit

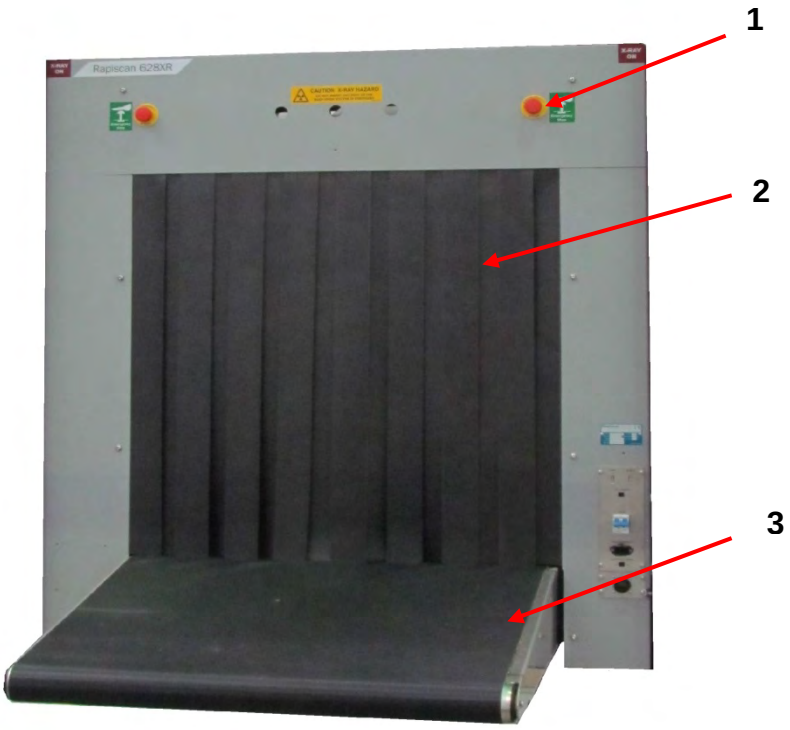

Figure 4-11 X-Ray Unit 1

No.	Description
1	Emergency Stop
2	Curtains
3	Drive Roller Bed

Roller Bed

Figure 4-12 Roller Bed

No.	Description
1	Roller Mount
2	Rollers

Emergency Stop

Figure 4-13 Emergency Stop (Typical)

Workstation

Figure 4-14 Typical Workstation

No.	Description
1	Flat Panel Monitor
2	Keyboard
3	Control Table

Electronic Control Unit

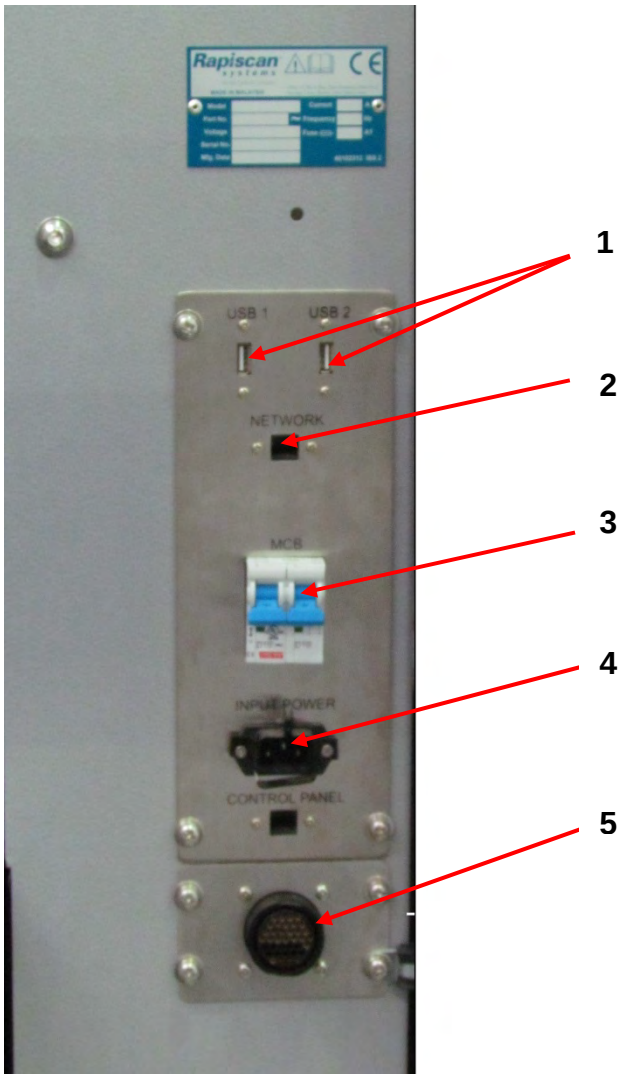

Figure 4-15 Electronic Control Unit

No.	Description
1	USB 1 & 2
2	Network
3	Main Circuit Breaker
4	Mains Power
5	Remote

4.16 Electronics Chassis

General

The electronics chassis contains two boxed power supplies, the X-ray head power supply, Control Interface (CI) PCB and the Power Distribution & Interface (PDI) PCB.

Boxed Power Supplies

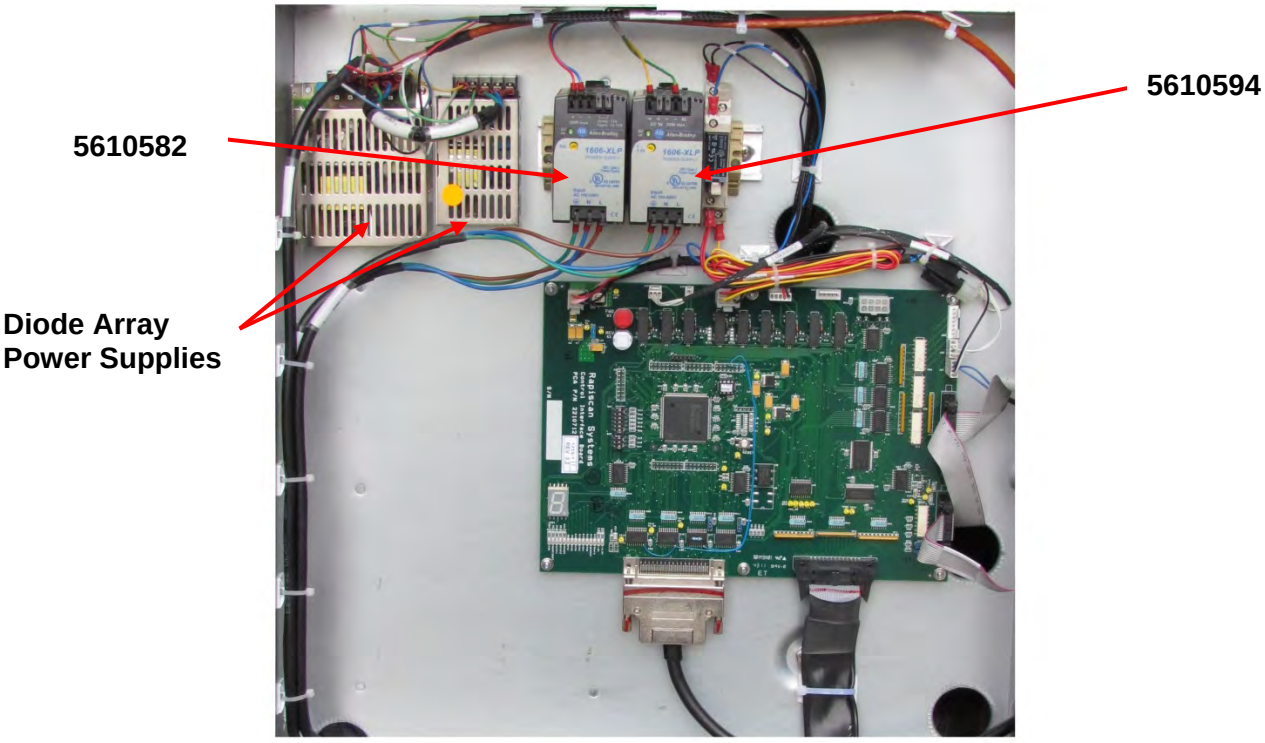

Figure 4-16 Boxed Power Supplies

Part Numbers

5610582 Power Supply, 1606-XLP, 5V 25W

5610594 Power Supply, 1606-XLP, 12V to 15V, 50W

5 System Configuration and Options

This version of the 636SV Mobile X-ray System has only one configuration and no optional equipment.

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6 Safety Systems

The M636 Mobile X-Ray Cargo Inspection System is manufactured to meet US, European, and international standards and local regulations. The system has been designed to ensure the safety of operators and members of the local public.

6.1 Emergency Stop Switches

Emergency Stop switches (E-Stops) are strategically located at different points around the M636 Mobile Cargo Inspection System. These are used to immediately disable X-Ray generation and halt system operations when activated.

WARNING **Do not** reset the Emergency Stop switches until the problem or hazard it was pressed for has been resolved.

To stop any of the processes from continuing activate any of the red emergency stop switches. Whatever movement or process is occurring will stop immediately. To release the emergency stop switch, twist it to the right and it will pop out allowing the system to be reset.

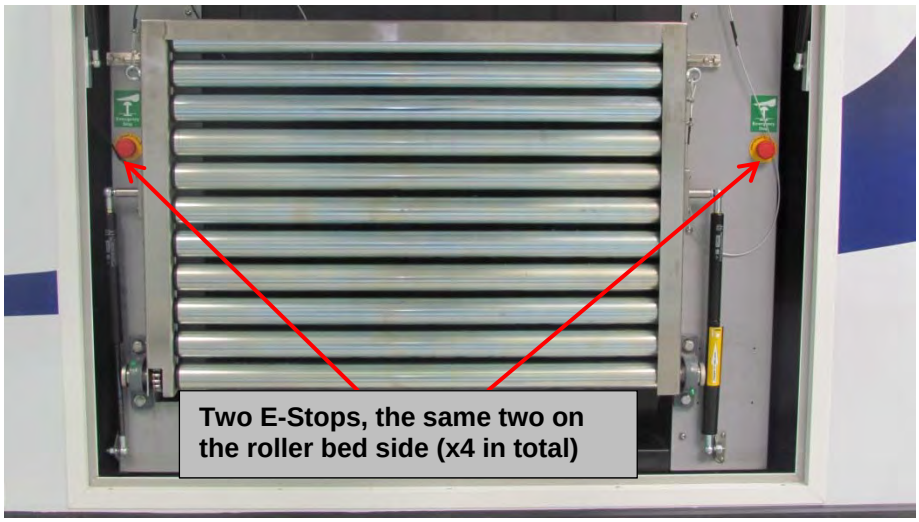

Figure 6-1 628 Machine Mounted Emergency Stop (Typical)

Figure 6-2 628 Control Panel Emergency Stop (Typical)

Figure 6-3 Van Mounted Emergency Stop

6.2 Fire Safety

The fire safety system includes for fire extinguishers located as required by the customer. A typical fire extinguisher deployment is shown below.

Drivers' Cab **Vehicle Rear** **Inspection Area**

Figure 6-4 Typical Fire Extinguisher Locations

6.3 Digital Carbon Monoxide Alarm

The Carbon monoxide alarm has an electrochemical sensor can accurately detect even low levels of poisonous carbon monoxide in the air. If carbon monoxide is detected, the unit will sound a loud alarm to alert you and your family to the danger. This advanced carbon monoxide alarm is NCC approved and conforms to BS EN 50291:2001.

Figure 6-5 Digital Carbon Monoxide Alarm

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7 Operation Procedure

7.1 System Pre-Start Checks

Before you switch on:

- Check that the power cord is connected.
- Open the gullwing doors either side of the van
- Check that the power switch is activated on the monitor.
- Check the functionality of all warning lights.
- Check that all service panels are closed and locked.
- Check that no lead curtains are torn or missing.
- Check that all emergency switches are in their released or out position.
- Check that there are no objects in the inspection tunnel.
- Check that the circuit breaker switch is set to the ON position.

7.2 X-ray System Set Up

Lower the Roller Bed

⚠CAUTION

Make sure you push the sleeve towards the strut as shown on the strut sleeve or you will damage the strut and the strut will not compress.

1. **Push the sleeve on the suspension strut, inwards, towards the strut.**

Figure 7-1 Pushing the Suspension Strut Sleeve

2. Carefully lower the X-ray drive roller bed until it is horizontal with the ground.

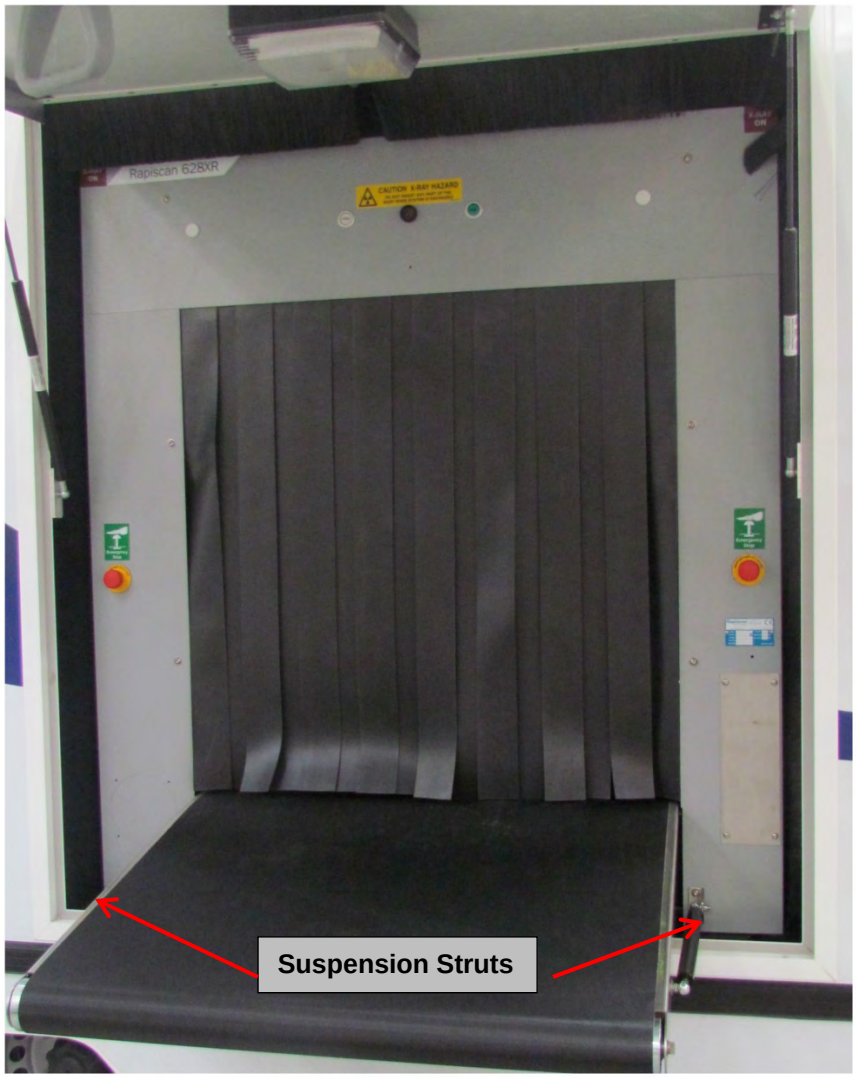


Figure 7-2 Drive Roller Bed in full lowered position

Lower the Roller Bed

1. Support the drive roller bed..
2. Unclip the two support clips from the X-ray unit

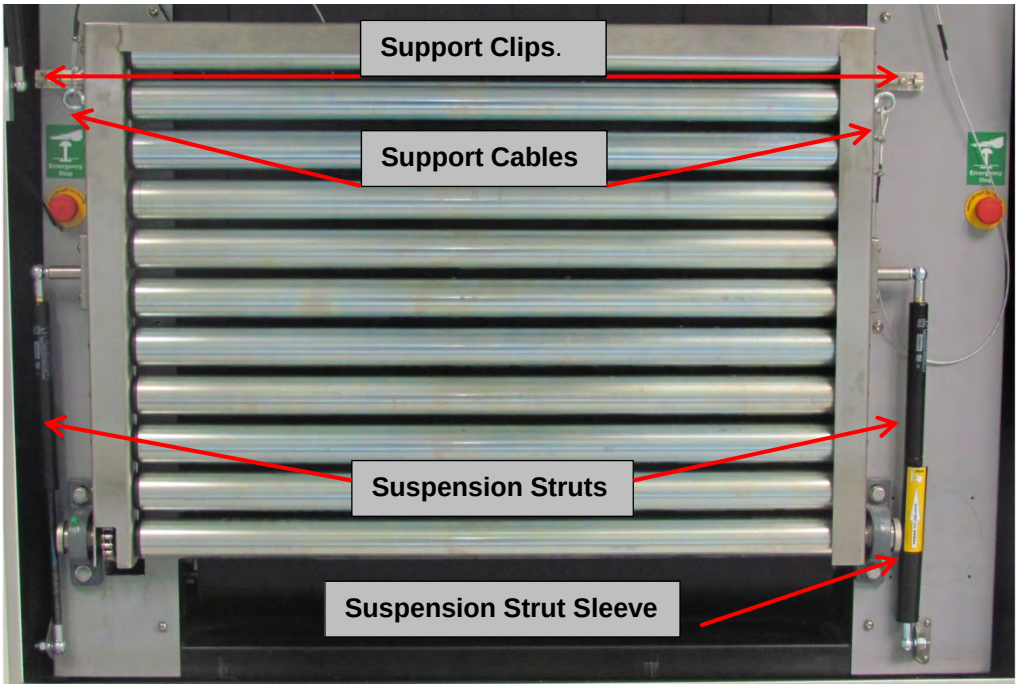


Figure 7-3 Drive Roller Bed Support locks.

3. Push the sleeve on the suspension strut, inwards, towards the strut.

Figure 7-4 Pushing the Suspension Strut Sleeve

4. Fully lower the roller bed until it is horizontal.
5. Make sure the support cables are untangled and straight.

7.3 Power Connection

Every Rapiscan X-ray system has a rating plate or label which is located near the power inlet. Ensure the voltage and frequency marked on the plate or label is appropriate for your power supply before connecting (see End Panel and IEC Socket on page 6-1).

WARNING

The apparatus must have an earth connection.
This is normally supplied through the power cord.

7.4 Switching On

Power-up the system, as follows:

1. Connect the power lead to your supply, and turn the supply on.
2. Rotate the key switch on the power control panel and push the “Power On” button.

   The X-ray system will begin its power-up sequence, as follows:
3. The Power On light at the end of the machine should also light.
4. If no lamps illuminate, check your electricity supply, the power lead and circuit breaker
5. The X-rays will be turned on briefly, to calibrate the system.

Note: If there is baggage inside the tunnel, calibration will be performed incorrectly, and errors may be reported.

Subsequent images may also be incorrectly displayed.

6. Ensure there is no baggage inside the tunnel before switching on.

If the X-ray lamps turn on, but there is no picture, try adjusting the brightness and contrast controls on the monitors.

Check that the connectors on the cables to the monitors are secure.

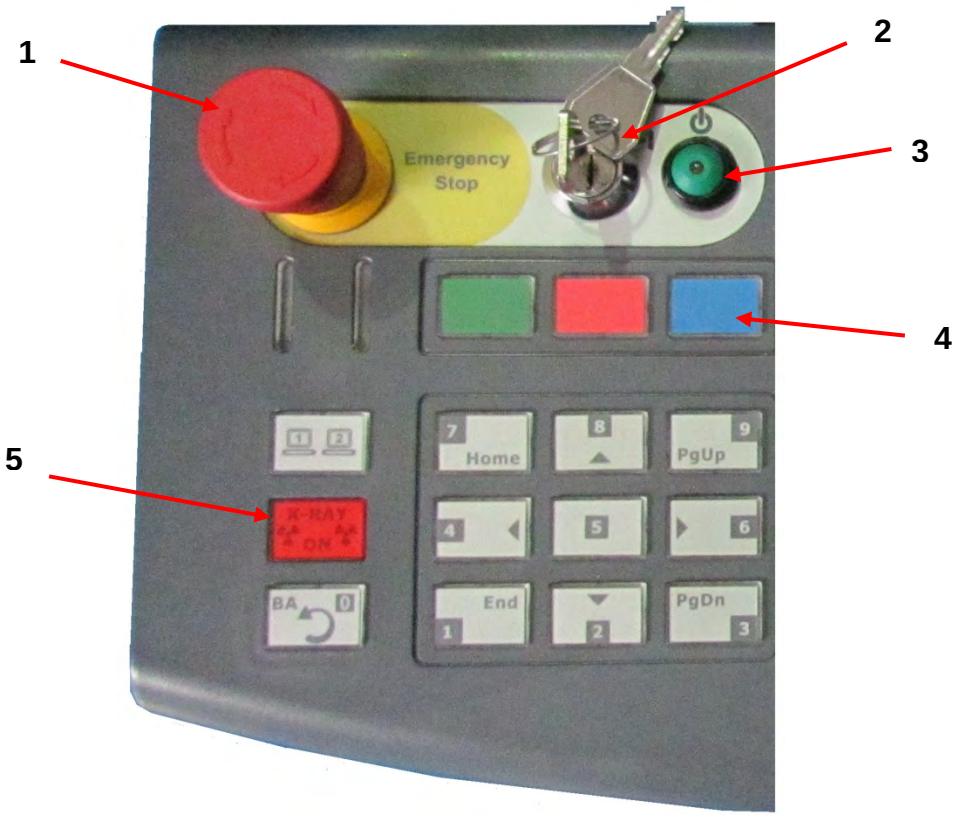


Figure 7-5 Emergency Stop, Key switch, Indicator Lights and Keypad

No.	Description
1	Emergency Stop Button
2	Key switch
3	Power on Button
4	Programmable Function buttons
5	X-ray on Light

7.5 Logging On

After calibration, the log on screen appears.

Remember, because this is a dual-view system there are two monitors showing two views (the vertical view will be on the left, the horizontal view on the right).

We see the login screen on the right and a blank screen on the left.

Note: For most of the rest of the manual, the screen images will be of one side or view (Horizontal or vertical) of the screen only, simply because the print on the menus are too small to be legible in the manual if both sides of the screen are shown below.

Figure 7-6 Log on Screen (Dual View)

The Log-on screen contains fields for User ID and Password, both of which must be correctly filled in order for the operator to access the main operator screen.

The Log-on screen also contains information in the lower right-hand corner about the software version, machine serial number and model number of the Rapiscan X-ray machine that the software is running on.

Finally, the Log-on screen contains two buttons in the lower left hand corner of the left screen, one green, one red.

The green button toggles between W and Y on the TR (Transmit) key on the Operator Control Panel, and between X and Z on the SEARCH (SE) key.

The red button acts as a backspace key when users are typing in their user ID and passwords. See page 9-2 for information on these function buttons.

The operator should type in his or her User ID and Password.

7.6 Main Operator's Screen

Once the Operator has entered his or her ID and Password, the main operation screen will appear as shown in. Notice that the function buttons have changed and now represent HP (High Penetration), BW (Black and White) and Manual Scan.

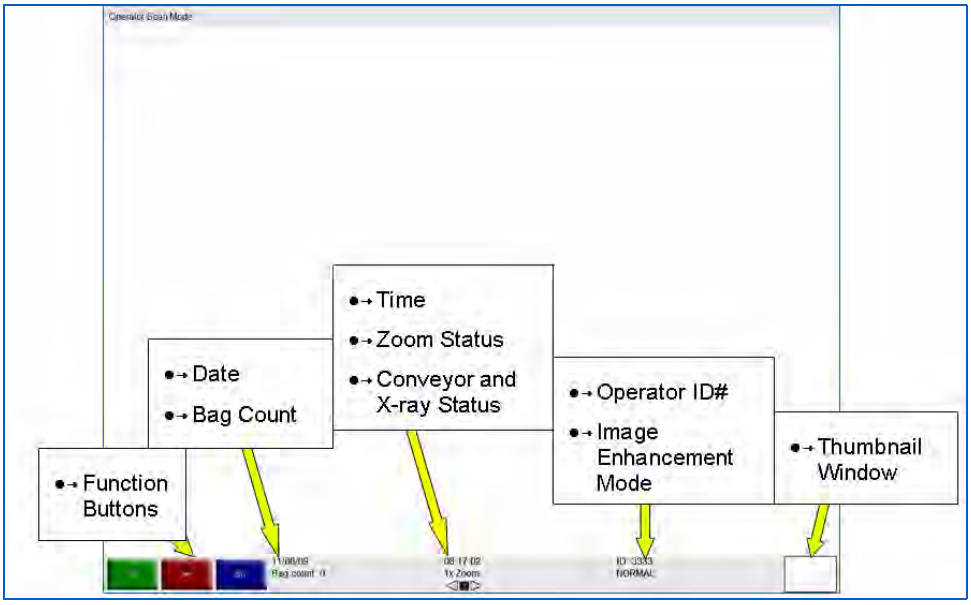


Figure 7-7 Main Operation Screen (Dual View)

The Main Operator's Screen displays:

- The system's current mode of operation, as indicated at the top left corner of the screen (e.g. "Operator Scan Mode").

The panel at the top of the screen is called the Mode Indicator Panel.

- Three Programmable Function button indicators (in the case the buttons read CC, HP and Toggle).
- Date
- Bag count
- Time
- Zoom status (2x, 4x, 8x, 16x, 32x and 64x)
- Operator ID
- Image Enhancement mode (e.g. Normal, Crystal Clear, Black and White, et al)
- Conveyor status, i.e. Stop, Reverse or Forward.
- Thumbnail Window.

Figure 7-8 Forward / Thumbnail Window

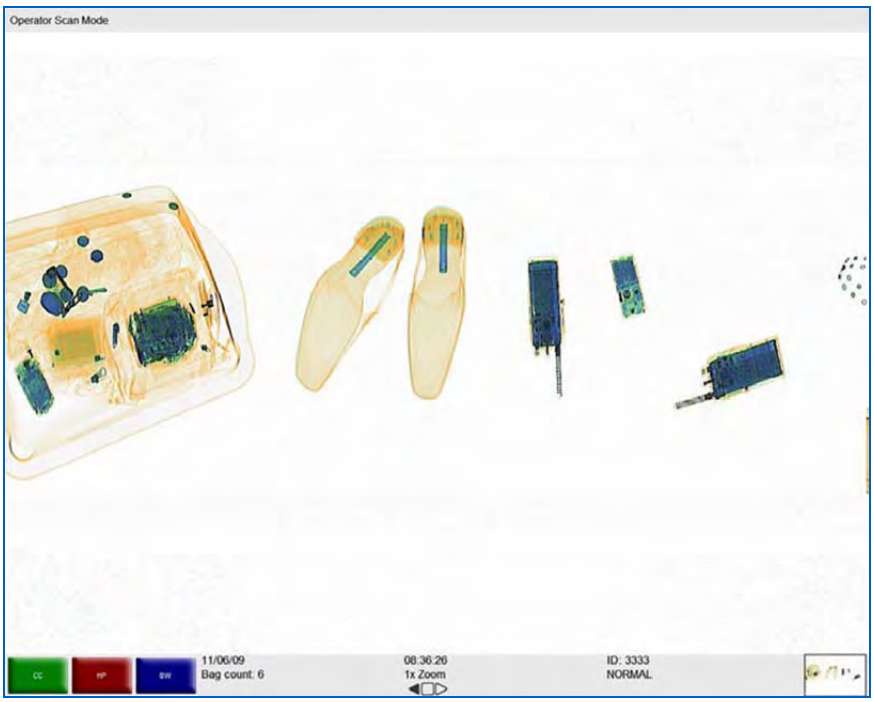


Figure 7-9 Reverse

7.7 Programmable Function Button Indicators

The main operation screen contains “Programmable Function Button Indicators.” These consist of three colored on-screen buttons, which are programmable in that any of a number of image processing functions can be assigned to each button.

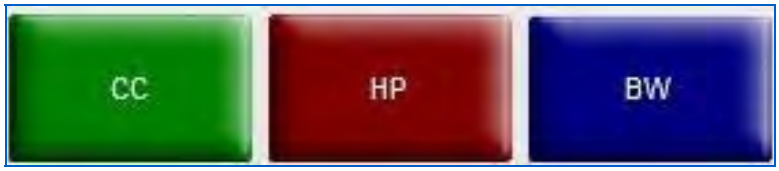


Figure 7-10 Programmable Function Buttons close-up

The function of the two programmable buttons will be configured for the User by Rapiscan Systems or by a site supervisor so as to reflect the functions most often used by specific operators. The figure below shows the two programmable button functions as:

- Green: Crystal Clear (CC)
- Red: High Penetration (HP)
- Blue: Black and White (BW)

If these are the two most frequently used functions by a particular user, then they are easily available to that user. If another user wanted different functions assigned to those two buttons, a Site Supervisor could reprogram them.

In addition, each button can actually perform multiple functions. For example, the green button can be programmed to perform Crystal Clear, High Penetration and Black and White simultaneously. Please note, however, that variable functions (such as Variable Gamma and Variable Edge) cannot be applied together.

7.8 Scanning Baggage

The system is now ready to accept a bag to be scanned. Objects to be scanned should be placed lengthwise on the conveyor belt with all straps and projections underneath (if possible) to achieve the best image

Figure 7-11 Conveyor Control Buttons

Press the green “S” button (Forward) on the operator control panel. The conveyor will run forward until the R button Stop, is pressed. When the bag reaches the center of the tunnel, the X-rays will be turned on, and an image of the bag will be displayed on the screen. When the bag has emerged from the output end of the system, you may press the R/ST button to stop the conveyor. A typical image is shown below.

Figure 7-12 Typical Scanned Image

8 Control Panel Operation

Figure 8-1 Operator Control Panel

8.1 General

The Rapiscan Control Panel (keyboard) uses high reliability switches and has a high resistance to liquid spills, and can be cleaned easily by wiping with a damp cloth. Inside the control panel a printed circuit board contains a micro controller that communicates with the X-ray system computer.

Note: The Operator Control Panel does not support multiple simultaneous key presses.

8.2 Function Keys

The 600 series operator control panel includes three colored function keys.

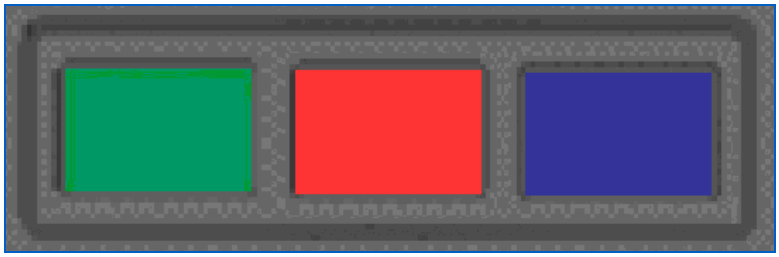


Figure 8-2 Function Keys

The functions assigned to these three keys vary depending on which screen or mode you are in.

During log in, these keys are assigned the following functions:

- The Green Key performs the functions of toggling between W and Y, and X and Z – W and Y are on the same OCP key, as are X and Y.
- The Red Key performs the functions of the backspace key.
- The Blue Key performs the functions of the Shift Key

Before scanning or while scanning has stopped, the green and red keys will be assigned specific image processing functions such as CC (Crystal Clear) and BW (Black and White). The Blue key will be assigned the Toggle Function which allows the operator to remove or reinsert red quadrangles on the screen that highlight potential threats.

While scanning, all three keys will be assigned image processing functions.

8.3 Conveyer Controls

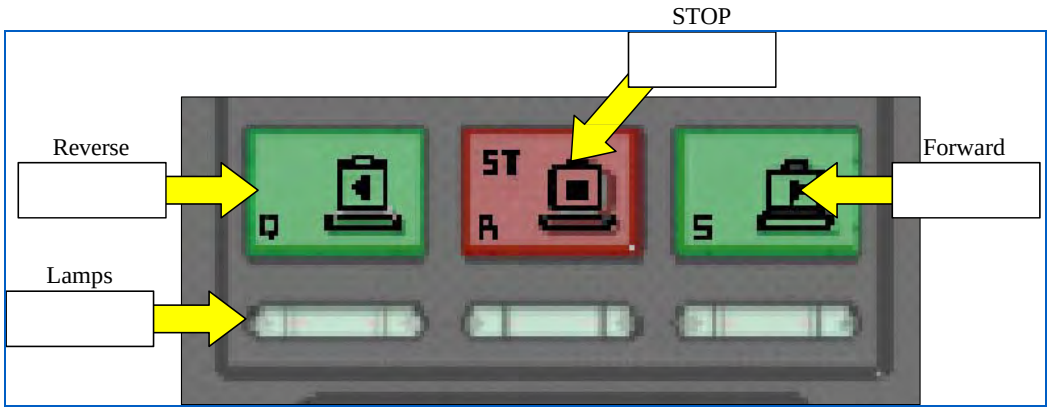


Figure 8-3 Conveyor Controls

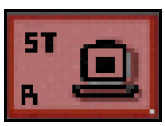
Forward button

When this button is pressed, the conveyor will move objects on the belt to the inspection tunnel for scanning.

Forward lamp

The Forward lamp is located beneath the Forward ("S") Button. This lamp lights when the conveyor is traveling in the forward direction.

Stop button

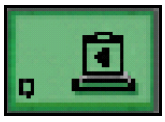


When this button is pressed, the conveyor belt will halt. Note: If this button is pressed during scanning of an object, the belt will stop then reverse a few centimeters. This is to ensure that when 'forward' is selected again, no part of the object is missing from the image. If the X-rayed image is being viewed with an image processing function, the ST Button will cancel the function.

Stop lamp

The stop lamp is located beneath the Stop ("R") Button. This lamp lights when the conveyor belt is stationary.

Reverse button



When this button is pressed, the conveyor belt will travel in the reverse direction. Any objects on the belt will reverse through the tunnel. Depending on the model type, X-ray scanning will or will not take place in reverse. Note: Reverse- scanning X-ray machines are available to special order.

Reverse lamp

This is located beneath the Reverse "Q" Button. This lamp lights when the conveyor is traveling in the reverse direction.

X-ray lamps

These lamps light when X-rays are being produced from the X-ray generator.

Figure 8-4 X-ray on Lamps

8.4 Image Processing Keypad

This figure shows the image processing keypad on the Operator Control Panel. These keys are described in the following paragraphs.

Note: All image processing functions can be applied to images whether the bags have been stopped on the belt and the images are stopped on the operator's screen, or when the bags are still moving through the X-ray tunnel, the images scrolling across the operator's screen.

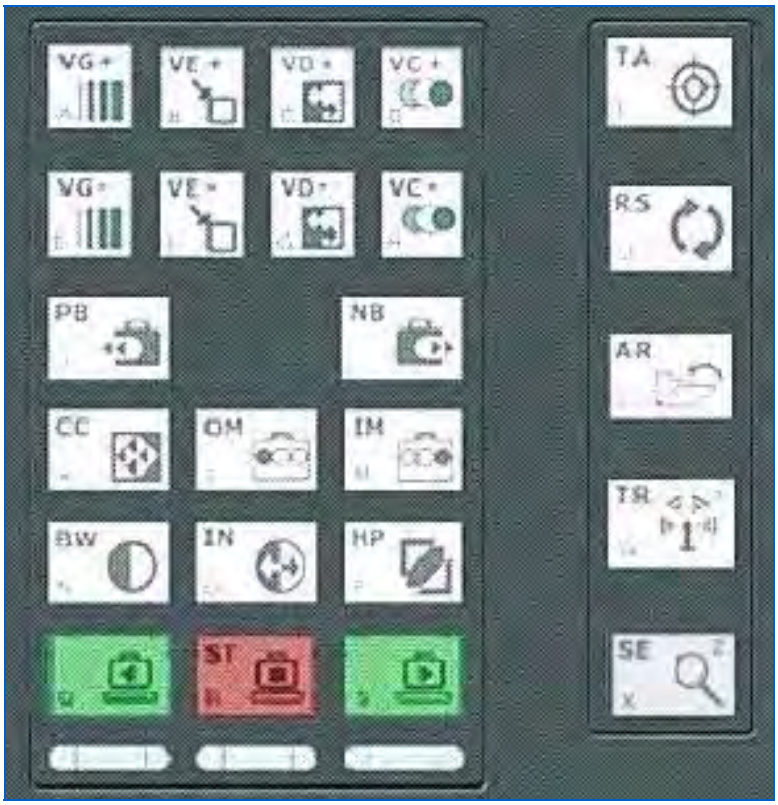


Figure 8-5 Image Processing Buttons

Material Groups

Organic substances composed of light chemical elements that have an atomic weight of less than ten (irrespective of their molecular structure) are displayed in orange on the operator's screen.
The most important elements in this category are hydrogen, carbon, nitrogen and oxygen.

Most explosives are made of a combination of these elements. Explosives like nitro- glycerin and Semite belong to this group.
Materials such as drugs, paper, wood, water and plastics will also be displayed in orange.

Objects composed of a medium heavy element such as aluminum are displayed in green. This also applies to overlapping objects of organic and inorganic substances. This group is termed the 'mixed' group.

This group is composed of inorganic substances such as zinc, tin, copper and steel. If a material is too dense to be penetrated by X-rays, it is shown in black.

Organic Material button (OM)

Operation of the Organic Material Stripping button has the effect of removing the color information of all groups except for Group 1 (organic). See “Material Groups” on page 9-5.

NOTE: For most of the manual, screen images will be of one side or view (Horizontal or vertical) of the screen only, simply because the print on the menus are too small to be legible in the manual if both sides of the screen are shown.

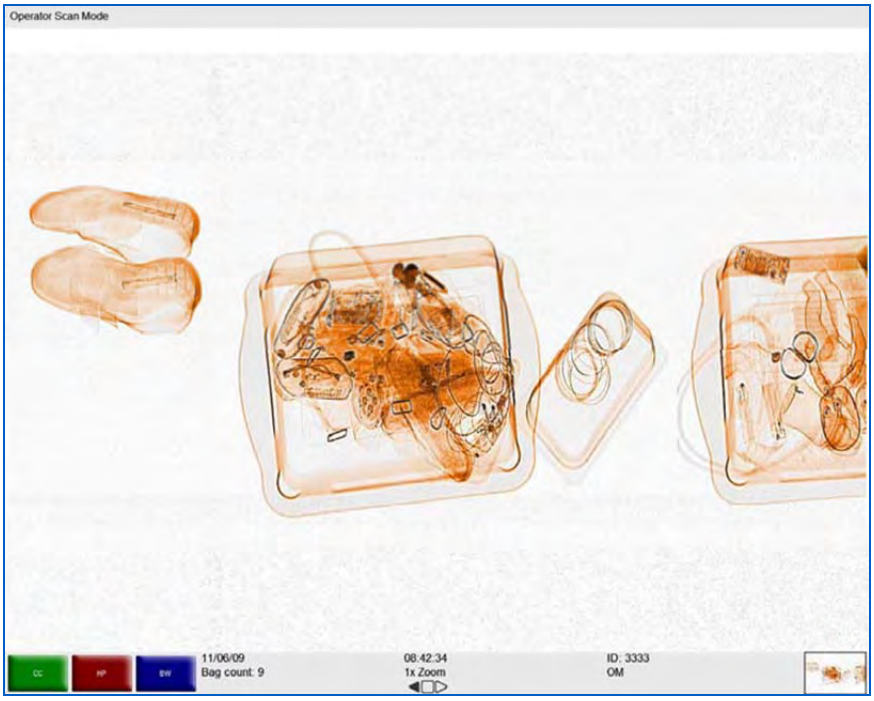


Figure 8-6 Organic Material, Vertical (left) and Horizontal (right) Views

Inorganic Material button (IM)

Operation of the Inorganic Material Stripping button has the effect of removing the color information of all groups except for Group 3 (inorganic). See “Material Groups” on 9-5.

Figure 8-7 Inorganic Material (IM)

Crystal Clear button (CC)

This brings out the detail in both light and dark areas simultaneously.

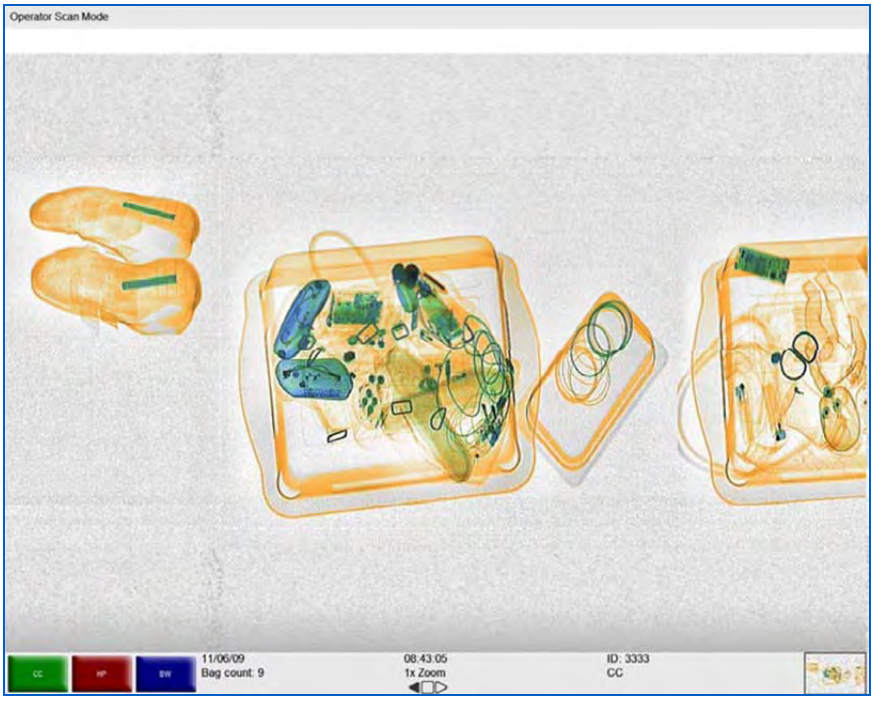


Figure 8-8 Crystal Clear (CC)

Black and White button (BW)

All color information in the image is removed.

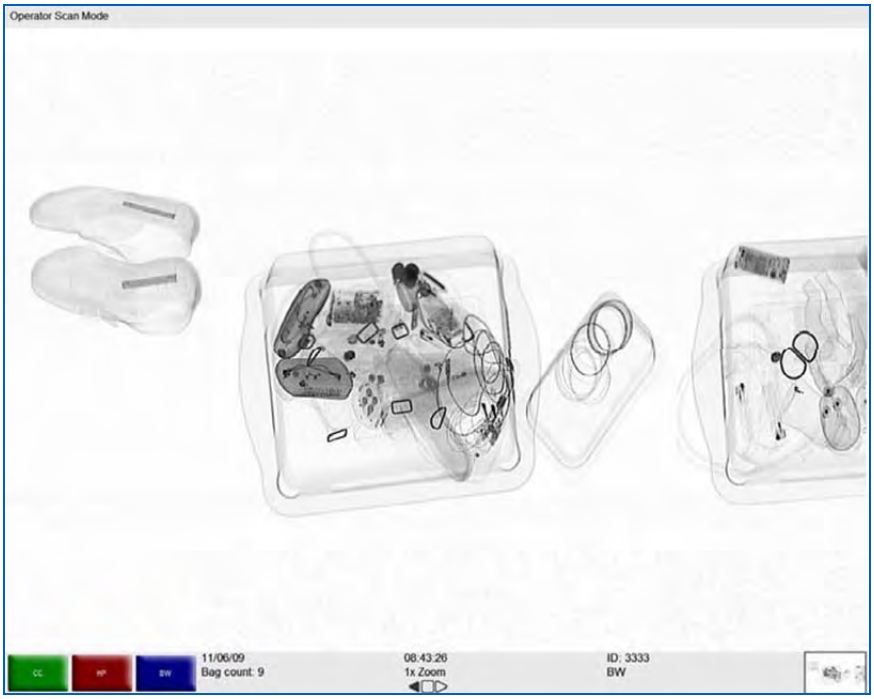
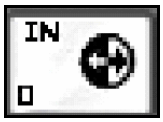


Figure 8-9 Black and White (BW)

Inverse button (IN)



When this button is pressed, the image is displayed in reverse i.e. black becomes white and vice-versa.

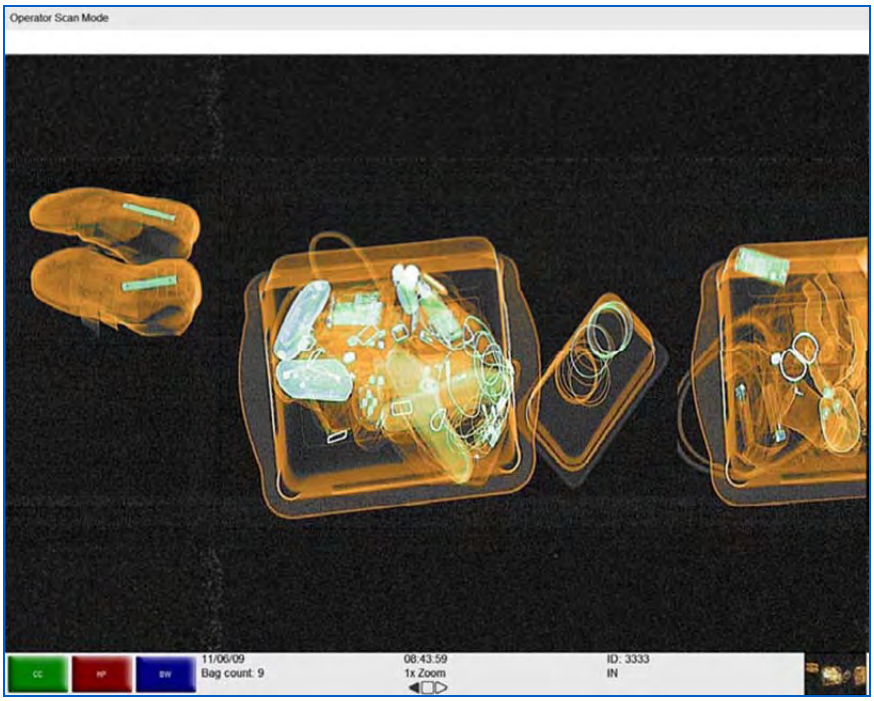


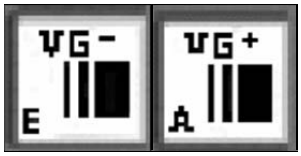
Figure 8-10 Inverse (IN)

High Penetration button (HP)

When this button is pressed, the presentation of high-density objects is enhanced.

Figure 8-11 High Penetration

Variable Gamma (VG)



The Variable Gamma function allows the operator to alter the brightness of the image.

Use buttons VG+ and VG-.

Multiple keystrokes on the VG- or VG+ button will either increase or decrease image brightness. This figure shows an image with VG+ applied.

Note the variable slider pointed out by the yellow arrow.

This indicates that the user pressed the VG+ key several times in order to apply a near-maximum amount of VG+.

This figure, conversely, shows an image with heavy VG- applied as indicated by the variable slider.

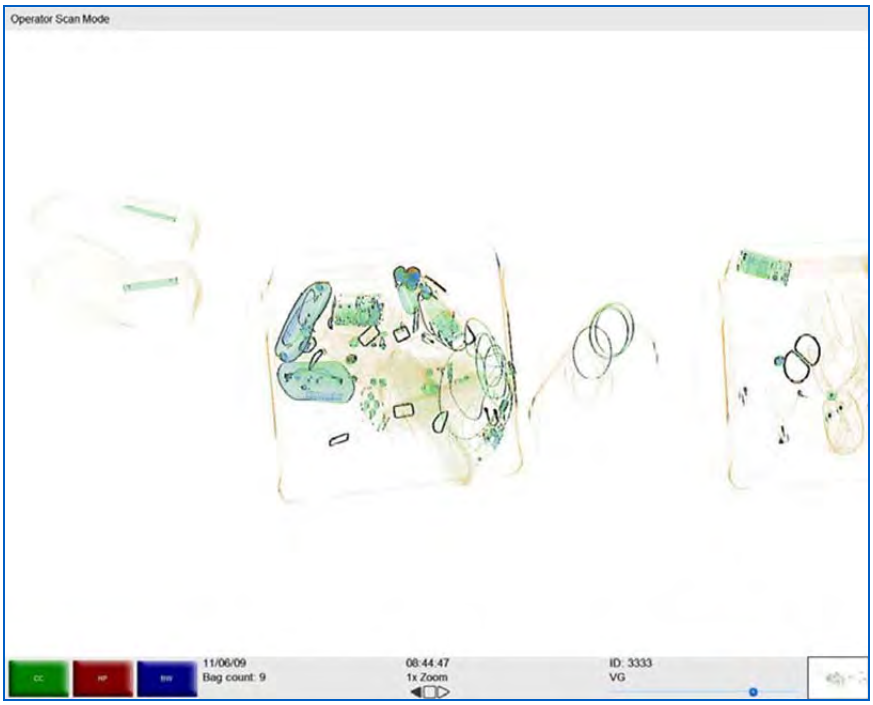


Figure 8-12 Variable Gamma (V+)

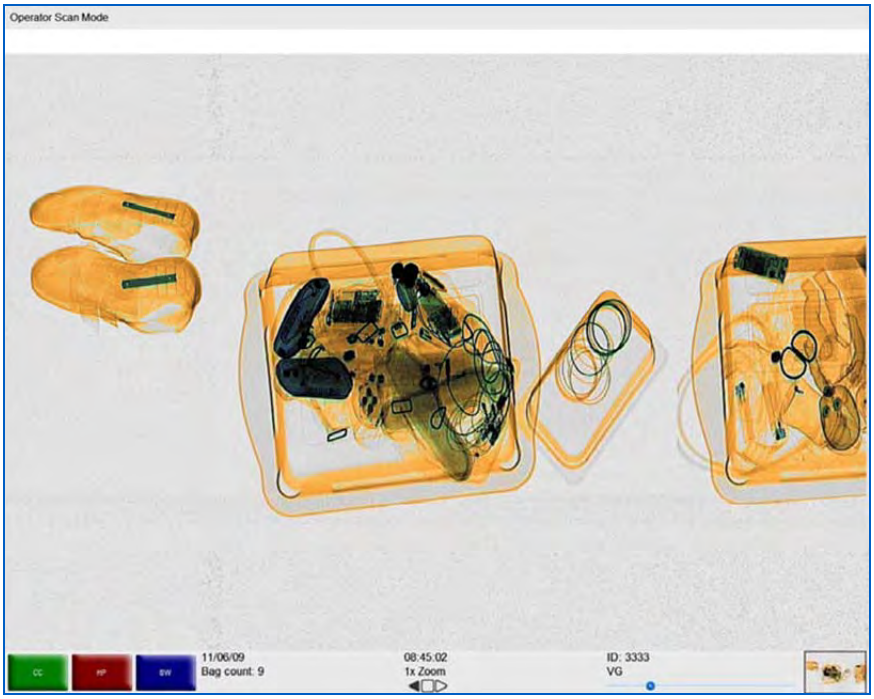


Figure 8-13 Variable Gamma (V-)

Variable Edge Enhancement

The Variable Edge Enhancement buttons (VE- and VE+) cause objects' boundaries to become sharper and easier to see.

Multiple keystrokes on the VE- or VE+ button will either increase or decrease the sharpness of different boundaries within the objects being scanned. The figures below show images with heavy VE+ and VE- applied.

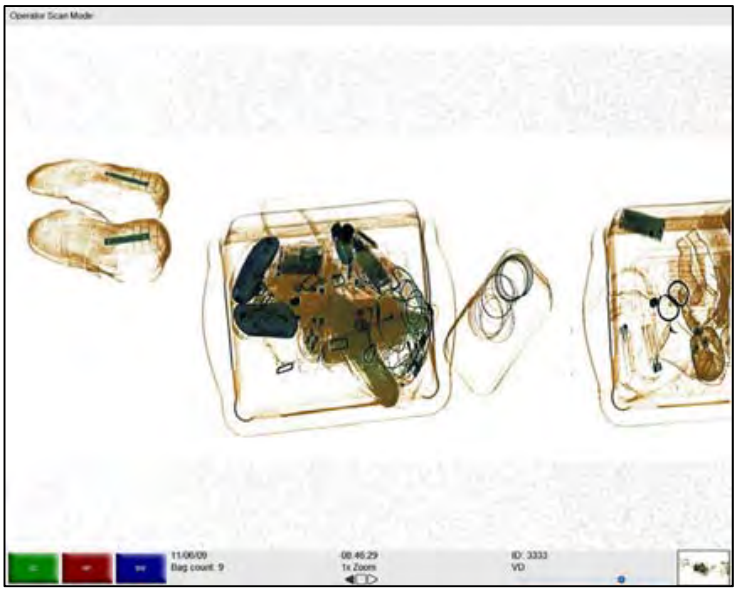


Figure 8-14 VE-

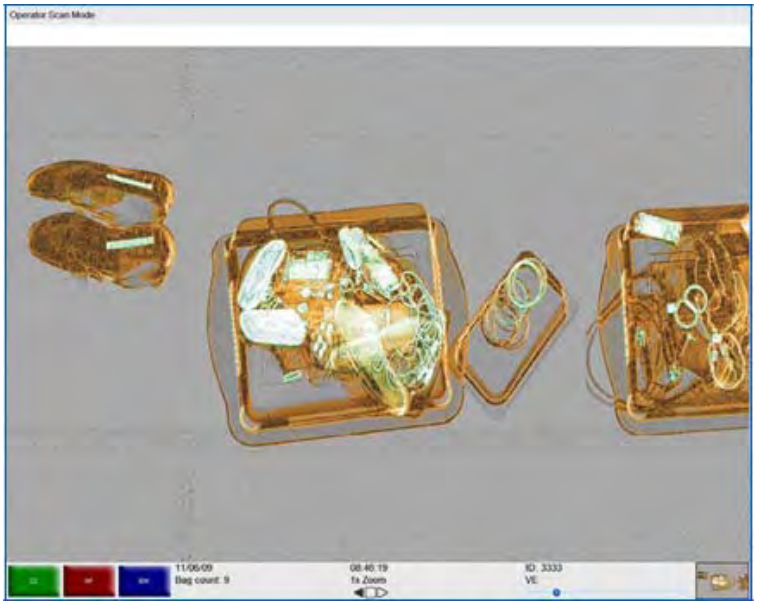
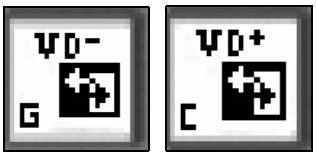


Figure 8-15 VE-

Variable Density



The Variable Density function allows the operator to exaggerate the difference in color brightness between objects having similar X-ray penetration properties. To adjust this facility, use buttons VD+ and VD.

Multiple keystrokes on the VD+ or VD- button will either increase or decrease the difference in color brightness. This figures below show images with heavy VD+ and VD- applied.

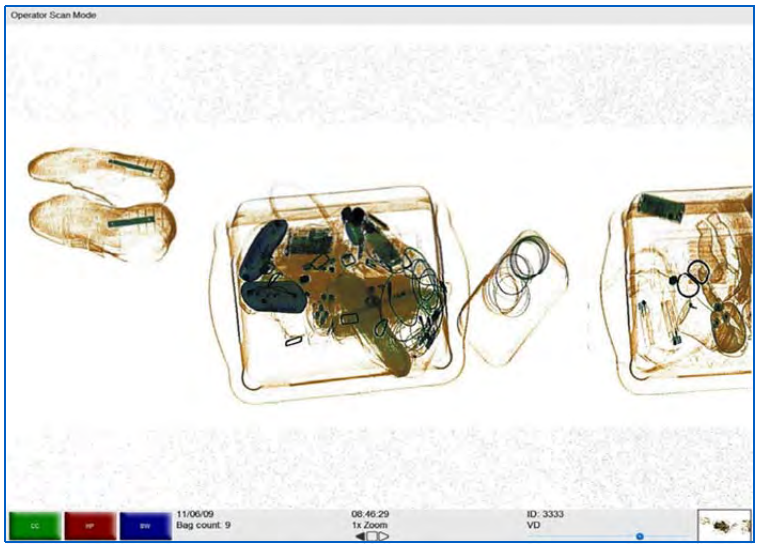


Figure 8-16 VD+

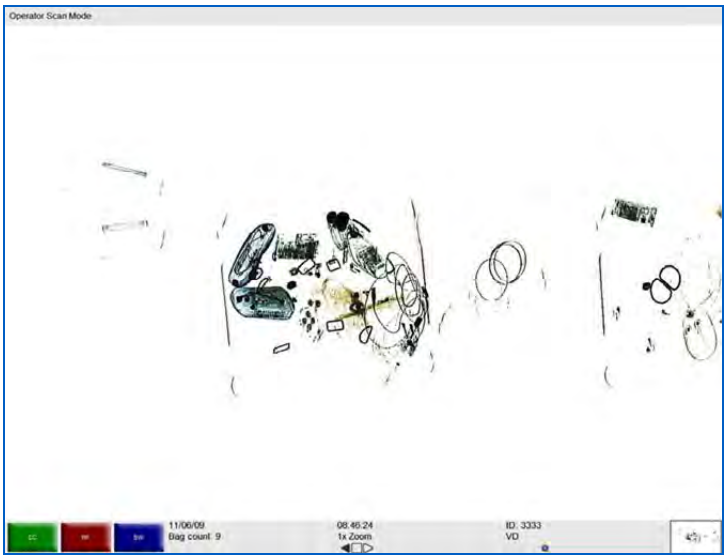
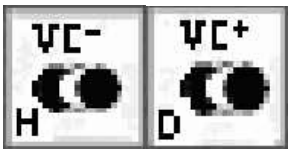


Figure 8-17 VD

Variable Color



In this mode, highlighted materials will show in their original colors while the rest of the objects display in grayscale. The VC+ and VC- buttons are used to highlight the differences between the material groups.

Multiple keystrokes on the VC- or VC+ button will highlight different material groups.
The figures below show image with heavy VC+ and VC- applied.

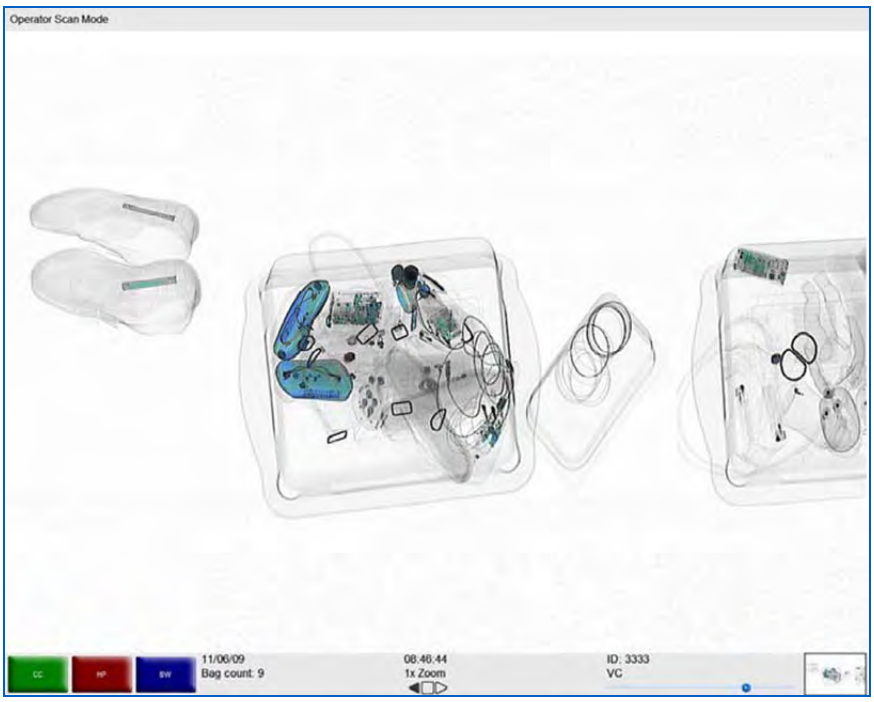


Figure 8-18 VC+

Figure 8-19 VC-

Previous Bag and Next Bag

In this mode the operator is able to scroll in reverse to view previous bags or to scroll forward to get back to the latest bag.
Note that the Mode Indicator Panel reads: “Scanned Image Review Mode” which is the mode the system enters when allowing review of previous and next bags.

Previous Bag

This is accessed by the Operator pressing the “PB” (Previous Bag) button. When “PB” is pressed, the previous bag will scroll back until it is completely on screen. When in reverse mode, “Previous Bag” will operate as “Next Bag” and vice versa.

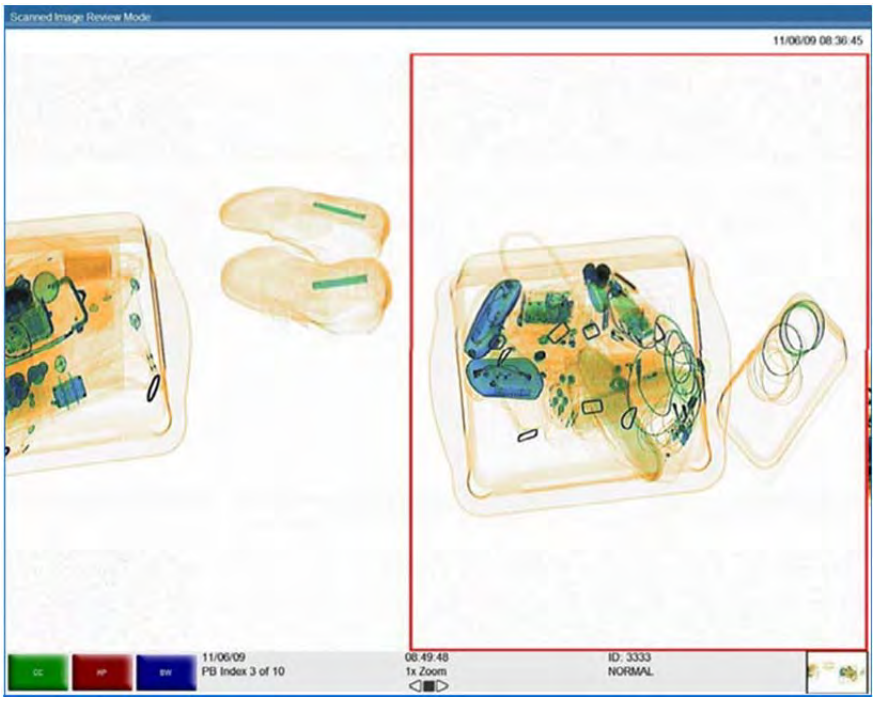


Figure 8-20 Previous Bag

This figure shows the screen when in Previous Bag mode.

Note that the previous bag is outlined in red once it is chosen, and moves onto the screen from right to left.

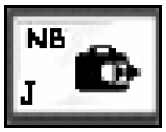
The Previous bag will be any previous bag’s image that is completely or partially on screen.

When the operator reaches the end of the image review buffer in Previous Bag mode, a message will appear, reading: “End of Image Review Buffer. Press the NB/J button to clear this message box.

The message will disappear automatically after 5 seconds.

The “R” or Stop button can be used to exit the Previous Bag or Next Bag mode and return to the Normal mode.

Next Bag



This mode is accessed by pressing the “NB” key on the Operator Control Panel. When “NB” is pressed, the Next bag will scroll on screen.

Figure 8-21: Next Bag

This shows how the screen looks when Next Bag key (“NB”) is pressed. Note that the next bag is outlined in red once it is chosen, and moves onto the screen from left to right.

A message reading, “End of image review buffer. Press the PJ/I button to clear this message box” will appear on screen once the operator has reached the end of the image review buffer when in Next Bag mode. As indicated in that message, the operator can press the “J” or “NB” key on the operator control board to clear the message, but the message will disappear automatically after 5 seconds. The “R” or Stop button can be used to exit the Previous Bag or Next
Bag mode (i.e. the Scanned Image Review Mode) and back to the Normal mode.

NOTE: Each bag in Previous Bag or Next Bag mode has a date/stamp indicator above the bag’s image on screen.

Everything gets reversed, of course, if the conveyor belt is traveling in Reverse. In that case the “previous” bag now becomes the “next” bag and vice versa.

Archive

This function allows one of the most recently scanned bags that are still on-screen to be stored on the hard disk of the computer.

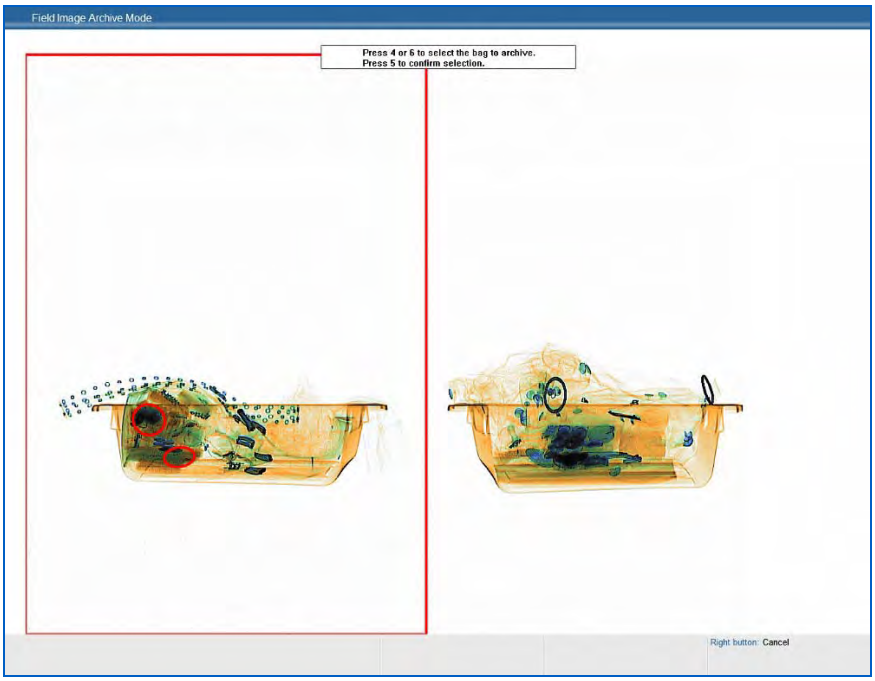


Figure 8-22: Archive Message

This shows what the Operator will see upon pressing the “V” or “AR” key on the operator control panel whenever the system is in stop mode. Note the image to be archived will be outlined in red. In addition, a message appears above the image.

Pressing 4 on the operator control panel numeric keypad causes the red square to move to the left. Pressing 6 will cause the red square to move to the right. The Operator must press 5 in order to confirm the selection of the bag to be archived. A message confirming selection will appear briefly.

This option may not be present in some systems. The number of images that can be archived is limited to hard disk space or to a configurable allowable maximum disk space, whichever is smaller.

It is possible to retrieve archived images but this can only be done in Supervisor mode.

Transmit

This function is applicable when the X-ray machine is part of a network and allows images to be transmitted to other machines in the network.

Reset

This button allows the operator to return to “normal” mode from image enhancement and Zoom modes.

Combined Function

The system software also allows the operator to use more than one image enhancement feature simultaneously. The figure below, for example, shows an image that is being enhanced with Crystal Clear, Black and White and Organic Material

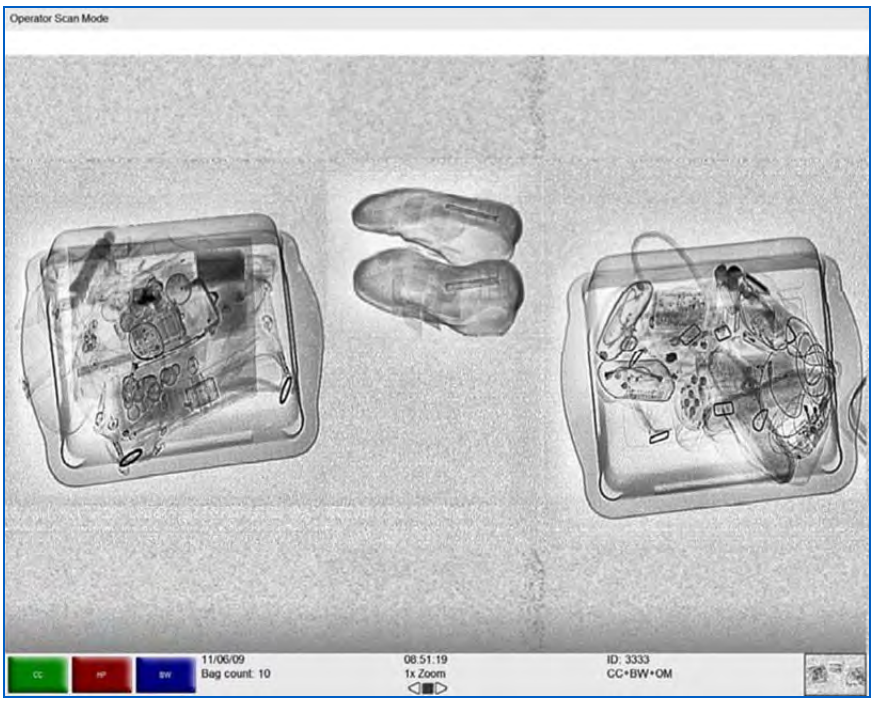


Figure 8-23: CC+ BW + OM

NOTE: Applying too many image enhancement functions to an image can actually have the opposite effect and distort the image beyond the operator’s ability to spot possible threats

Real Time Mode

One of the' unique abilities of the new Windows-based operating system is being able to use image enhancement on images as they scroll across the screen. Previously images/bags would have to be stopped in order to use image enhancement on them. Thus as an image is scrolling across the screen, the operator can use CC, Black and White, Inverse, etc. on the image without having to stop it.

The new Windows-based software allows the operator to enhance images even when the images are scrolling across the screen in reverse order. This figure shows a screen in forward/scanning mode, with Variable Gamma enabled.

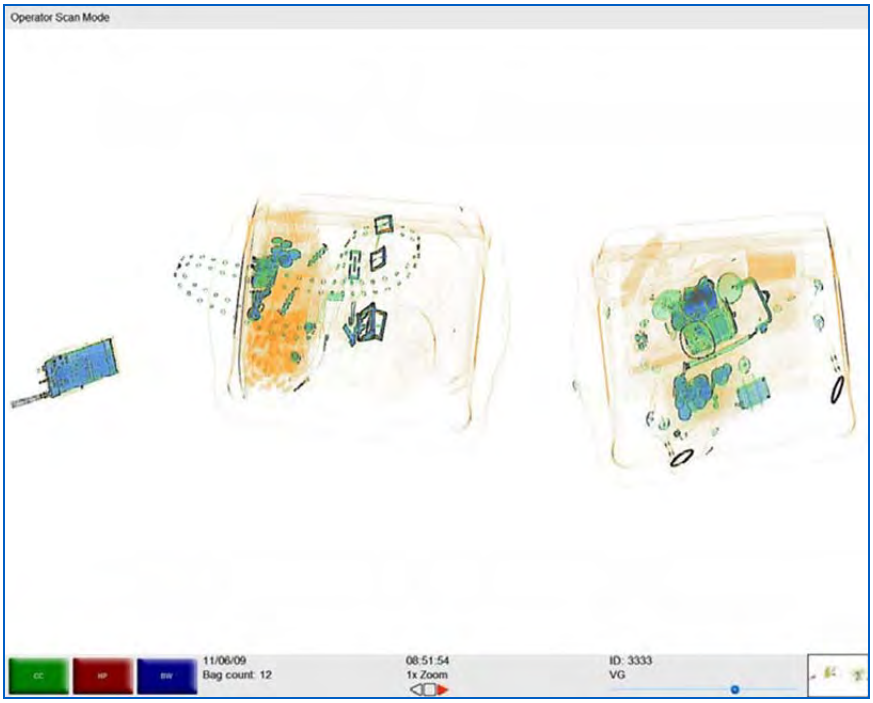


Figure 8-24: Scanning Mode with VG Enabled

8.5 Zoom Keypad

This figure shows a typical scanned image, which has divided by non-existent dashed lines into nine segments, each corresponding to a button on the Operator Control Panel zoom/numerical keypad.

NOTE: These nine segments actually overlap somewhat rather than being evenly divided. This ensures complete coverage of all the objects on screen.

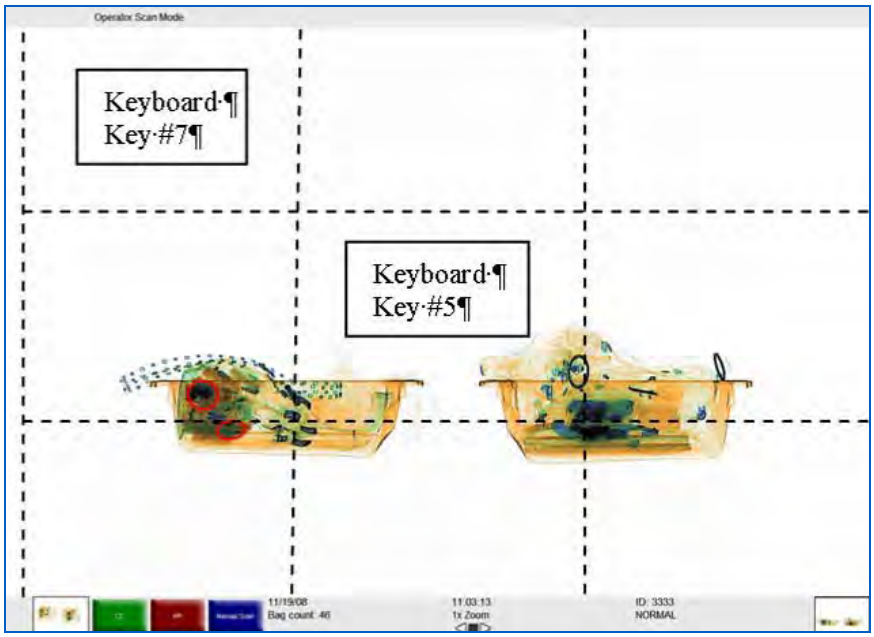


Figure 8-25: Screen Divided into Nine Segments

For example, the top left corner of the horizontal view corresponds to #7 on the Control Panel Numeric Keypad; the center square corresponds to #5 on the Control Panel Numeric Keypad.

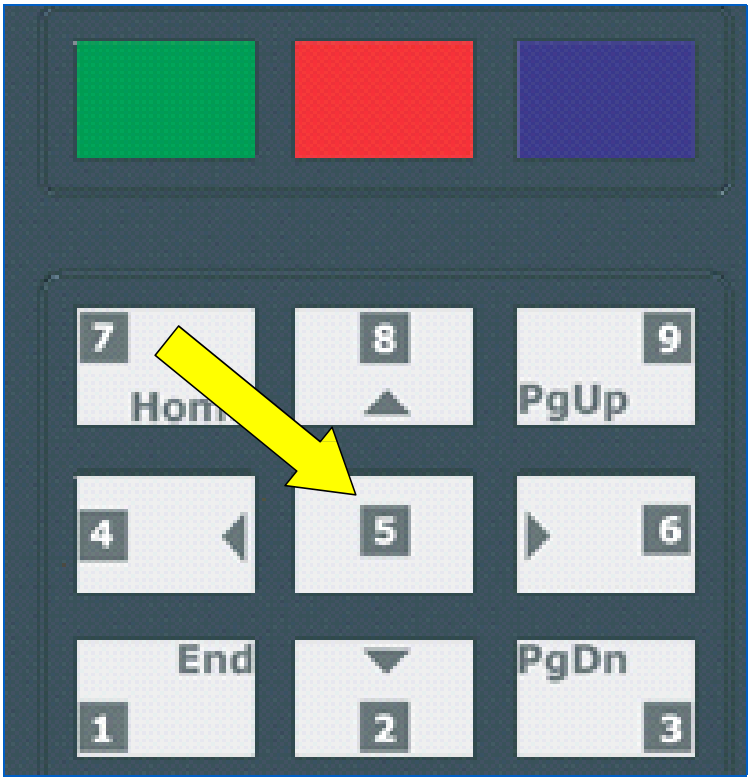


Figure 8-26: Keyboard Selection

When the #5 button on the zoom keyboard is pressed it corresponds to the center area of the screen. For example, the image shown below is at normal size (not zoomed). The dotted square highlights the center of the screen, which corresponds to the #5 key on the number keypad on the operator control panel. Pressing that #5 key causes the system to zoom that (center) area of the screen to a power of 2 (2X Zoom).

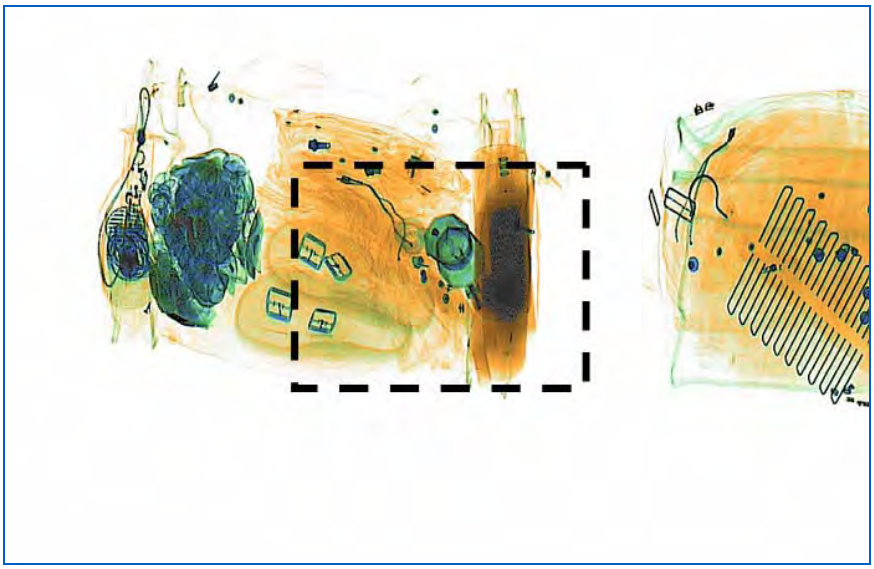


Figure 8-27: Center Selected (Button #5 on Operator Control Panel)

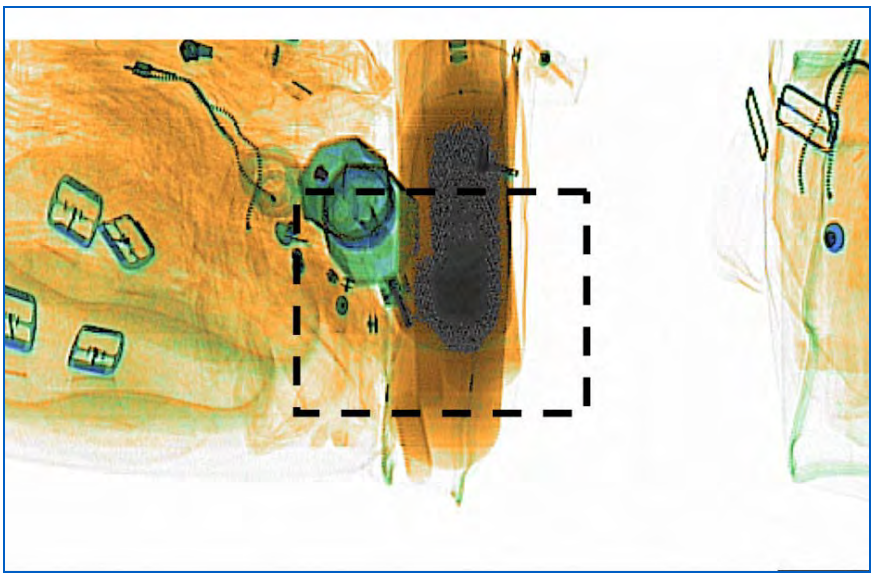


Figure 8-28: 2 x zoom

Press #5 on the zoom keypad again, the same area of the screen is increased to 4X Zoom.

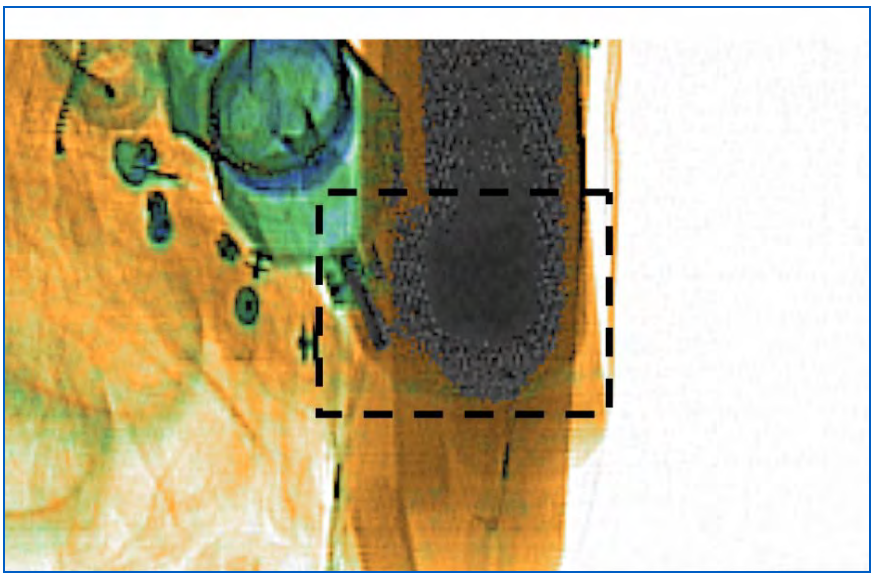


Figure 8-29: 4 x zoom

Pressing the same button zooms the same area to a power of 8, and 16 , with a maximum possible zoom of 64X.

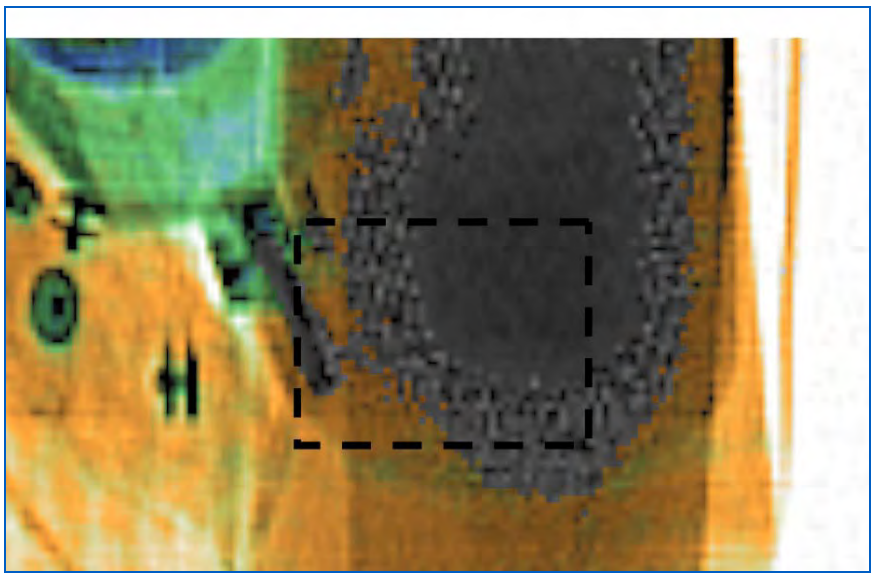


Figure 8-30: 8 x zoom

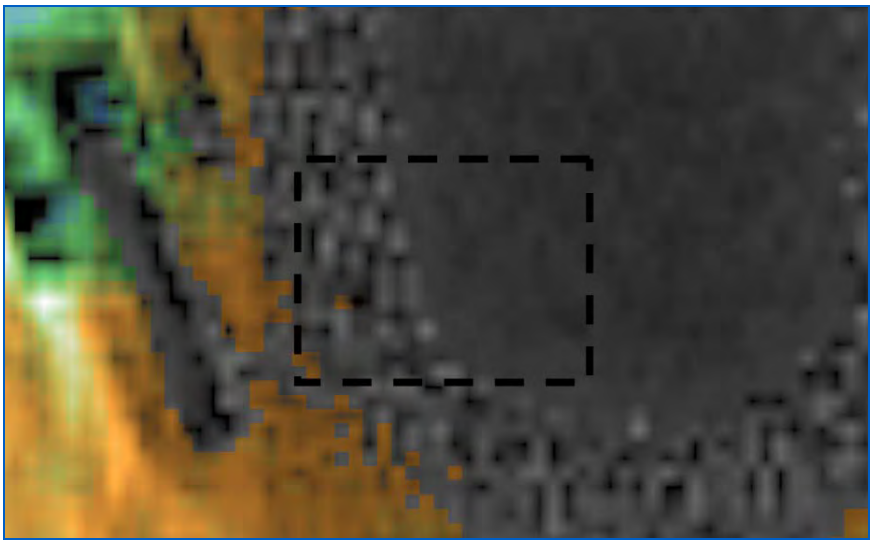


Figure 8-31: 16 x zoom

The Back to Normal button returns the image to a normal size.

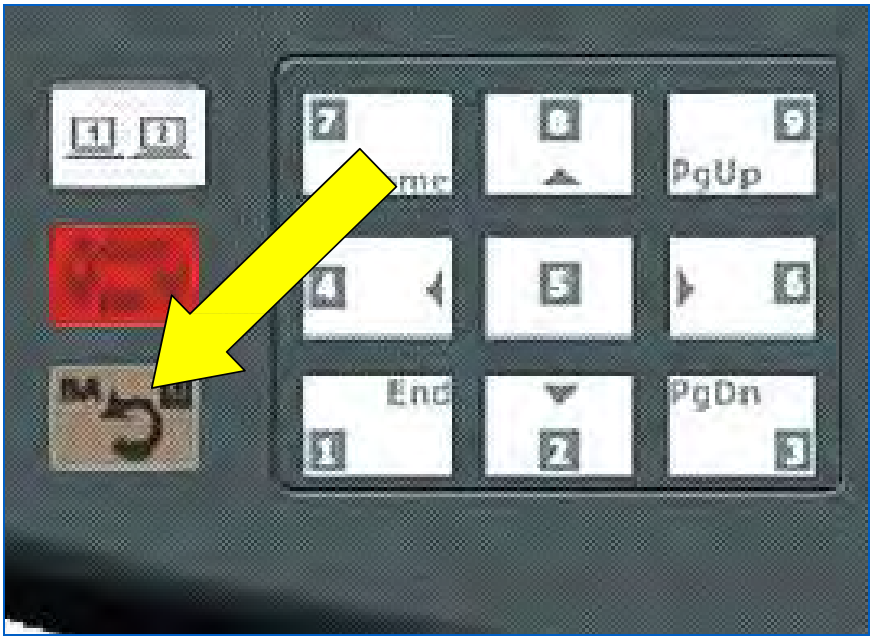


Figure 8-32: Back-to-Normal and Zero Button

8.6 Other

Emergency Stop

As the name implies, this button will immediately stop the unit from generating x-rays or moving the conveyor belt.

Figure 8-33: Emergency Stop Switch, Key switch and Power Button

When the E-stop is pressed, the following message will appear.

Figure 8-34: E-Stop Initial Message

If the STOP button on the Operator Control Panel is pressed before the E-stop is released, the message in this figure will appear.

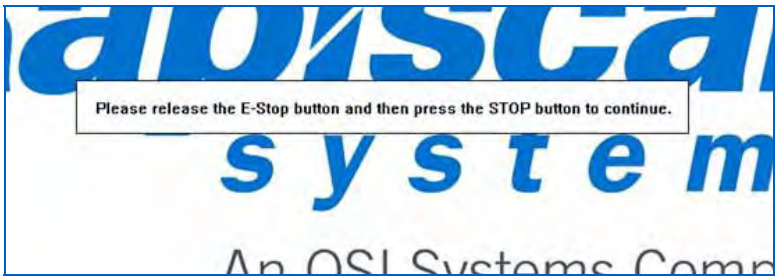


Figure 8-35: E-Stop Release Message

The operator must release the E-stop and then press the Operator Control Panel STOP button again. At that point the following message will appear:

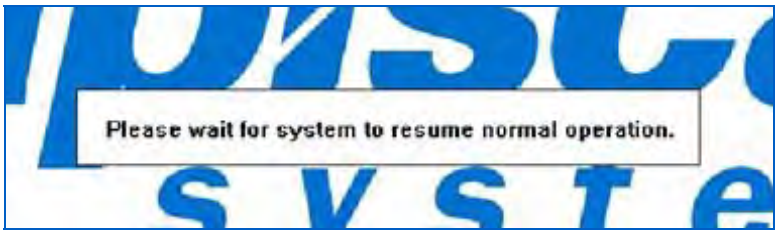


Figure 8-36: E-Stop "Wait for System" Message

Indicator Lights

The Operator Control Panel features five indicator lights. This figure shows two of those lights: X-rays On and System On. Also the figure below shows the indicator lights at the base of the Image Processing Keypad (NOTE the SE button. These lights are for the Reverse (RE), Stop (ST) and Forward (FW) conveyor buttons and indicate when the respective buttons have been pushed.

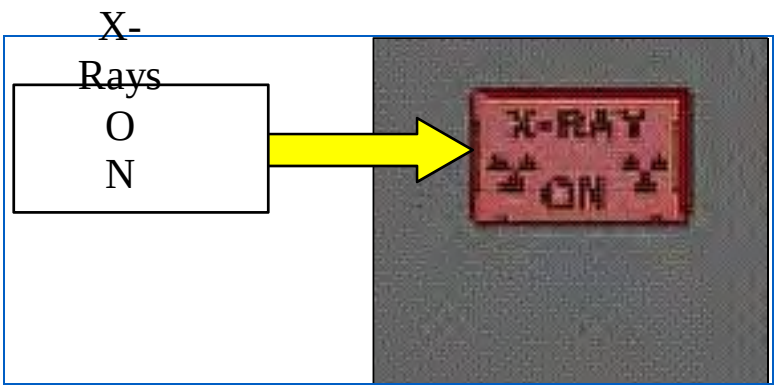


Figure 8-37: E-X-rays On Light

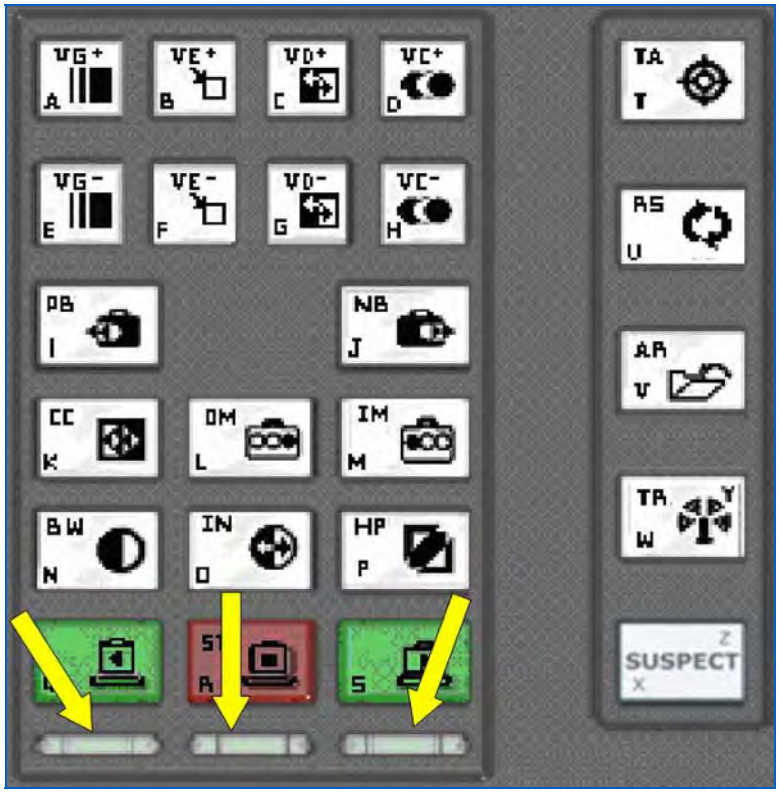


Figure 8-38: Conveyor Indicator Lights

9 Operator Mode

To enter the Operator Mode, type in your User ID and Password on the Log-On screen then left-click the mouse button. This will cause the main screen to appear, as shown below.

Note: For most of the manual, screen images will be of one side or view (Horizontal or vertical) of the screen only, simply because the print on the menus are too small to be legible in the manual if both sides of the screen as shown below.

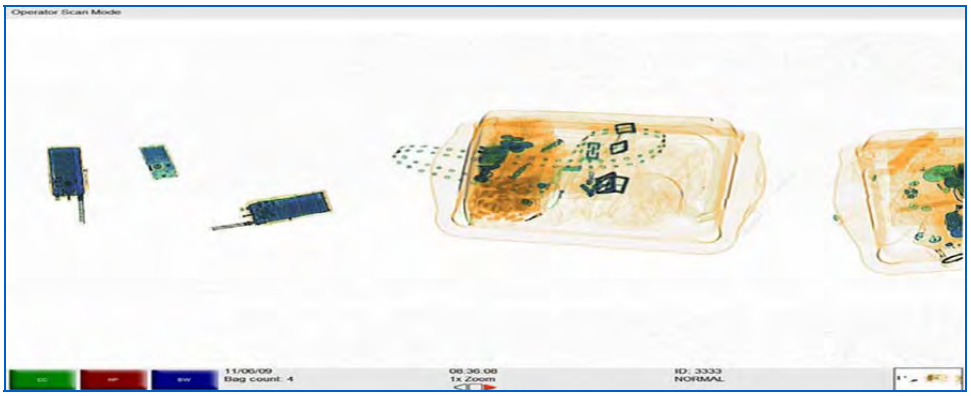


Figure 9-1: Log On Screen (Dual View)

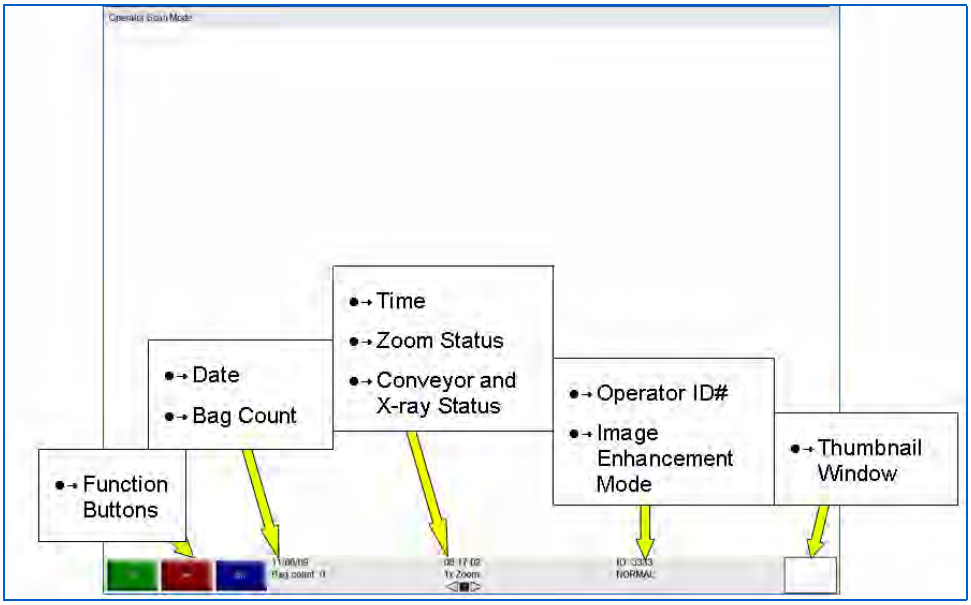


Figure 9-2: Main Screen

The Main Operator's Screen displays:

- The system's current mode of operation, as indicated at the top left corner of the screen (e.g. "Operator Scan Mode"). The panel at the top of the screen is called the Mode Indicator Panel.
- Three Programmable Function button indicators.
  The buttons read CC and Toggle.

The Toggle button will become a third image processing button once scanning begins.

- date
- bag count
- time
- zoom status (2x, 4x, 8x, all the way up to 64x)
- Operator ID
- Image Enhancement mode (e.g. Normal, Crystal Clear, Black and White, et al)
- Conveyor status, i.e. Stop, Reverse or Forward, see figure below.

9.1 Main Menu

This figure shows the Operator's Main Menu. There are seven functions on the main menu:

- Bag Count
- Machine Configurations
- Reports
- Help Manuals
- Session Lock
- Machine Serial Number
- Log Out

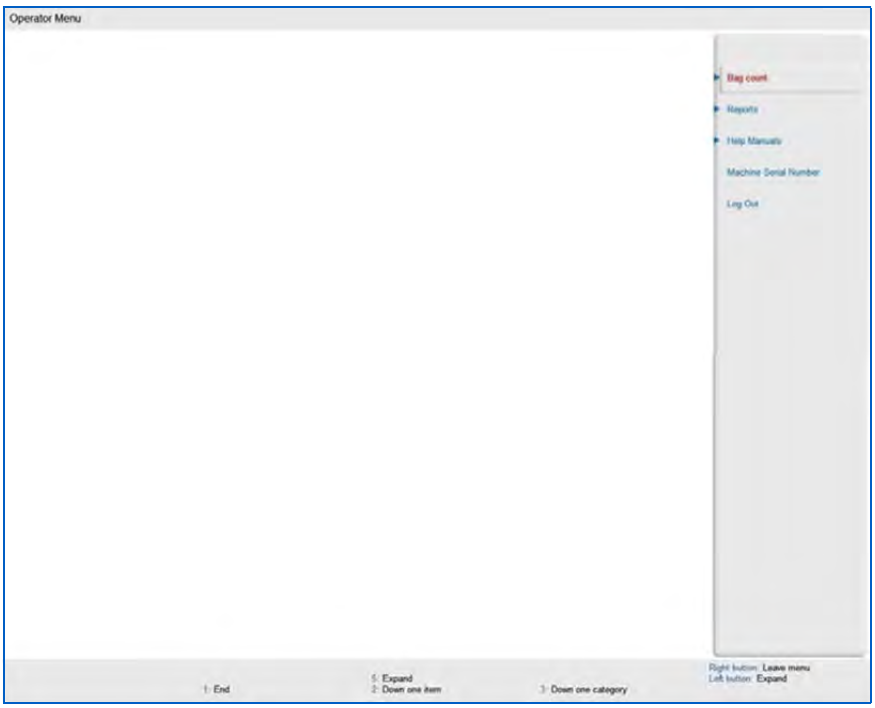


Figure 9-3: Operator's Main Menu

This screen shows the Operator's Main menu, which is accessed by clicking the left mouse button. Clicking the right mouse button reverses that choice, making the menu slide

Back out of sight. The left/right mouse button works all through this menu: left click will bring up a sub-menu; right click will slide that submenu out of sight.

Bag Count

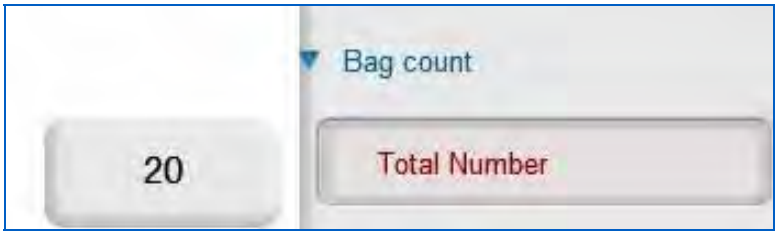


Figure 9-4: Bag Count

Selecting “Bag Count” and then “Total Number” brings up the sub-screen shown below which displays the number of bags scanned since the machine first operated at the factory. This number cannot be changed.

Reports

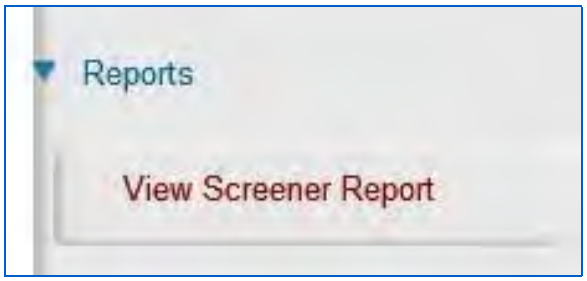


Figure 9-5: Reports

This figure shows the Reports option with the “View Screener Report” sub-option. Selecting “View Screener Report” brings up the screen shown below.

Figure 9-6: Report Data

Selecting “View Reports” from the Report Data screen brings up the following six screens which can be viewed and sorted by the various criteria listed on those screens.

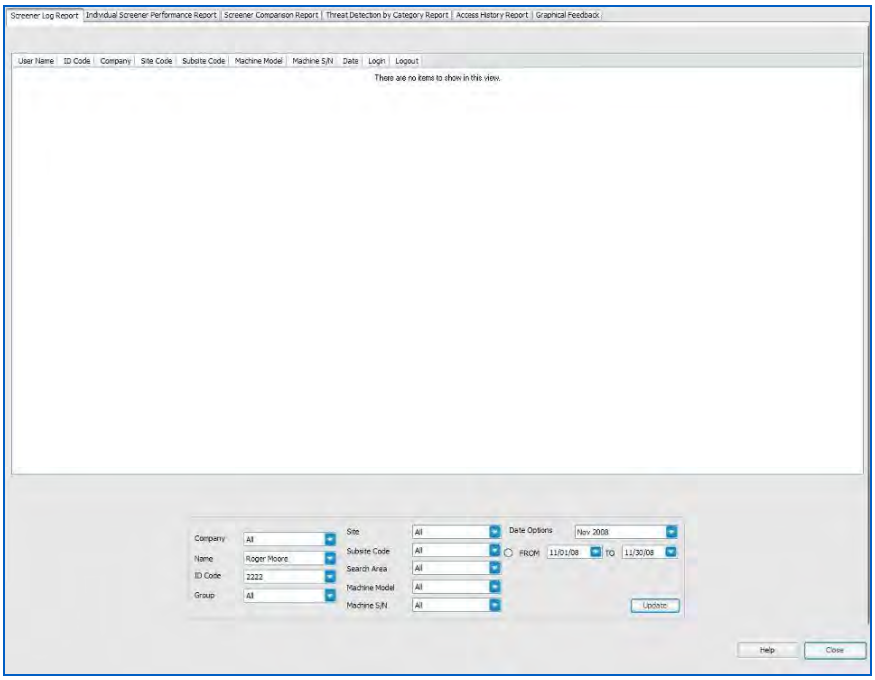


Figure 9-7: Screener Log Report

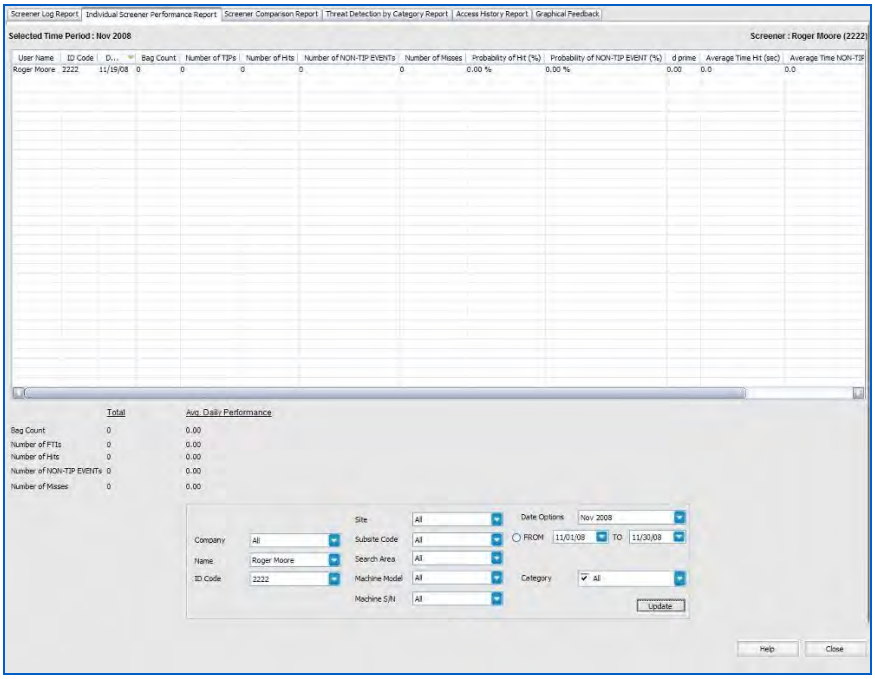


Figure 9-8: Individual Screener Performance Report

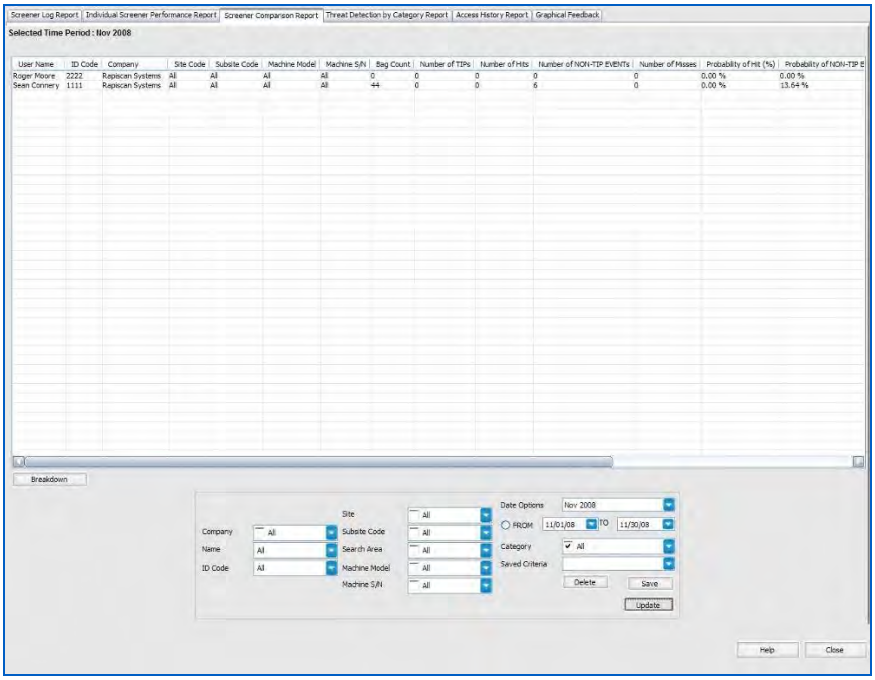


Figure 9-9: Screener Comparison Report

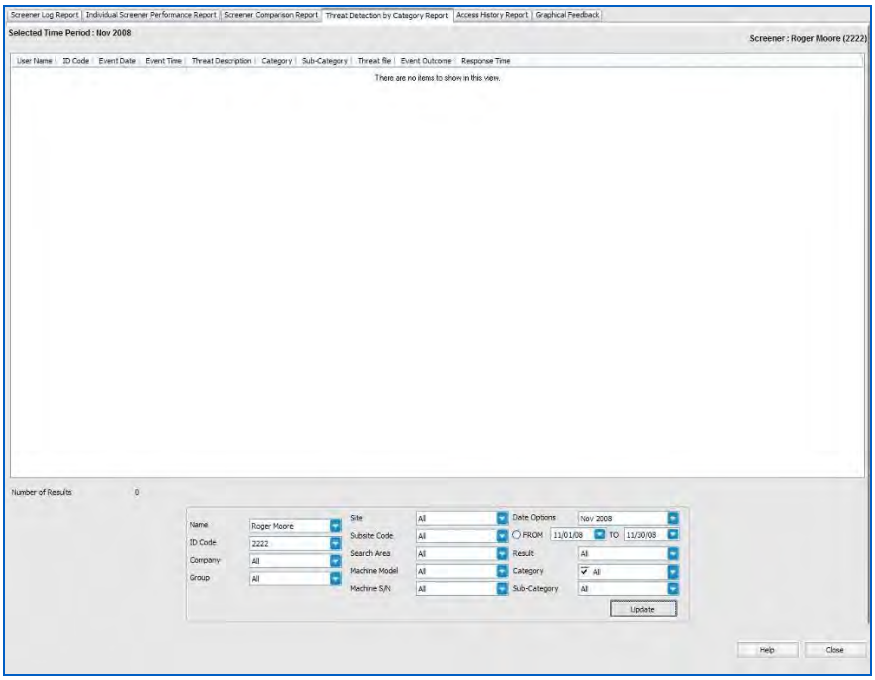


Figure 9-10: Threat Detection by Category Report

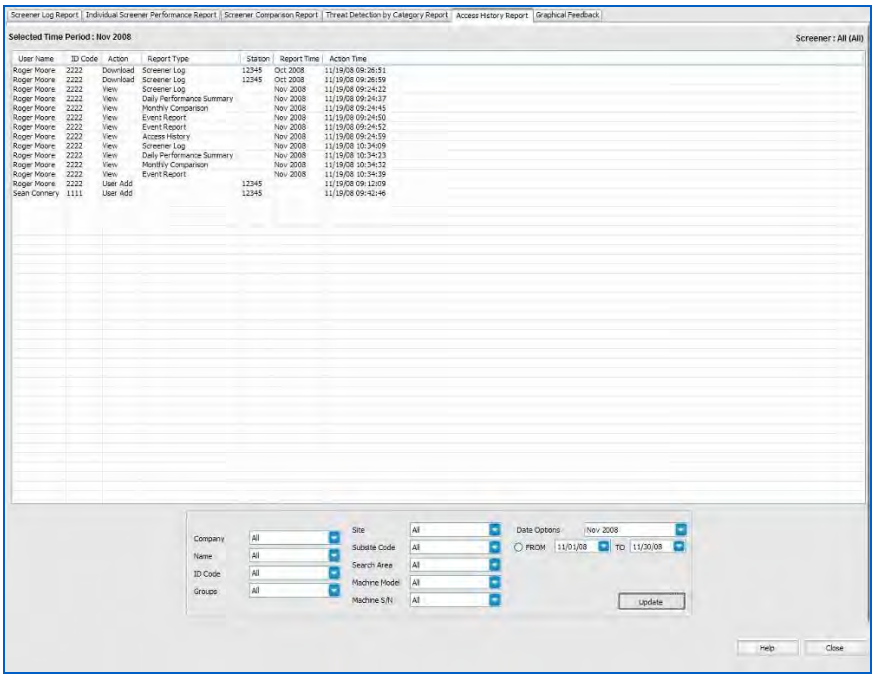


Figure 9-11: Access History Report

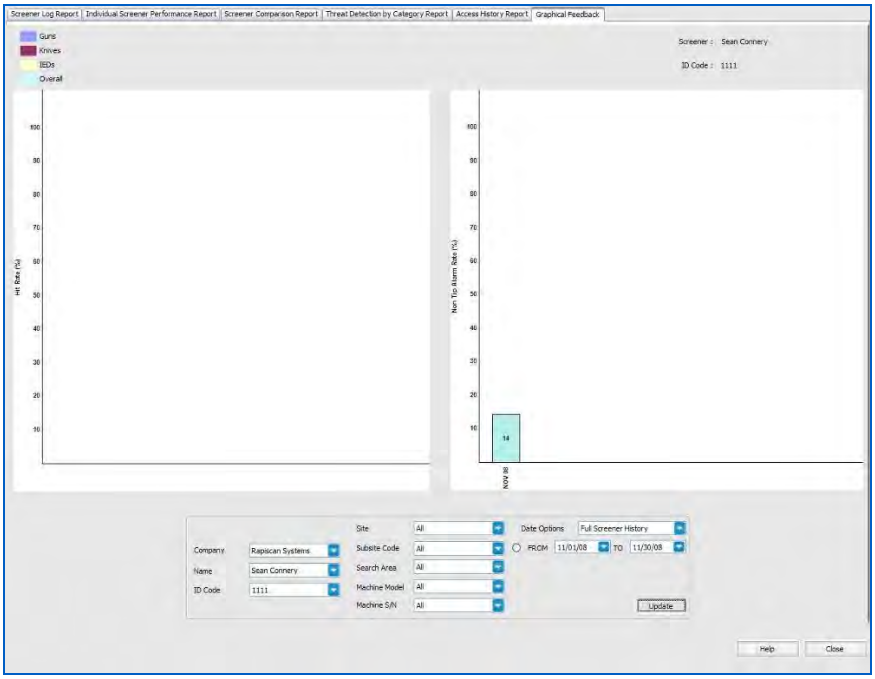


Figure 9-12: Graphical Feedback

Help Manuals

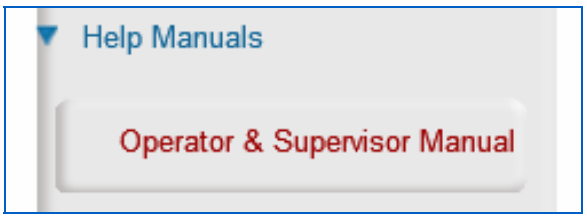


Figure 9-13: Operator & Supervisor Manual option

This figure shows the Operator and Supervisor Manual option, which is under the "Help Manuals" option. When selected, this brings up that manual.

Machine Serial Number

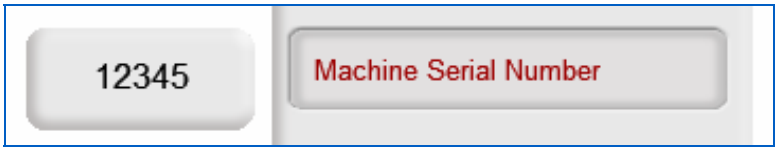


Figure 9-14: Machine Serial Number

This figure shows the Machine Serial Number option. It is important to know the service and maintenance history of a machine and the machine's serial number is the best way to match a machine with its service/maintenance history.

Log Out

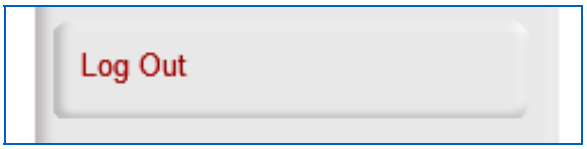
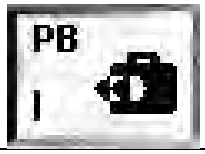
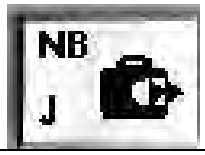
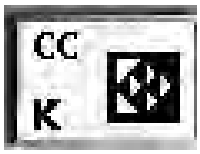
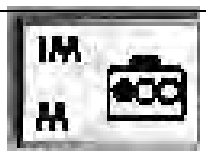
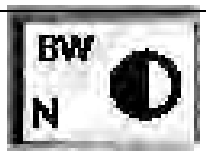
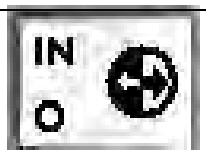
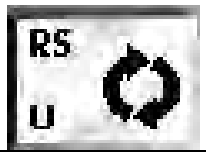
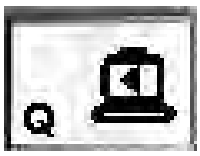


Figure 9-15: Log Out Option.

This figure shows the Log Out option.

Following is a table of describing the Image Enhancement functions.

BUTTON	NAME OF FUNCTION	BRIEF DESCRIPTION
	**VARIABLE GAMMA** (ON and OFF)	These buttons alter the brightness of the image. This remains active until ST button is pressed.
	**VARIABLE EDGE ENHANCEMENT** (ON and OFF)	These buttons show the centre of enhancement, which causes objects boundaries to become sharper and easier to see. This remains active until ST is pressed.
	**VARIABLE DENSITY ZOOM** (ON and OFF)	These buttons place correlate an image's brightness with the scanned object's density.
	**VARIABLE COLOR STRIPPING** (ON and OFF	These buttons progressively strip away color from inorganic matter in an image, defining the shape of objects within the blue/black color scheme. Blue shades represent inorganic materials namely metals, while the green shades the low-density materials.
	**PREVIOUS BAG**	This button allows the Operator to go back to a previous bag stored in the buffer.
	**NEXT BAG**	This button allows an Operator to view the next bag in line stored in the buffer.
	**CRYSTAL CLEAR**	Crystal Clear brings out the detail in both light and dark areas simultaneously. This remains active until ST or F button is pressed.

	ORGANIC MATERIAL	This button toggles between showing all material and showing organic material only.
	INORGANIC MATERIAL	This button toggles between showing all material in the bag and showing inorganic material only
	**BLACK AND WHITE**	When this button is pressed, all color information from the image is removed.
	**INVERSE**	When this button is pressed, the image is displayed in reverse i.e. black becomes white and vice-versa.
	**RESET**	This button allows the operator to return to “normal” mode from image enhancement and zoom modes.
	**REVERSE**	When this button is pressed, the conveyor belt will travel in the reverse direction. Any objects on the belt will reverse through the tunnel, although no X-ray scanning will take place.
	**STOP**	This button will stop the unit from generating x-rays or moving the conveyor belt. **NOTE:** If this button is pressed during scanning of an object, the belt will stop then reverse a few centimeters. This is to ensure that when ‘forward’ is selected again, no part of the object is missing from the image. This button is used to control any image enhancements that have been selected.

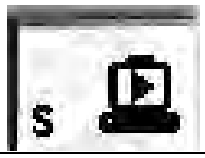
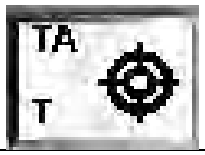
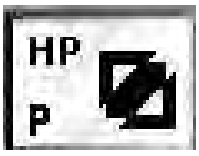
	**FORWARD**	Moves the conveyor belt forward, allowing X-ray scanning to take place.
	**TARGET**	This button causes an ellipse to be drawn around a suspected threat or contraband, if Target is installed.
	**HIGH PENETRATION**	When this button is pressed, the presentation of high-density object is enhanced. This remains active until ST or H button is pressed.
	**ARCHIVE**	Allows the scanned image to be stored on the computer. The image can be recalled later but only in Supervisor mode.
	**TRANSMIT**	This function is applicable when the X-ray machine is part of a network and allows images to be transmitted to other machines in the network.
	**SE/SUSPECT**	An Operator, who suspects that there may be a threat or contraband in a particular bag, should press the “SE/SUSPECT” button, and then follow the security procedures used at his place of employment.

Figure 9-16: Image Enhancement Functions

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10 Administrator Scan Mode

To enter the Administrator Scan Mode, type in your User ID and Password on the Log- On screen. This will cause the main screen to appear, as shown below.

NOTE: For most of the manual, screen images will be of one side or view (Horizontal or vertical) of the screen only, simply because the print on the menus are too small to be legible in the manual if both sides of the screen are shown.

Figure 10-1: Login Screen

The Main Screen displays:

- The system's current mode of operation, as indicated at the top left corner of the screen (e.g. "Administrator Scan Mode"). The panel at the top of the screen is called the Mode Indicator Panel.
- Two Programmable Function button indicators the buttons read CC and HP with a third non-programmable button reading Manual Scan).
- Date
- Bag count
- Time
- Zoom status (2x, 4x, 8x, all the way up to 64x)
- Operator ID
- Image Enhancement mode (e.g. Normal, Crystal Clear, Black and White, et al)
- Conveyor status, i.e. Stop, Reverse or Forward.

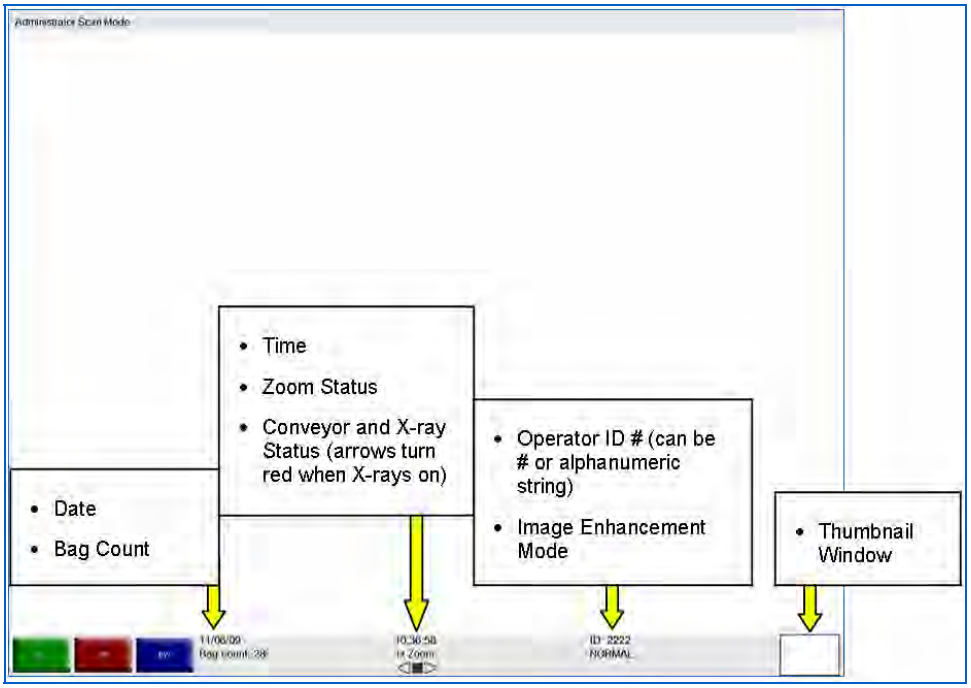

Figure 10-2: Main Screen

10.1 Main Menu

Left-clicking on this screen brings up the Maintenance Management menu. This menu allows the supervisor to change specific settings for the 600DV. Right-clicking on the screen will collapse a menu one step at a time.

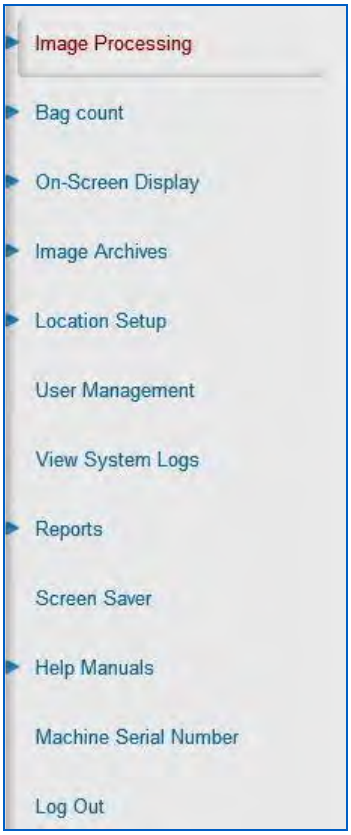

Figure 10-3: Administrator Menu

10.2 Image Processing

Figure 10-4: Image Processing – Mode

This figure shows the first item in the Supervisor menu, “Image Processing Mode.” Selecting “Image Processing” expands that section to show “Mode,” “Bind Processing Functions” and “Auto Reset on Scan.” Selecting “Mode” brings you to the screen shown below.
“Mode” includes a number of menu items that control the appearance of a scanned image:

- High Penetration
- Black & White
- Crystal Clear
- Inorganic Material
- Organic Material
- Inverse Color
- Edge Enhancement
- Gamma
- Color Stripping
- Density Zoom

Each of these menu items, when selected, offer three choices:

- Stop mode
- Disable/Enable
- Real-Time Mode

This determines whether a particular image enhancement, such as High Penetration, operates only in stop mode or in both stop mode and “real-time” mode and also whether the enhancement is enabled or disabled altogether.

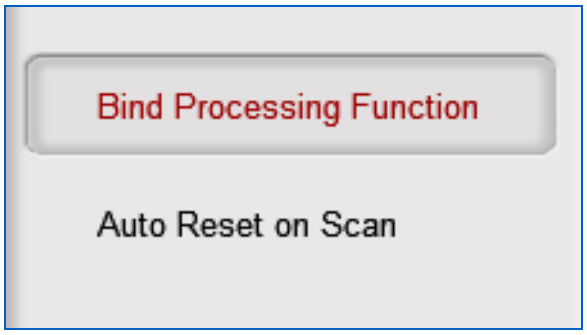

Figure 10-5: Image Processing – Bind Processing Functions

The Bind Processing Functions button allows the Operator to assign multiple image processing functions to individual function keys.

1. To make use of the Bind Processing Functions function, obtain a scanned image

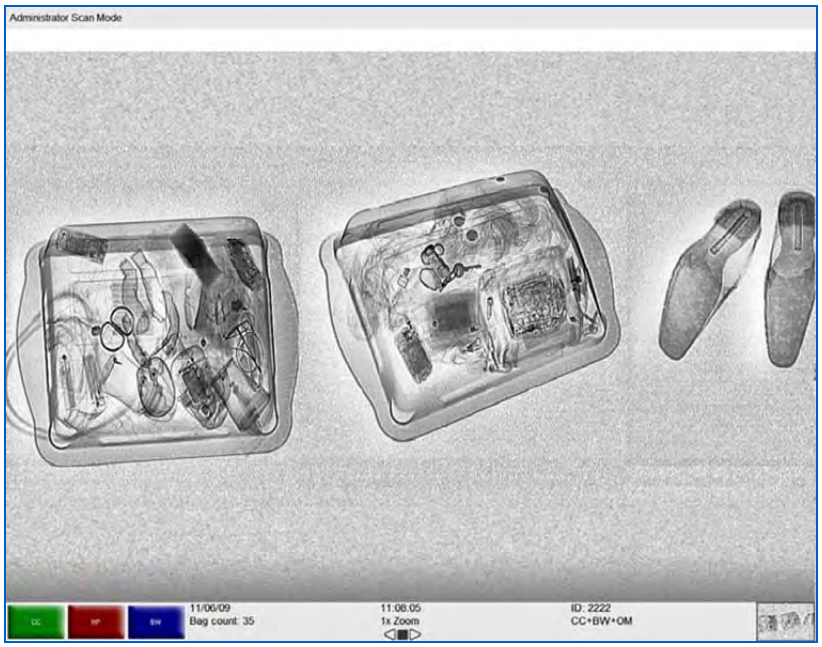

Figure 10-6: Scanned Image

2. Apply one or more image processing functions to the image., the operator has applied CC, BW and OM to the image
3. Click the right touchpad button, which brings up the Administrator Menu.
4. Using the touchpad, move down to highlight Image Processing.
5. Left click on “Image Processing.” The full Image Processing menu will be revealed, including the Bind Processing Functions button.

7. Using the touchpad, move down to highlight the Bind Processing Functions button and left-click on the button. The Bind Processing Functions drop down menu will appear.

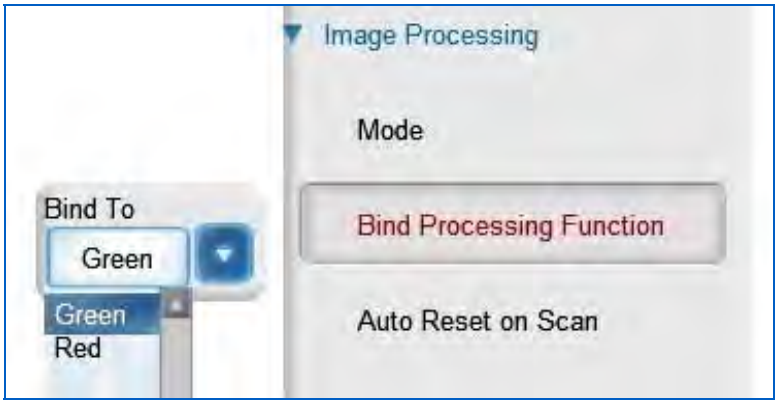

Figure 10-7: Image Processing – Bind Processing Functions

8. Choose the colored button to which you want to assign the image functions you've just applied to the scanned image (green or red)
9. Right-click until you return to the main screen (without the main menu showing) where you'll see that the functions you chose have been assigned to the function button you selected.

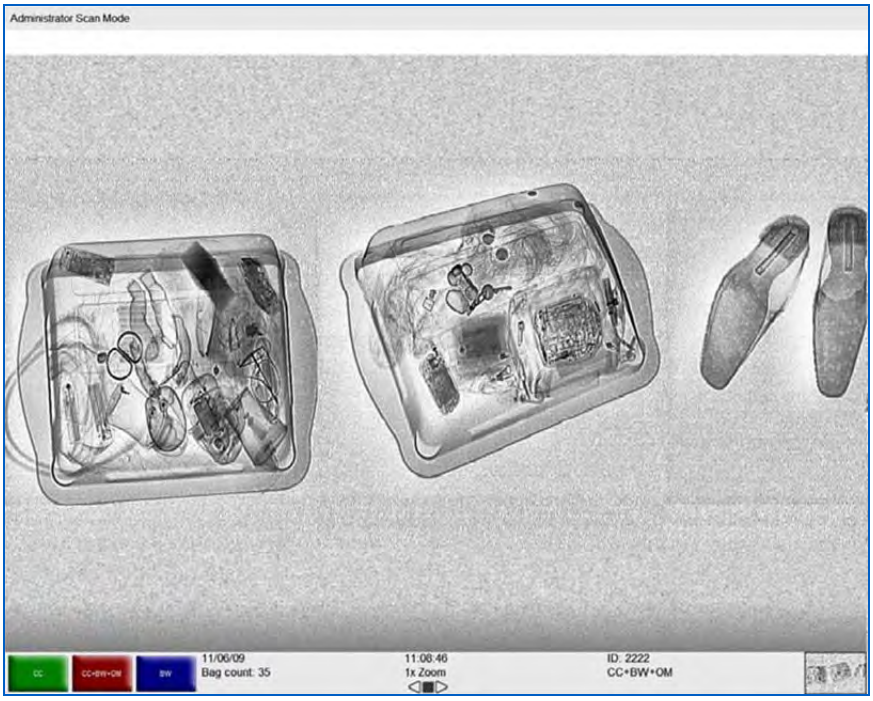

Figure 10-8: Multiple Image Processing Functions

This figure shows the blue button now representing the CC, B&W and HP functions. Now each time that button is selected, all three of those functions will be applied to the scanned image whenever the blue button is selected. Of course an operator may choose any number of functions to assign to any one of these buttons.

NOTE: Assigning too many functions may prove counterproductive to the quality of the actual image the operator's ability to discern possible threats in the image.

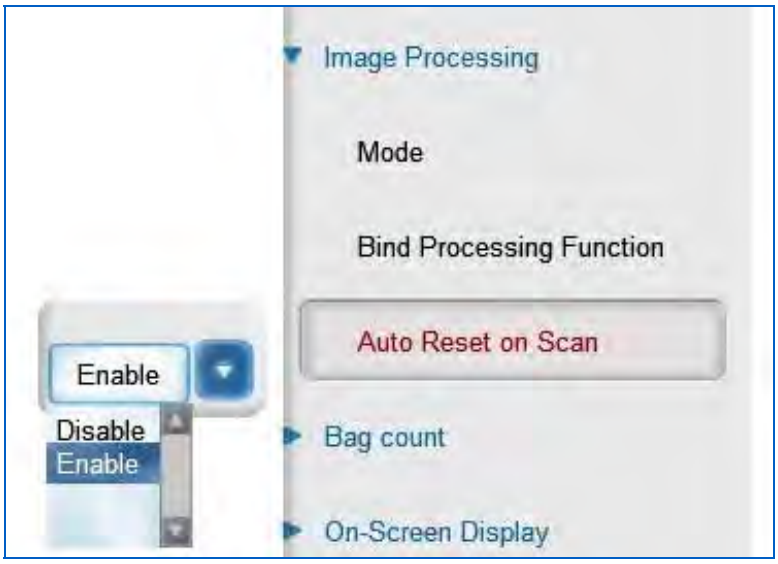

Figure 10-9: Image Processing – Auto Reset on Scan

This figure shows the third and final item under "Image Processing," the Auto Reset on Scan function. When enabled, this function resets the image processing functions to normal each time a new item is scanned. Note the Enable and Disable options.

10.3 Bag Count

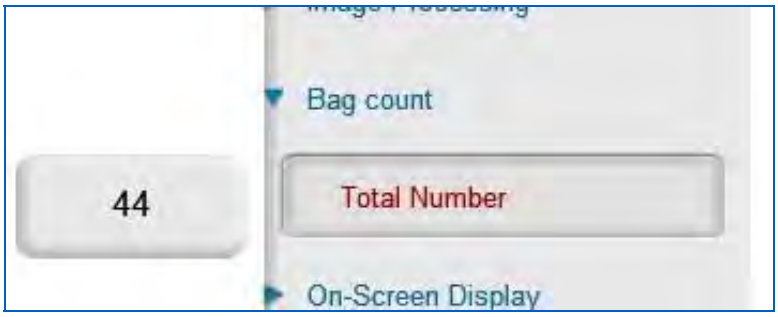

Figure 10-10: Bag Count – Total Number

Bag Count includes the Total Number sub-option. Total Bag Count displays the number of bags scanned since the Machine first operated at the factory. This number cannot be changed.

10.4 On-Screen Display

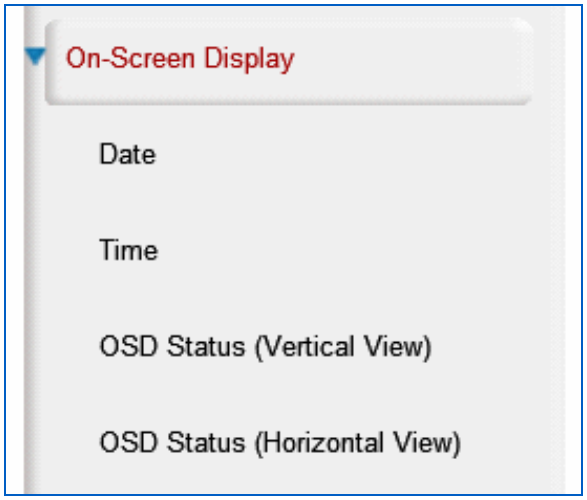

Figure 10-11: On-screen Display

This figure shows the On-Screen Display button. Selecting this brings up three sub- buttons: Date, Time and OSD (On Screen Display) Status for both vertical and horizontal views.

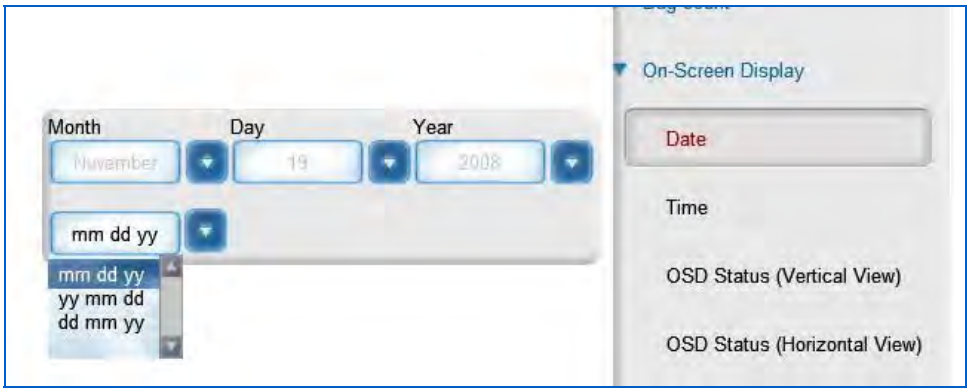

Figure 10-12: On-Screen Display, Date

This figure shows the Date readout, which can be displayed on screen in one of three formats.

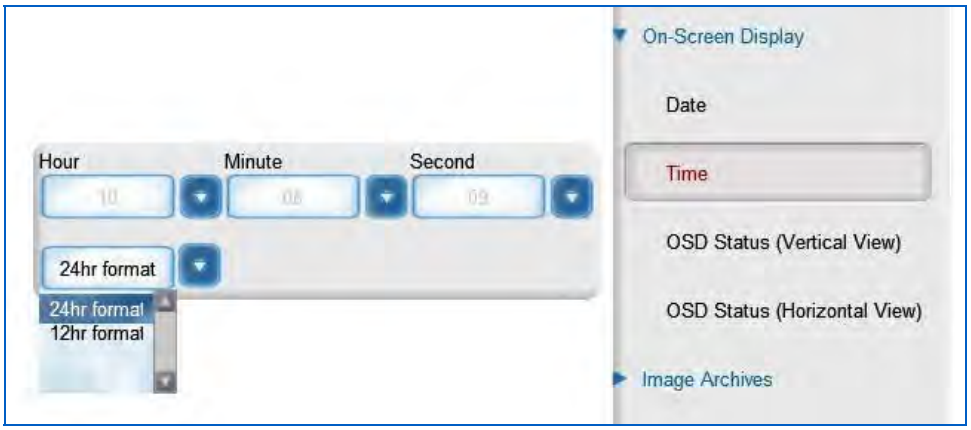

Figure 10-13: On-Screen Display, Time

Figure 100 shows On-Screen Display: Time. The time can be displayed in 12 hour or 24 hour format.

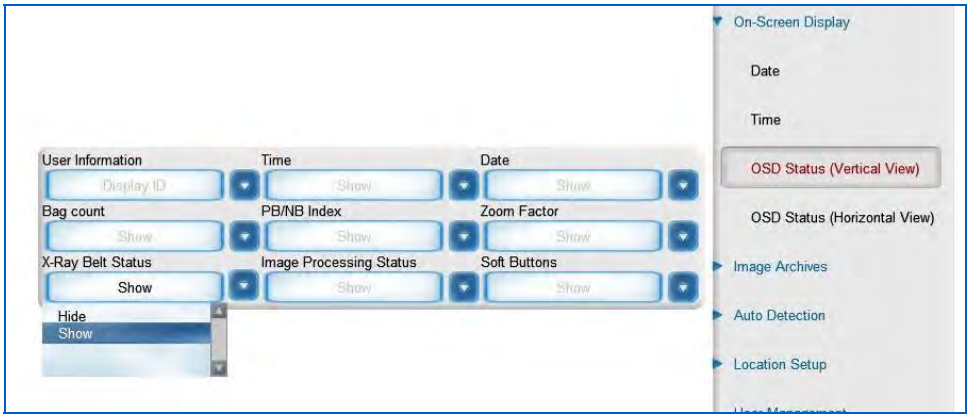

Figure 10-14: OSD (On Screen Display) Status

This figure shows the OSD (On Screen Display) Status button for the vertical view, with the accompanying slide-out/drop down menu, which allows control over a number of types of information that can be shown or not shown on screen:

- User Information
- Time
- Date
- Bag Count
- PB/NB Index
- Zoom Factor
- X-ray Belt Status
- Image Processing Status
- Soft Buttons

The vertical and horizontal OSD buttons contain the same menu of sub-options.

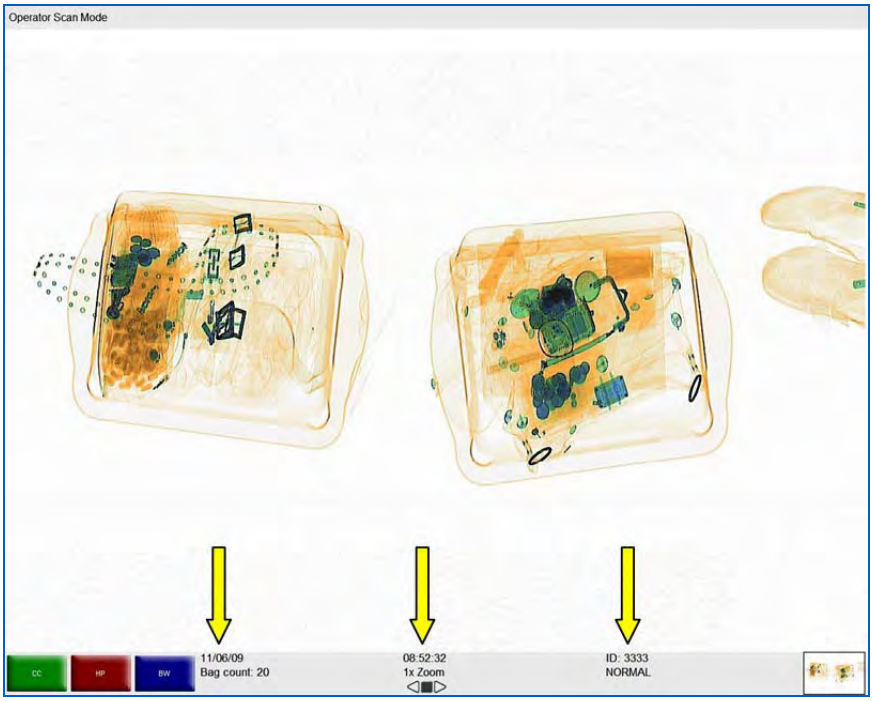

Figure 10-15: On Screen Information

This figure shows a typical scanned image, including information that can be displayed or hidden, using the OSD function.

10.5 Image Archives

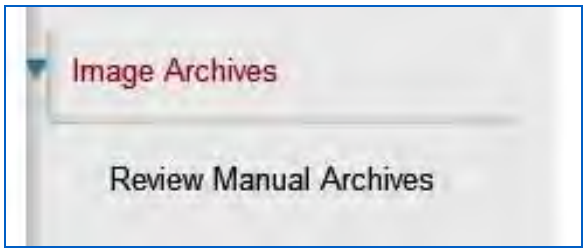

Figure 10-16: Image Archives

This figure shows the Review Archived Images option and its one sub-option: Review Manual Archives. Selecting Review Manual Archives brings up the Filter Options screen. The Filter Options screen allows you to determine the criteria that can be used to search the manually or automatically archived imaged, criteria such as Operator ID, Site, Bag Count and Date options.

Figure 10-17: Filter Options

Selecting “OK” on the Filter Options screen brings you to the Review Manual Archives Mode.

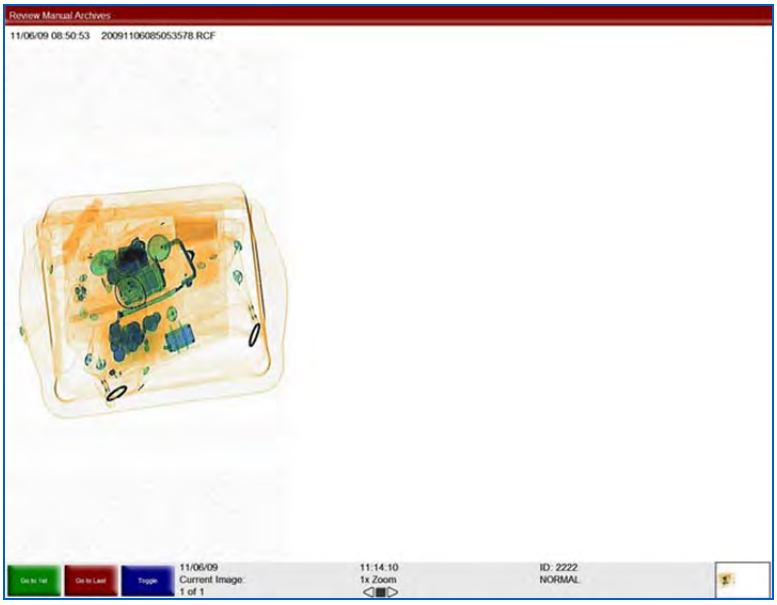

Figure 10-18: Review Manual Archives mode

Within a few moments of entering the Review Manual Archives mode, archived images will begin to scroll across the screen from left to right. These images can be

manipulated – press the red Stop (ST) key on the operator control panel. Left click and the Review Manual Archives menu will slide into view from the right side of the screen.

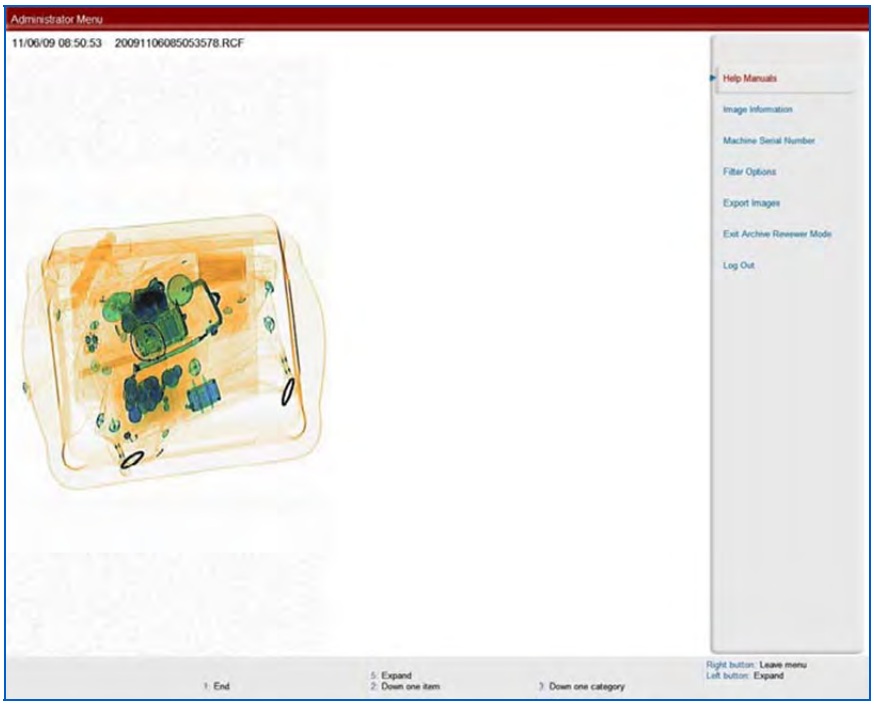

Figure 10-19: Review Manual Archive menu

The Help Manuals option allows the user to access the operator and supervisor manuals.

Figure 10-20: Help Manuals

Selecting Image Information brings up the screen shown in below.

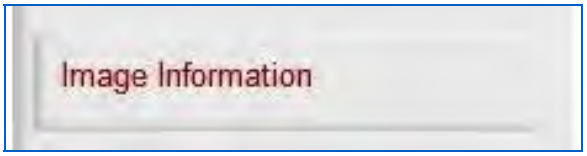

Figure 10-21: Image Information button

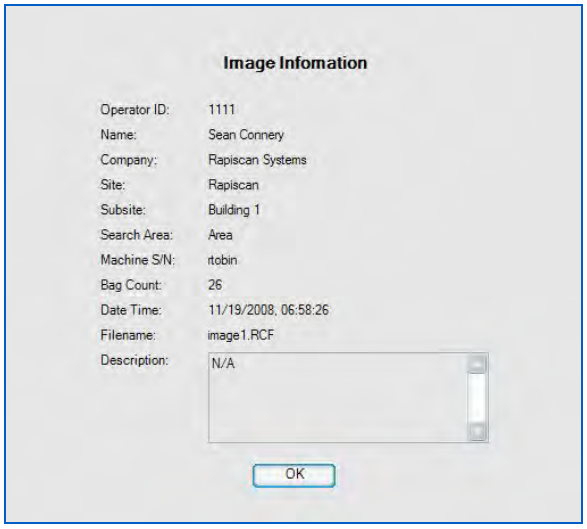

Figure 10-22: Image Information screen

This figure shows the Machine Serial Number option.

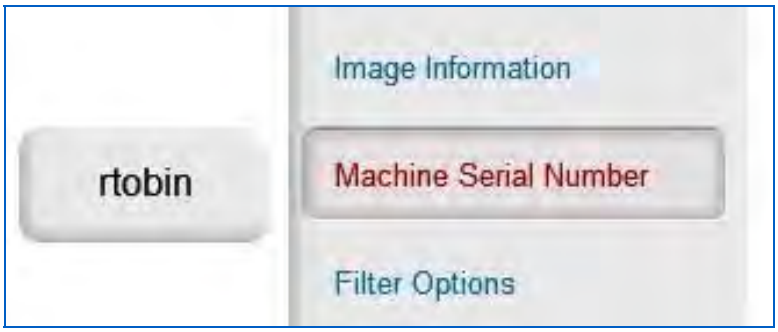

Figure 10-23: Machine Serial Number

Selecting Filter Options brings up the Filter Options screen.

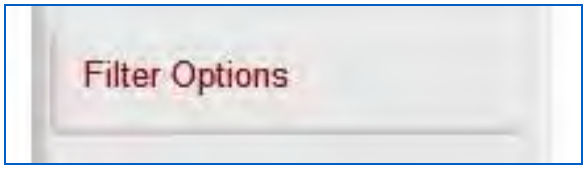

Figure 10-24: Filter Options

Selecting Export Images brings up the screen shown below.

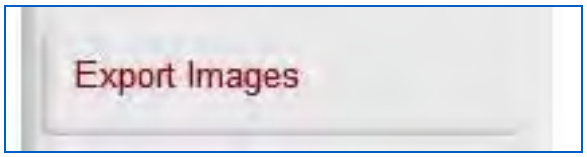

Figure 10-25: Export Images

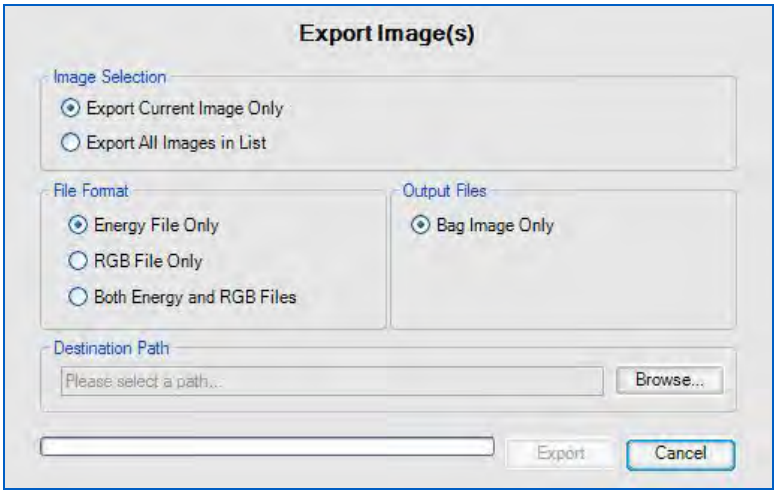

Figure 10-26: Export Image(s) screen

Selecting Exit Archive Reviewer Mode takes you out of the Review Manual Archives mode.

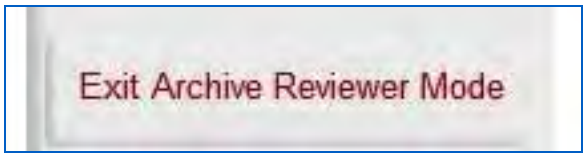

Figure 10-27: Exit Archive Reviewer Mode

The final option is the Log Out option.

10.6 Location Setup

This figure shows Location Setup and its two sub-options: Site and Station.

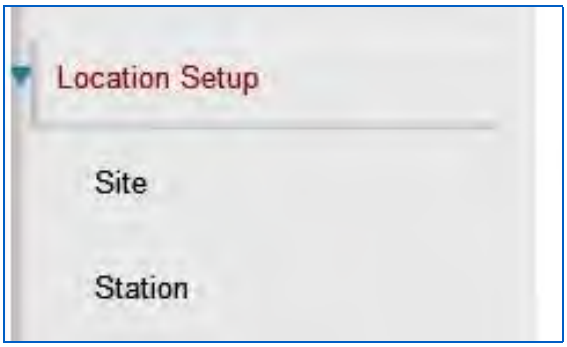

Figure 10-28: Location Setup

This screen shows the Site sub-option. When selected it takes you to the Site screen shown in the next screen

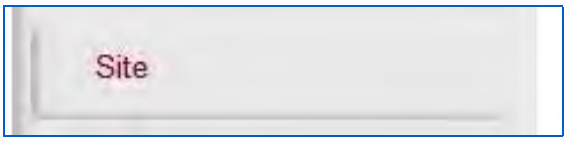

Figure 10-29: Location Setup - Site

The Site screen allows you to modify site information and to list all the current sites.

Figure 10-30: Site

This figure shows the Modify Site screen. To actually modify an entry, select a site from those listed on the screen, then click on “Modify.”

Figure 10-31: Modify Site

The Modify Site screen allows you to modify an particular entry, in this case a Site called RAP. As shown, you can change various data, from street name to email address. You can also modify the sub-site code and Search Area.

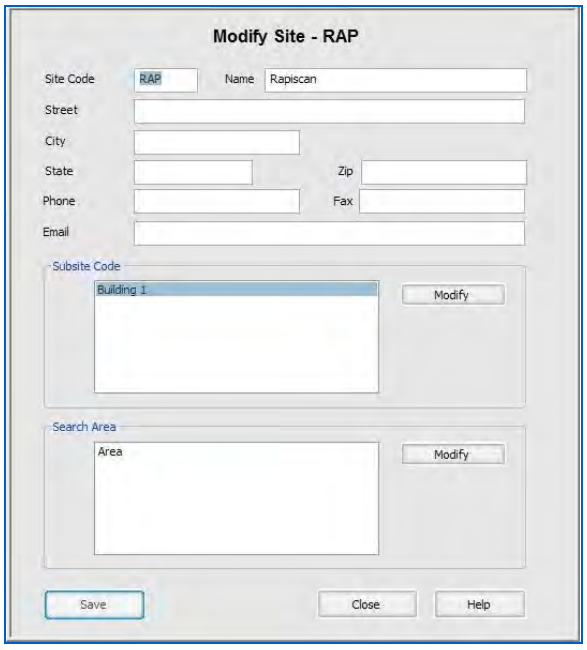

Figure 10-32: Modify Site – RAP

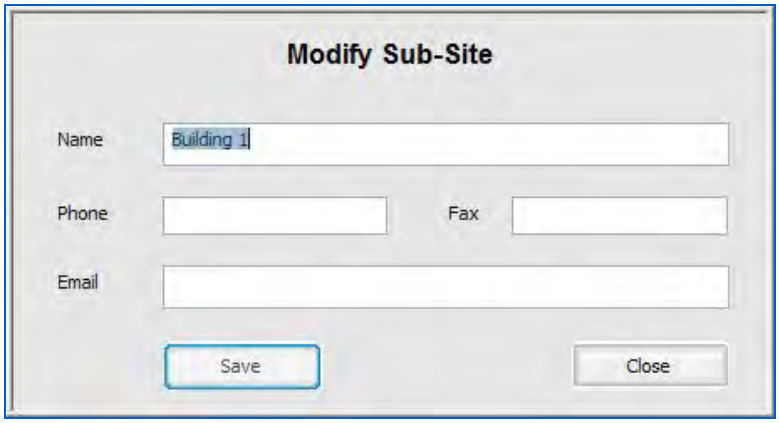

Figure 10-33: Modify Sub-Site

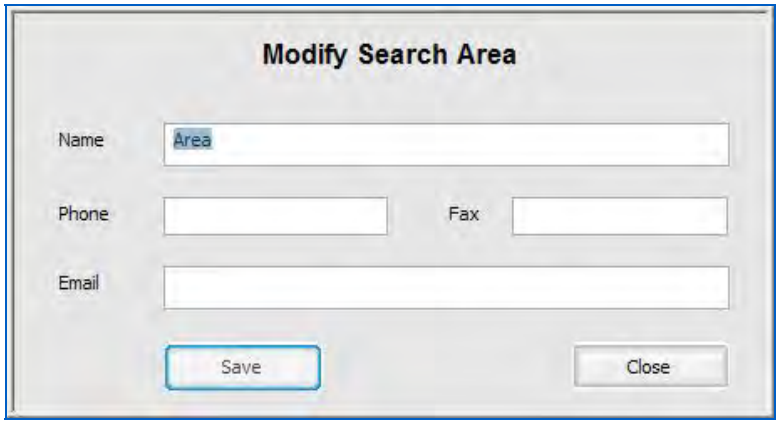

Figure 10-34 Modify Search Area

Choosing List All from the Site screen 117 brings you to the next screen which lists all current sites. You can also view more detail about any particular site by selecting that site from the list and clicking View which brings you to the screen shown below.

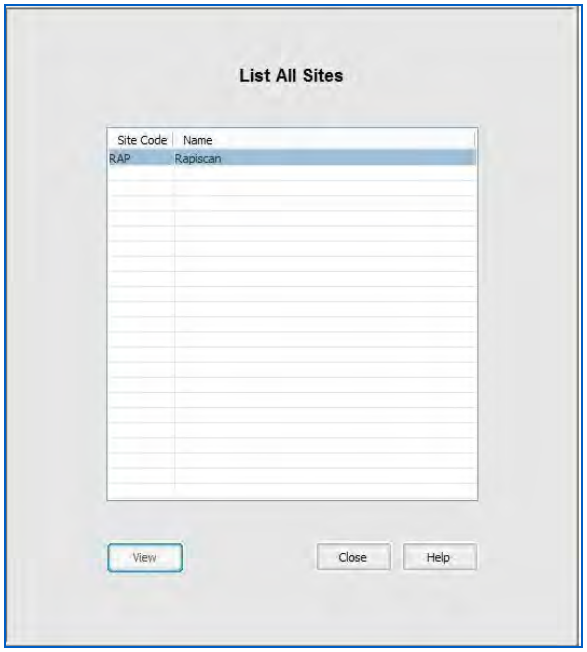

Figure 10-35: List All Sites

Figure 10-36: View Site

If you choose Station the screen shown below appears.

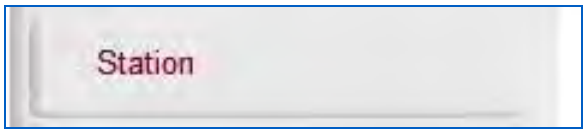

Figure 10-37: Station option

The Station screen allows you to modify and/or list all current stations.

Figure 10-38: Station

Choosing Modify from the Station screen brings up the Modify Station screen shown below. Select the desired station from the list of stations, then click “Modify.”

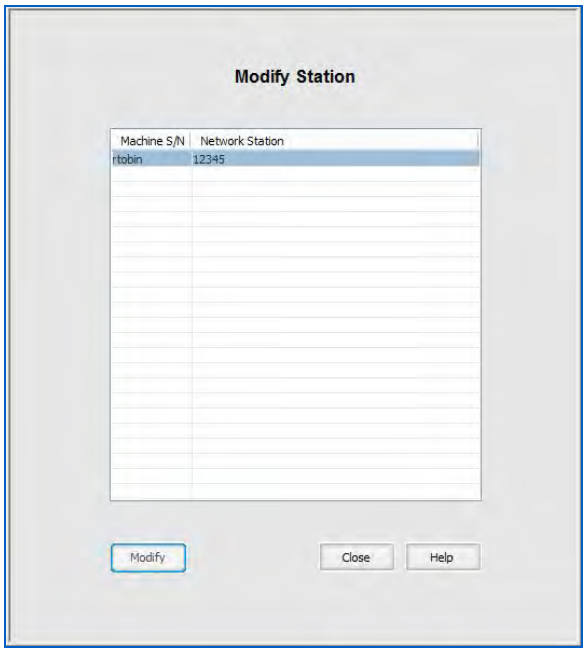

Figure 10-39: Modify Station

This figure shows the screen in which you can make changes to the Station information, from Station name to Sub-site Code and Equipment Type.

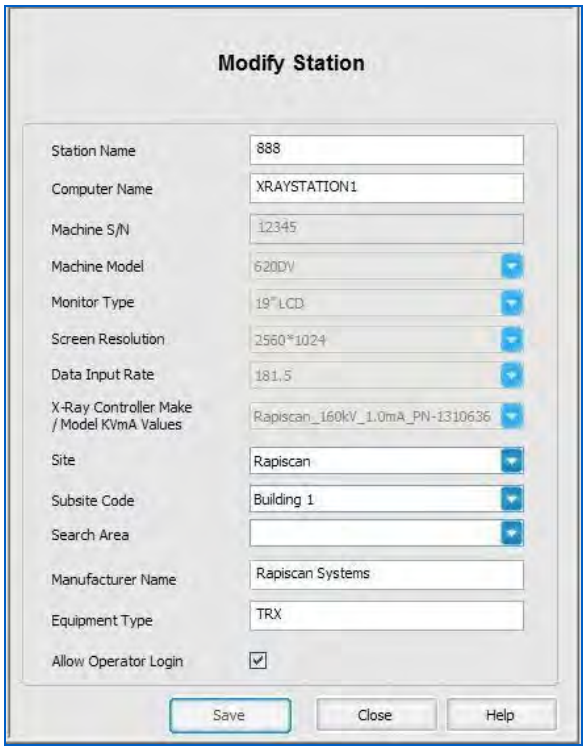

Figure 10-40: Modify Station

Choosing List All from the Station screen brings up the List All Stations screen. Select the station from the list of Stations and click View to see more detail.

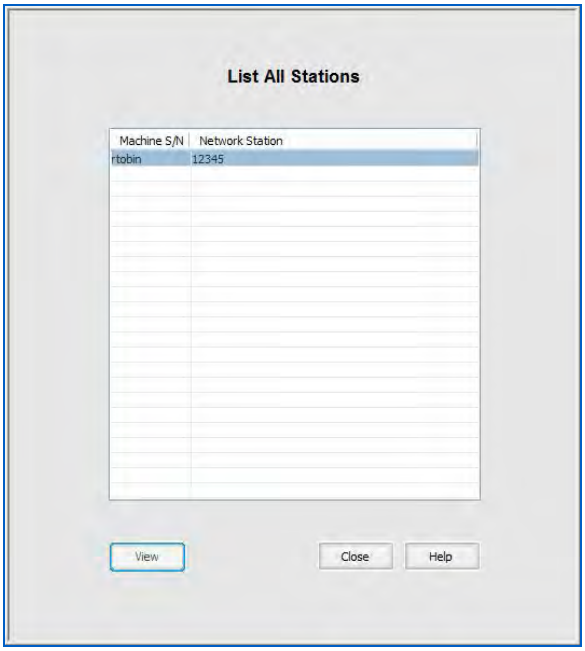

Figure 10-41: List All Stations

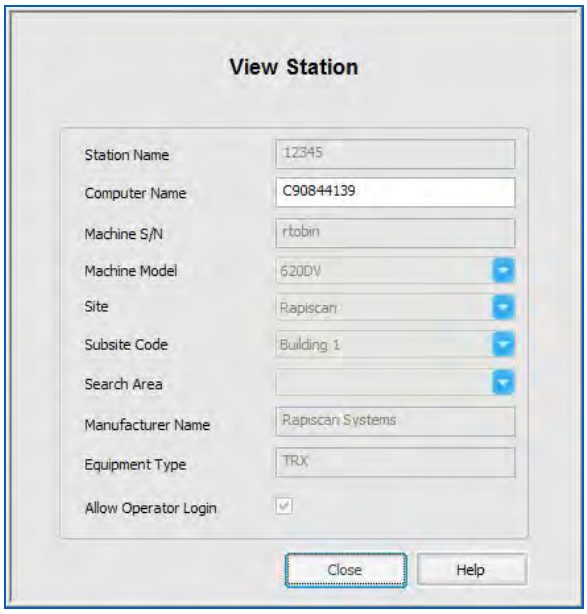

Figure 10-42: View Station

10.7 User Management

This figure shows the User Management option. Selecting this option brings up the screen shown below.

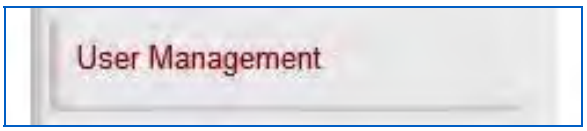

Figure 10-43: User Management

The “Users” Window allows users’ info to be viewed, added, deactivated, modified, activated, deleted, listed, imported and exported.

Figure 10-44: Users

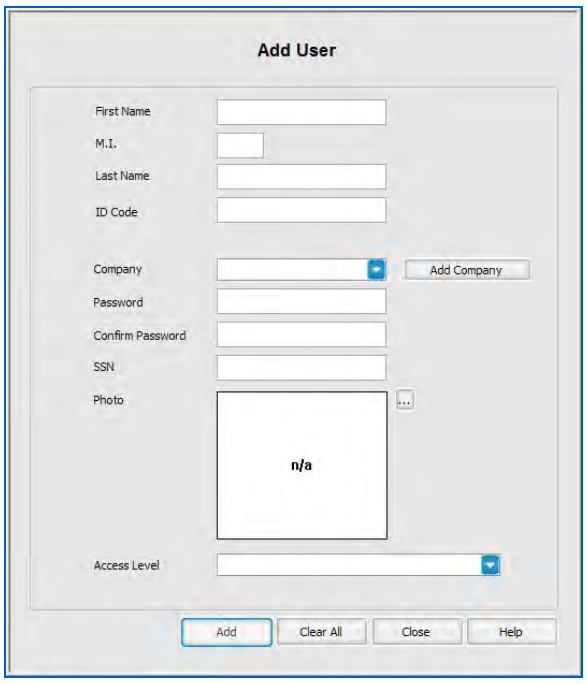

Figure 10-45: Add User

Selecting Add Company brings up the Add Company screen:

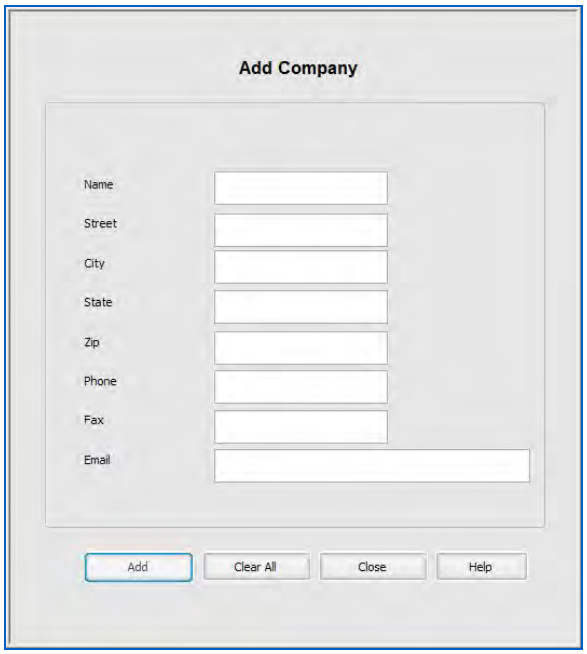

Figure 10-46: Add Company

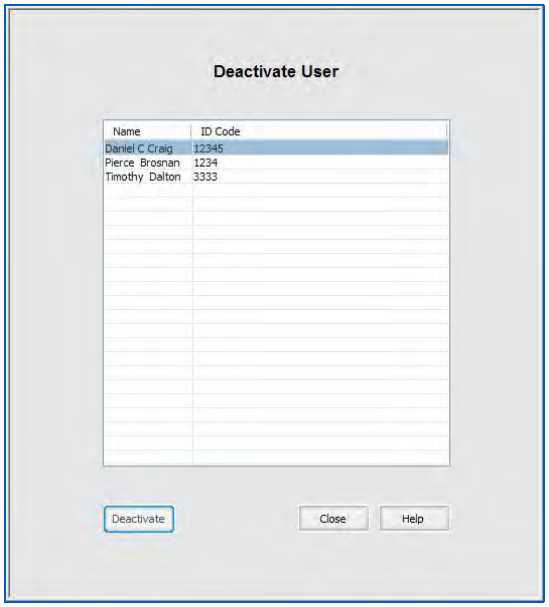

Figure 10-47: Deactivate User

Selecting Deactivate from the Deactivate User screen brings up a warning message:

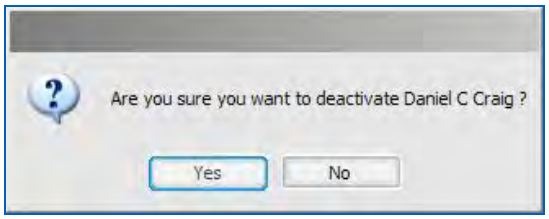

Figure 10-48: Deactivate user message

Selecting Yes will cause the selected user to be deactivated.

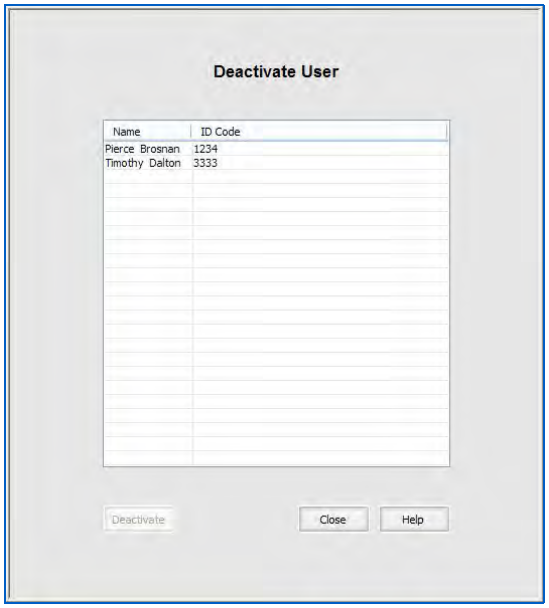

Figure 10-49: Deactivated user

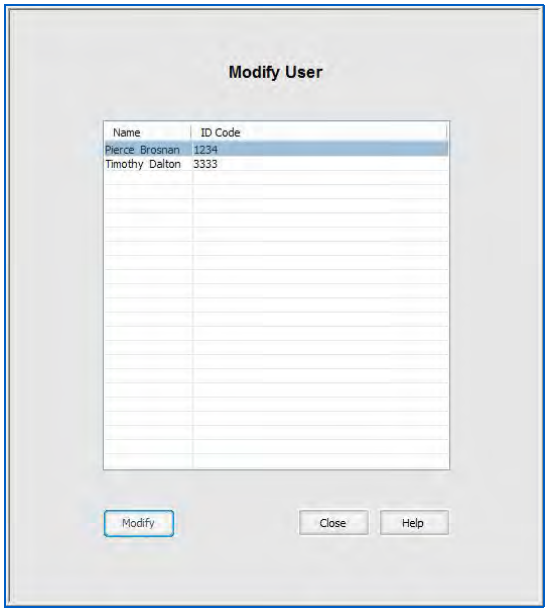

Figure 10-50: Modify User

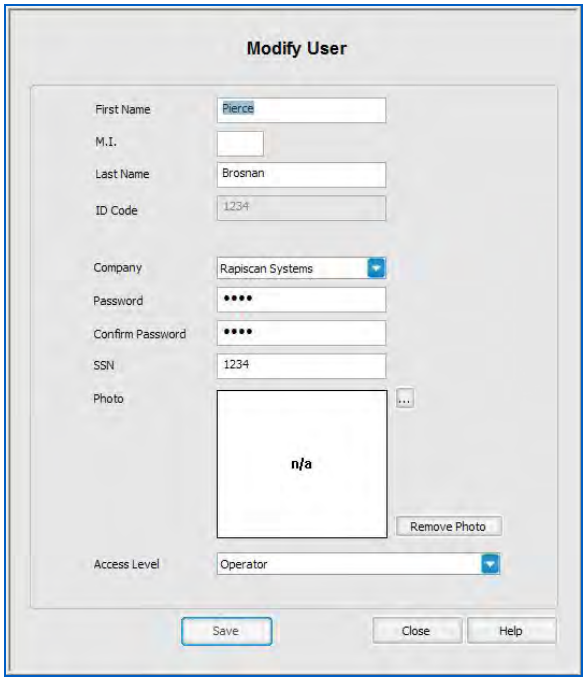

Figure 10-51: Modify User

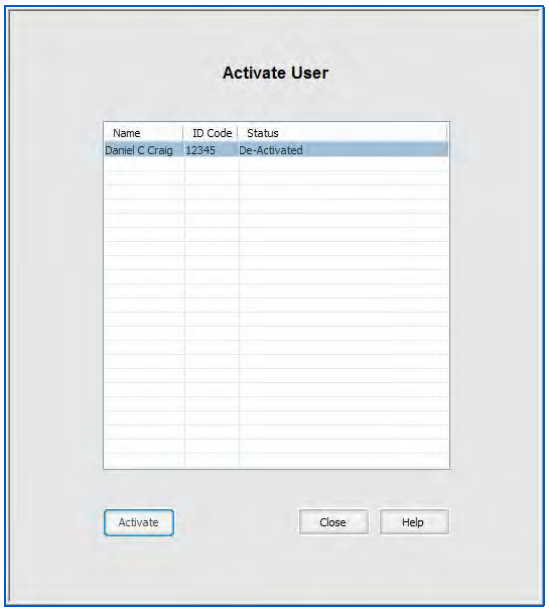

Figure 10-52: Activate user

Selecting Activate from the Activate User screen brings up a warning message:

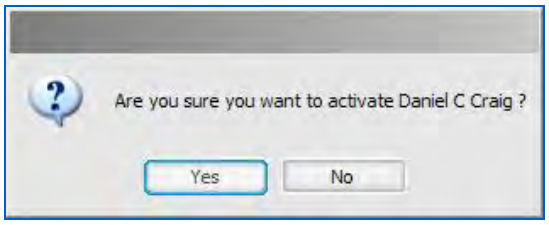

Figure 10-53: Activate User message

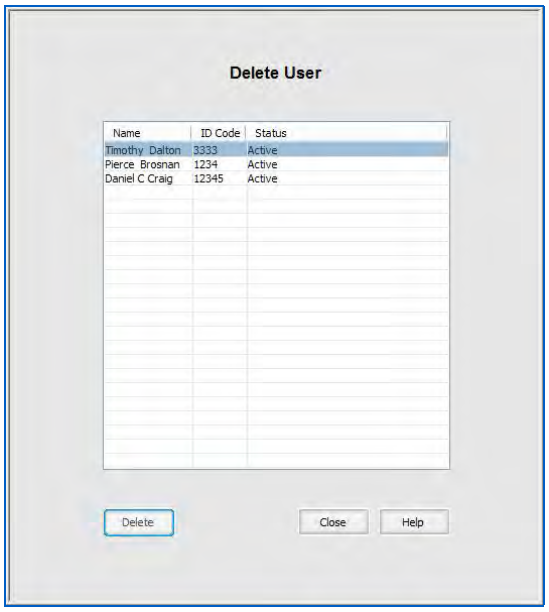

Figure 10-54: Delete User

Selecting Delete from the Delete User screen brings up a warning message:

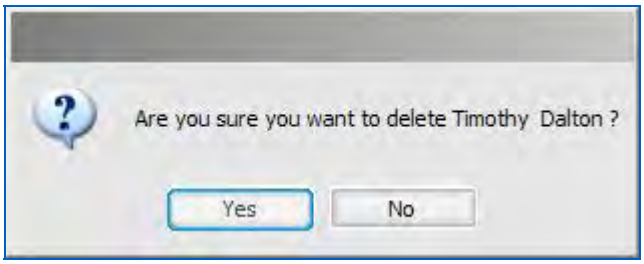

Figure 10-55: Delete User message

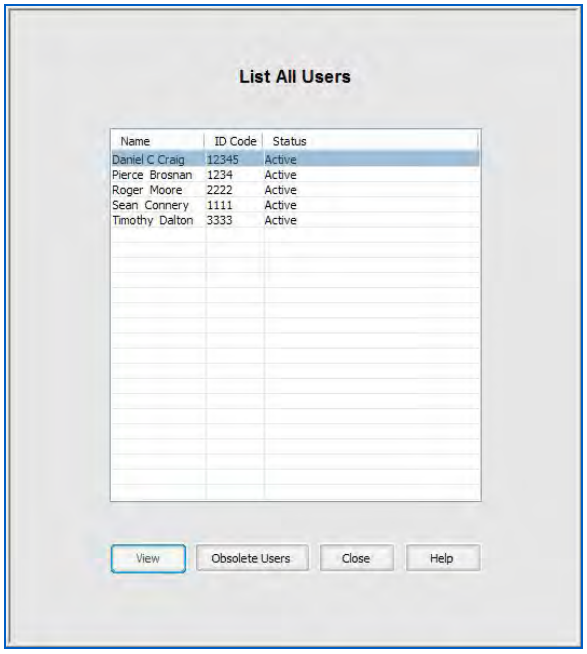

Figure 10-56: List All Users

Selecting View from the List All users screen brings up a more detailed screen:

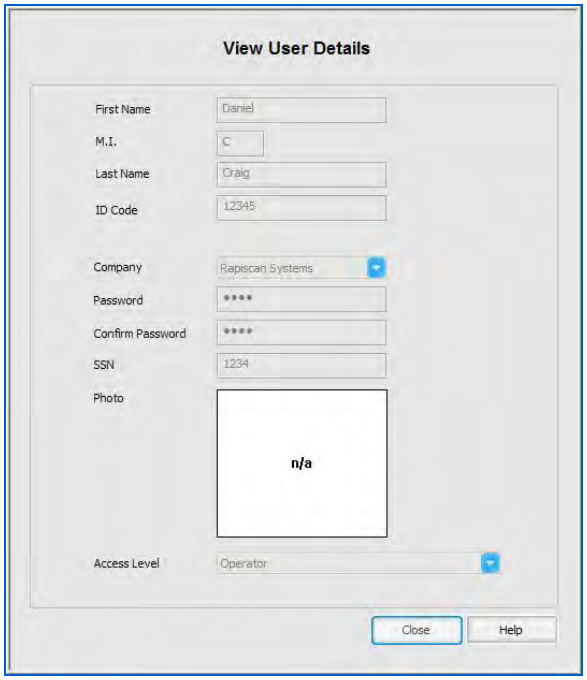

Figure 10-57: View User Details

NOTE: The Export/Import function is not available in this mode.

10.8 View System Log

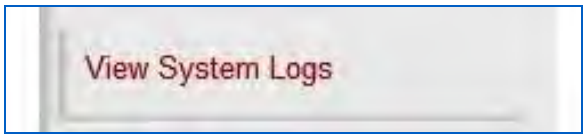

Figure 10-58: View System Logs

This figure shows the View System Logs button. Selecting this button brings you to the screen shown below.

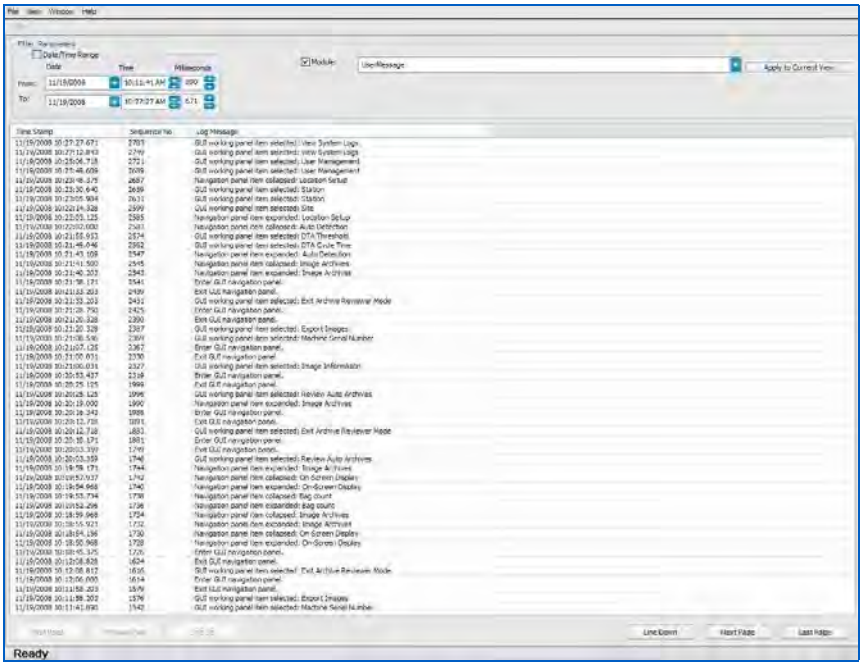

Figure 10-59: System Logs

To exit System Logs, select File in the upper left corner, then choose Exit from the pull- down File menu.

10.9 Reports

This figure shows the Reports/Manage Report Data option.

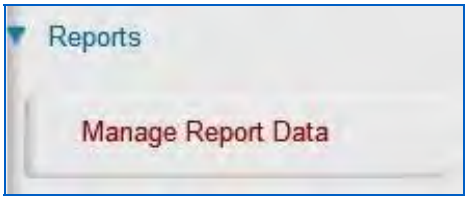

Figure 10-60: Manage Report Data

This figure shows the Manage Report Data option which brings up the Report Data screen shown below.

This figure shows the Report Data Screen which includes “View Reports,” “Download Data Files” and “Purge Data Records.”

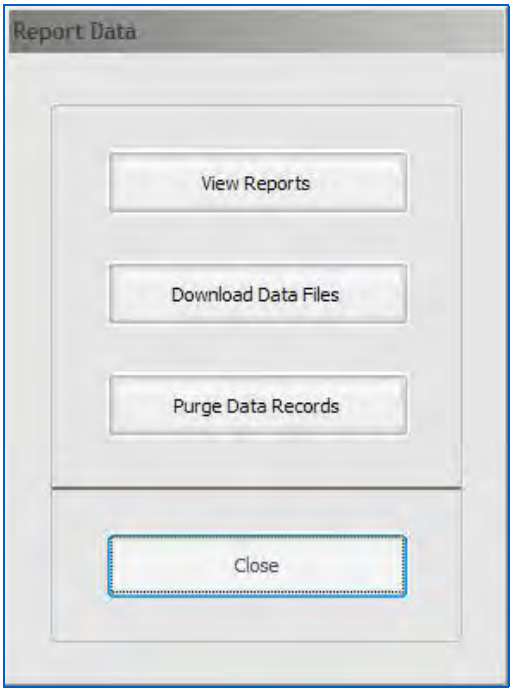

Figure 10-61: Report Data

Selecting “View Reports” from the Report Data screen brings up the following six screens which can be viewed and sorted by the various criteria listed on those screens.

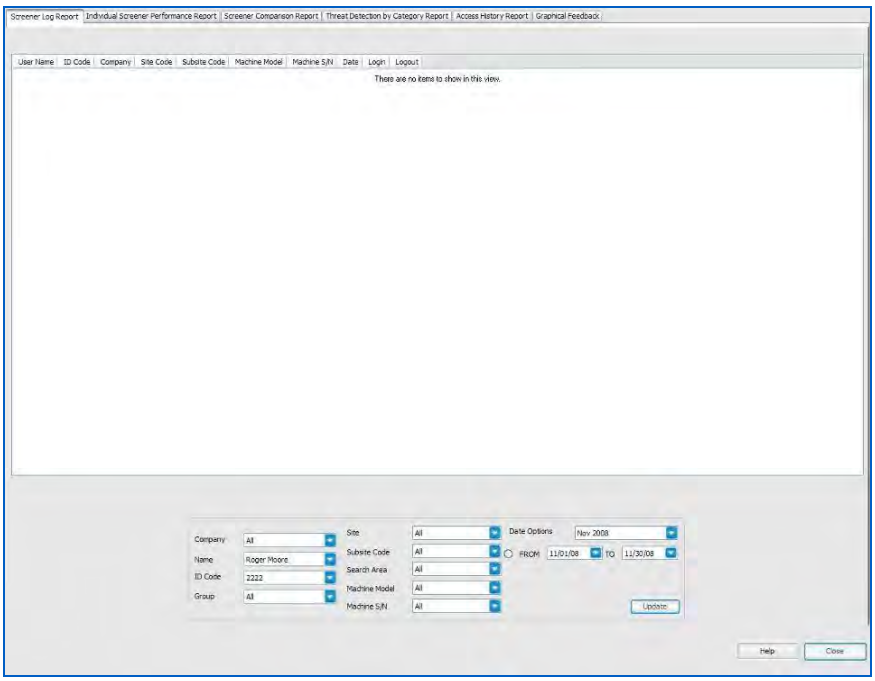

Figure 10-62: Screener Log Report

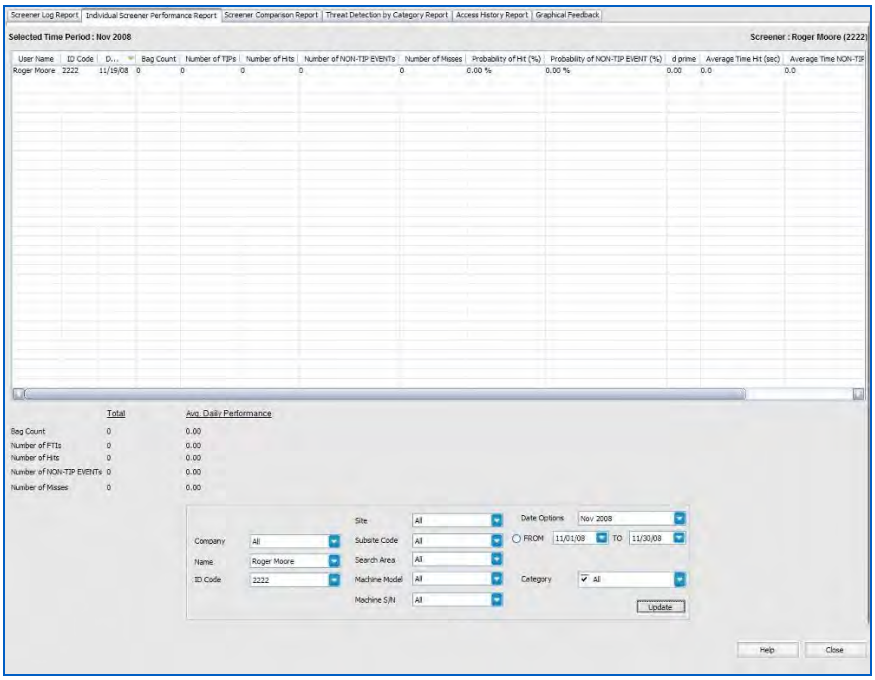

Figure 10-63: Individual Screener Performance Report

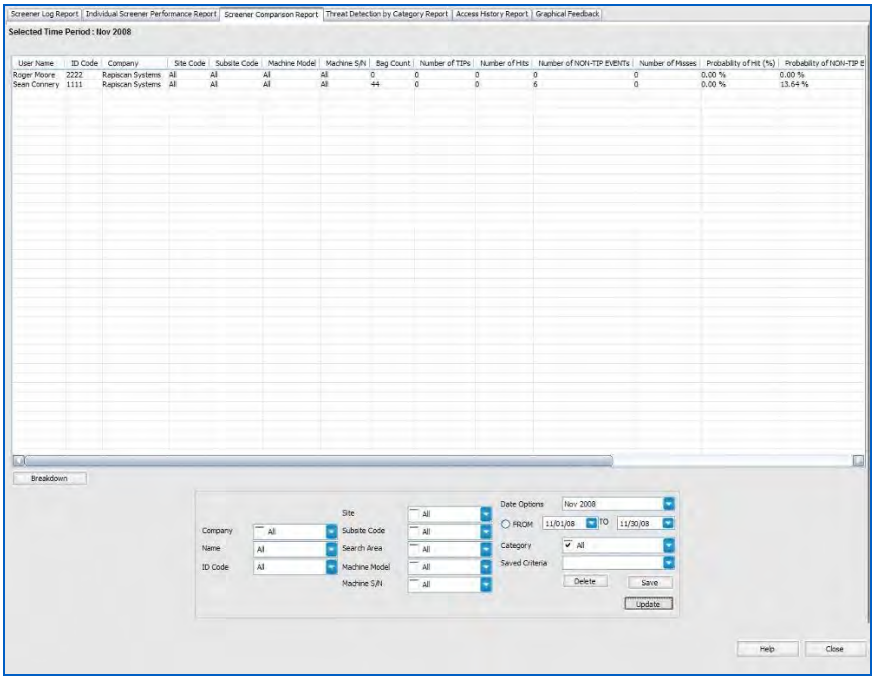

Figure 10-64: Screener Comparison Report

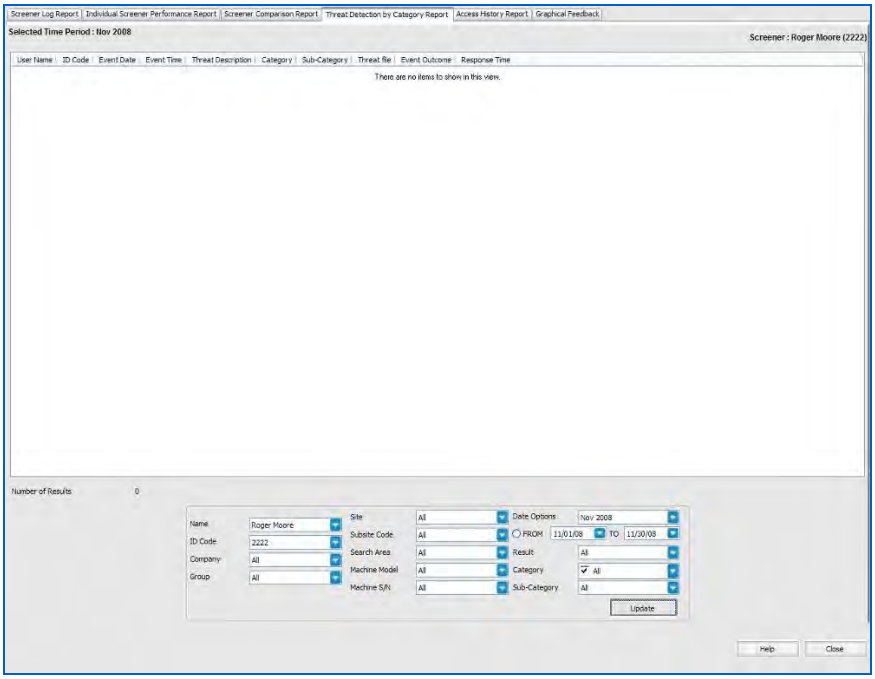

Figure 10-65: Threat Detection by Category Report

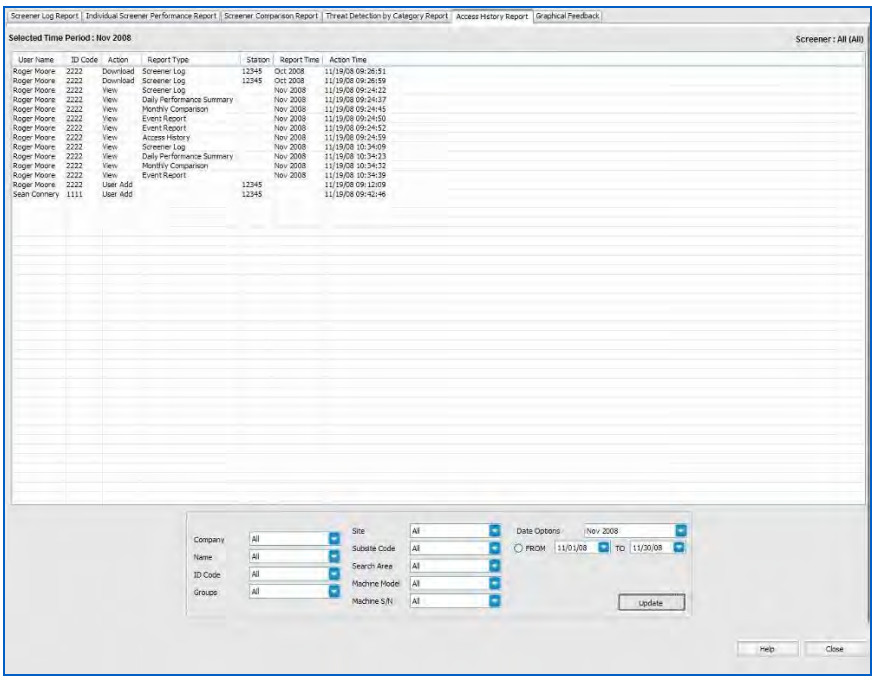

Figure 10-66: Access History Report

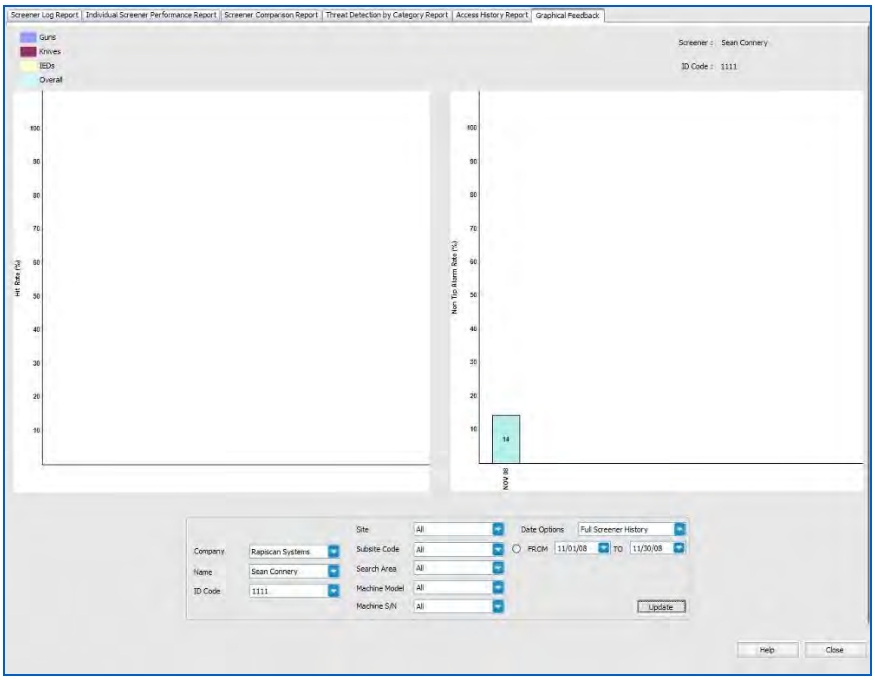

Figure 10-67: Graphical Feedback

Selecting “Download Data Files” from the “Report Data” screen menu brings up the "Download Data Files” screen. This screen allows a Supervisor to download reports from:

- Screener log report
- Individual screener performance report
- Screener comparison report
- Threat detection by category report
- Access history report
- All reports

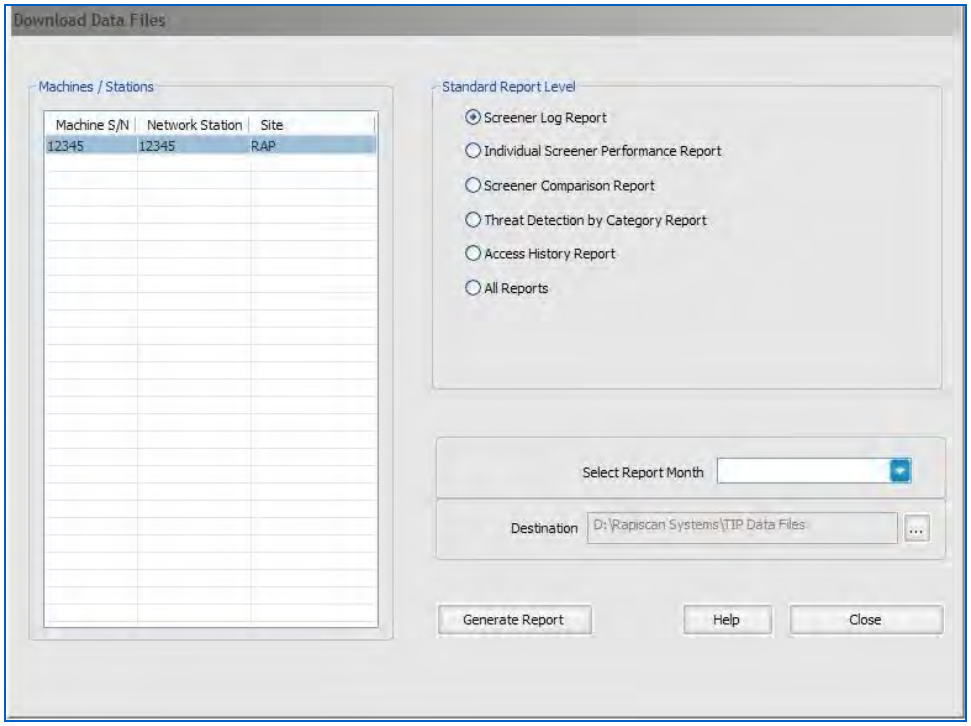

Figure 10-68: Download Data Files

Selecting “Purge Database” from the “Report Data” screen menu shown below brings up the “Purge Database” screen. This screen allows the Supervisor to purge test records based on the age of those records.

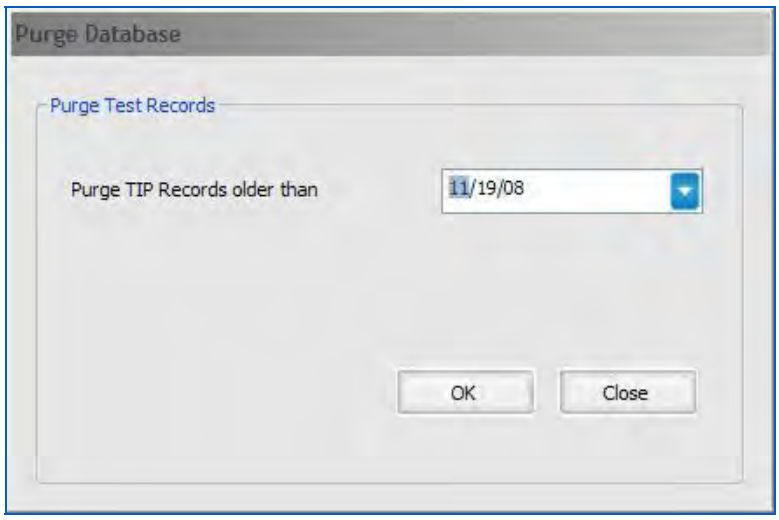

Figure 10-69: Purge Database

10.10 Screen Saver

This figure shows the Screen Saver option which allows you to set the wait time and/or to disable the function, and also whether or not to require a login.

Figure 10-70: Screen Saver

10.11 Help Manuals

This figure shows the Help Manuals button and the Operator and Supervisor Manual option. When selected, this brings up online versions of the Operator and Supervisor manuals.

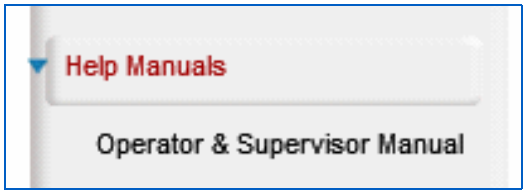

Figure 10-71: Help Manuals

Figure 10-72: Operator's Manual (Dual View)

10.12 Machine Serial Number

This figure shows the Machine Serial Number option. It is important to know this number for record keeping purposes – it is important to know the service and maintenance history of a machine and the machine's serial number is the best way to be able to match a machine with its service/maintenance history. Selecting "Machine Serial Number" will cause the serial number to appear.

Figure 10-73: Machine Serial Number

10.13 Log Out

Figure 161 shows the Log Out option. When selected, it brings the user back to the Login screen.

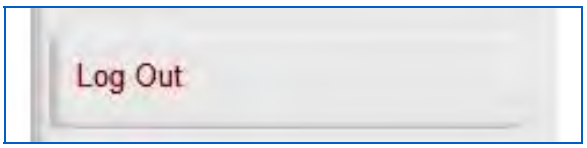

Figure 10-74: Log Out Option

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11 Technician Mode

Log into technician mode. This brings up the technician mode operating screen (Figure 162). The left side is the vertical view; the right side is the horizontal view.

NOTE: For readability the images shown in this section will mostly be of one side of the screen only – either the horizontal or vertical view.

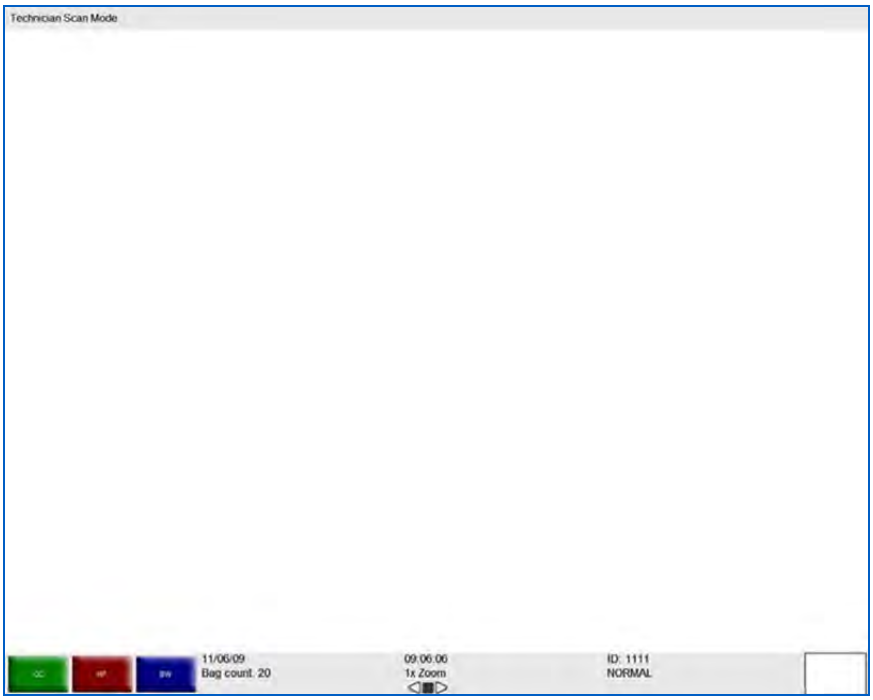

Figure 11-1: Operating Screen

11.1 Main Menu

Left-clicking on the mouse buttons on the operator control panel brings up the technician mode menu shown in Figure 163.

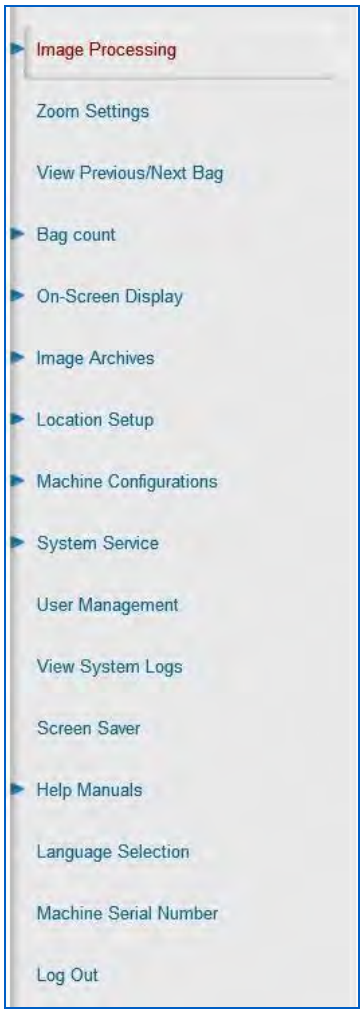

Figure 11-2: Technician Menu

11.2 Image Processor

Figure 164 shows the first item in the Supervisor menu, “Image Processing Mode.” Selecting “Image Processing” expands that section to show “Mode,” “Bind Processing Functions” and “Auto Reset On Scan.” Selecting “Mode” brings you to the screen shown in Figure 91.

“Mode” includes a number of menu items that control the appearance of a scanned image:

- High Penetration
- Black & White
- Crystal Clear
- Inorganic Material
- Organic Material
- Inverse Color
- Edge Enhancement
- Gamma
- Color Stripping
- Density Zoom

Each of these menu items, when selected, offer three choices:

- Stop mode
- Disable/Enable
- Real-Time Mode

This determines whether a particular image enhancement, such as High Penetration, operates only in stop mode or in both stop mode and “real-time” mode and also whether the enhancement is enabled or disabled altogether.

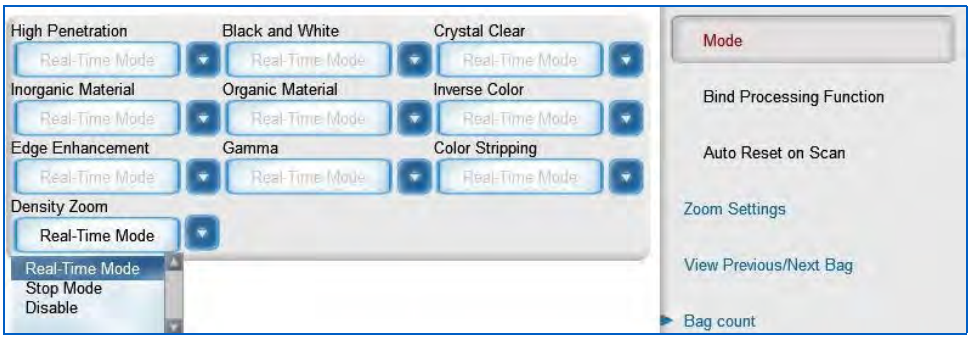

Figure 11-3: Image Processing – Mode

The Bind Processing Functions button (Figure 165) allows the Operator to assign multiple image processing functions to individual function keys

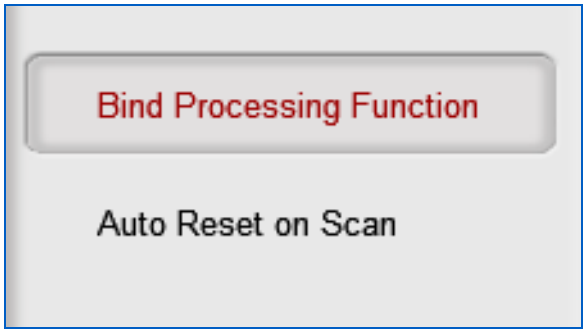

Figure 11-4: Image Processing – Bind Processing Functions

The Bind Processing Functions button (Figure 165) allows the Operator to assign multiple image processing functions to individual function keys.

1. To make use of the Bind Processing Functions function, obtain a scanned image

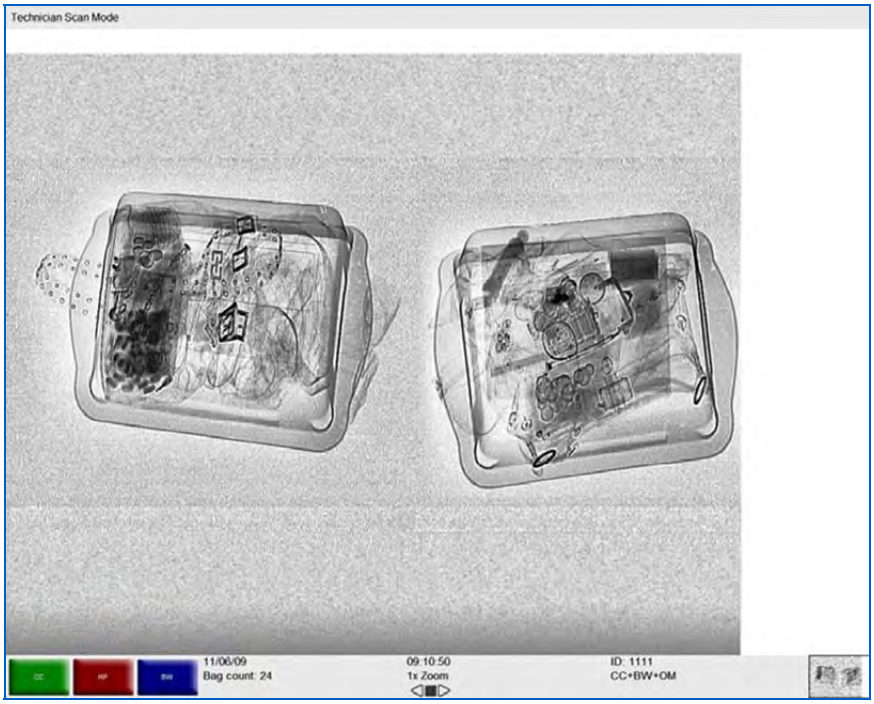

Figure 11-5: Scanned Image

2. Apply one or more image processing functions to the image. In Figure 166, for example, the operator has applied CC, BW and OM to the image
3. Click the right touchpad button, which brings up the Technician Menu (Figure 163)
4. Using the touchpad, move down to highlight Image Processing
    6. Left click on “Image Processing.” The full Image Processing menu will be revealed, including the Bind Processing Functions button

6. Using the touchpad, move down to highlight the Bind Processing Functions button and left-click on the button. The Bind Processing Functions drop down menu will appear (Figure 167)

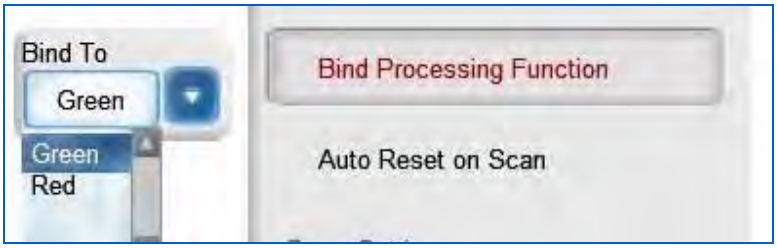

Figure 11-6: Image Processing – Bind Processing Functions

8. Choose the colored button to which you want to assign the image functions you've just applied to the scanned image (green or red)
9. Right-click until you return to the main screen (without the main menu showing) where you'll see that the functions you chose have been assigned to the function button you selected (Figure 168)

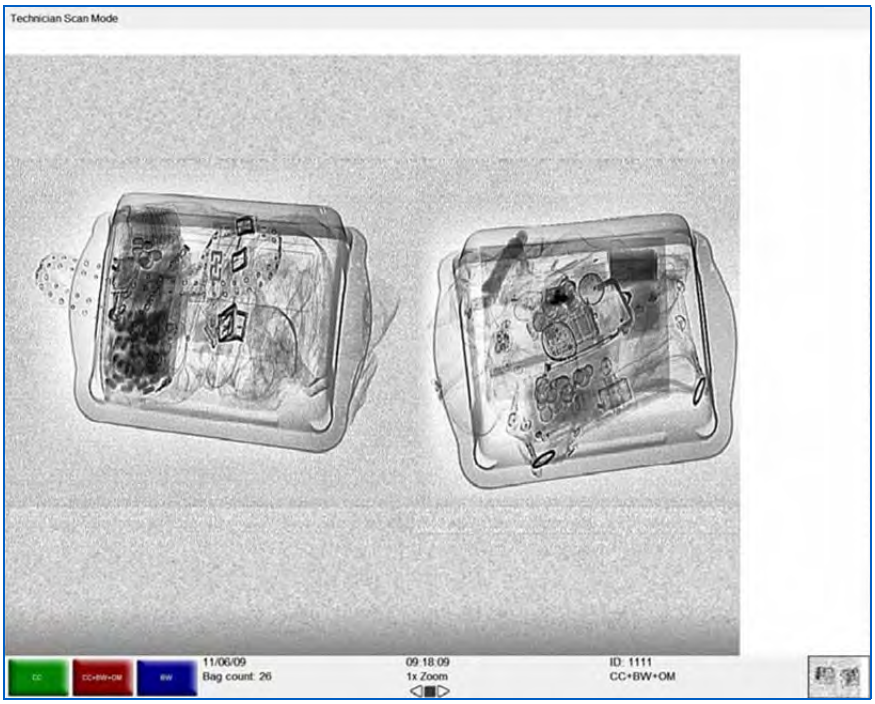

Figure 11-7: Multiple Image Processing Functions

Figure 168 shows the red button now representing the CC, B&W and HP functions. Now each time that button is selected, all three of those functions will be applied to the scanned image whenever the blue button is selected. Of course an operator may choose any number of functions to assign to any one of these buttons.

NOTE: Assigning too many functions may prove counterproductive to the quality of the actual image the operator's ability to discern possible threats in the image.

Figure 169 shows the third and final item under "Image Processing," the "Auto Reset on Scan function." When enabled, this function resets the image processing functions to normal each time a new item is scanned. Note the Enable and Disable options.

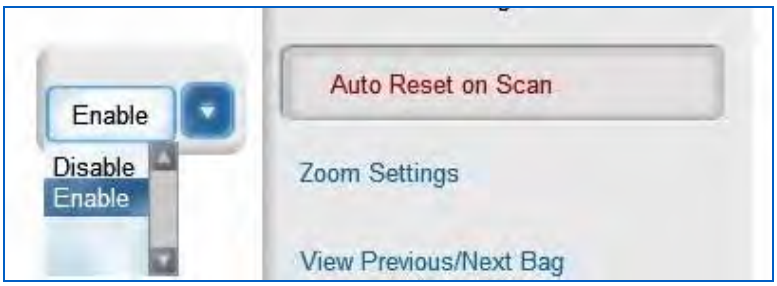

Figure 11-8: Image Processing – Auto Reset on Scan

11.3 Zoom Settings

Figure 170 shows the Zoom Settings function which allows you to pick the mode, as well as the maximum amount of zoom for the Stopped and real time modes. Picking 16x under "Stopped," for example, means that a user can zoom into an image only up to a maximum of 16x (as opposed the 64x which is the absolute maximum amount of zoom the system allows).

Figure 11-9: Zoom Settings

11.4 View Previous/Next Bag

Figure 171 shows the View Previous/Next Bag function which can be disabled or enabled. This function allows the user to scroll backward and forward through the list of previously scanned bags (their images having been archived for this purpose).

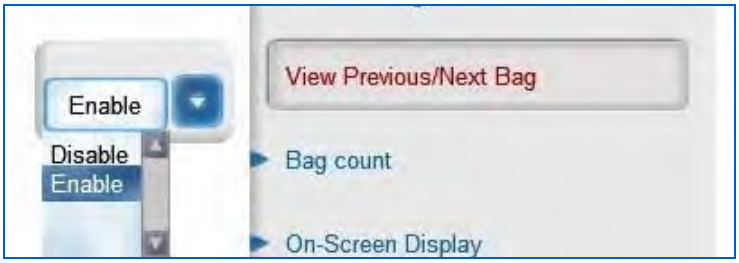

Figure 11-10: View Previous/Next Bag

11.5 Bag Count

Figure 172 shows the Bag Count function and its two sub-functions, Total Number and Reset Bag Count. Total Number displays the number of bags scanned since the Machine first operated at the factory. This number cannot be changed.

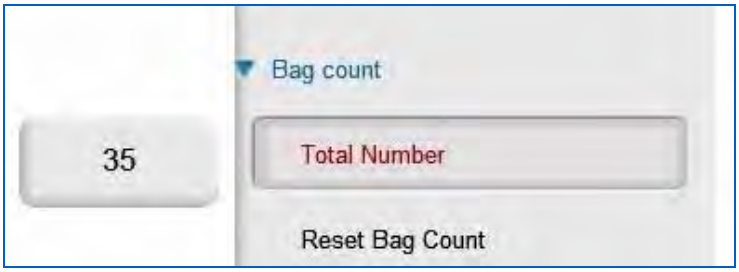

Figure 11-11: Bag Count - Total Number

Reset Bag Count (Figure 173) displays the number of bags scanned since the last time the count was reset.

Figure 11-12: Reset Bag Count

11.6 On Screen Display

Figure 174 shows the On-Screen Display button. Selecting this brings up three sub- buttons: Date, Time and OSD (On Screen Display) Status for both vertical and horizontal views.

NOTE: For single-view machines, there would be only one OSD Status showing, that being for the one primary view.

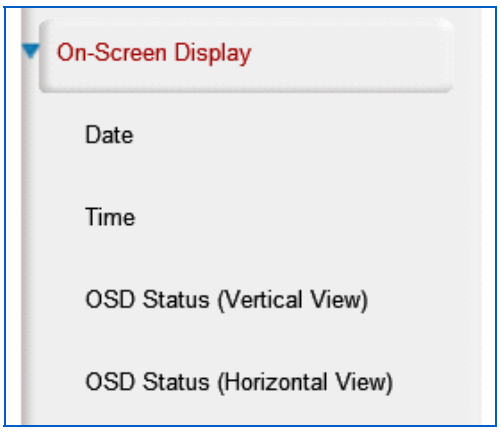

Figure 11-13: On-screen Display

Figure 175 shows the Date readout, which can be displayed on screen in one of three formats.

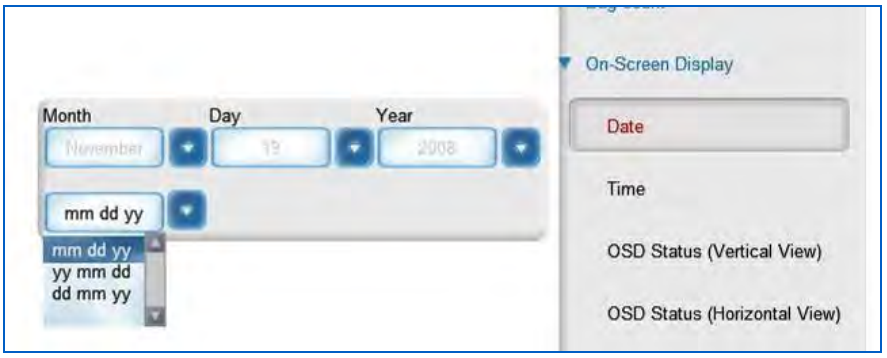

Figure 11-14: On-Screen Display, Date

Figure 176 shows On-Screen Display: Time. The time can be displayed in 12 hour or 24 hour format.

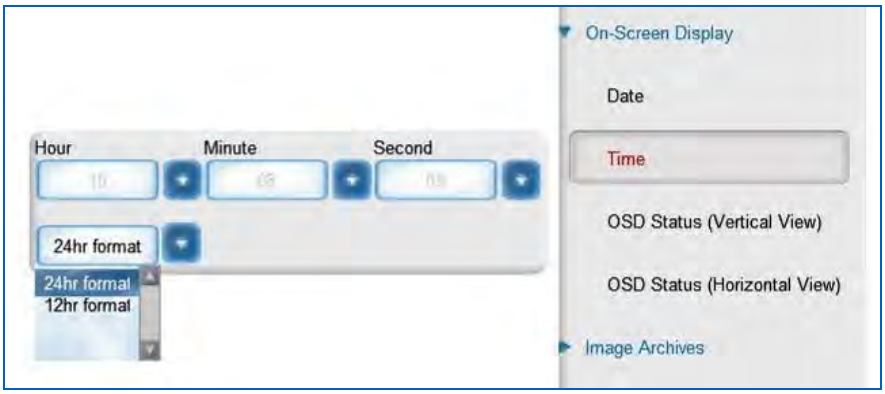

Figure 11-15: On-Screen Display, Time

Figure 177 shows the OSD (On Screen Display) Status button for the vertical view, with the accompanying slide-out/drop down menu, which allows control over a number of types of information that can be shown or not shown on screen:

- User Information
- Time
- Date
- Bag Count
- PB/NB Index
- Zoom Factor
- X-ray Belt Status
- Image Processing Status
- Soft Buttons

The vertical and horizontal OSD buttons contain the same menu of sub-options.

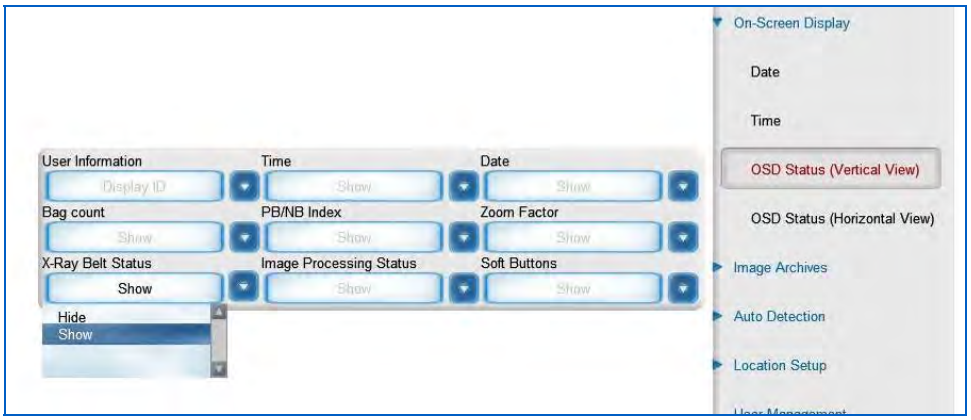

Figure 11-16: OSD (On Screen Display) Status

Figure 102 shows a typical scanned image, including information displayed that can be displayed or hidden, using the OSD function.

Figure 11-17: On Screen Information and Variable Process Slider

11.7 Image Archives

Figure 11.18 shows the Image Archives option and the four sub-options: Review Manual Archives, Review Auto Archives, Manual Archive Settings and Auto Archive Settings.

NOTE: Choosing either Review Manual Archives or Review Auto Archives brings the user through the same screens and menus, the only difference being that in one case the images being viewed were manually archived as opposed to automatically archived. Thus the following procedure is valid for reviewing either manually or automatically archived images.

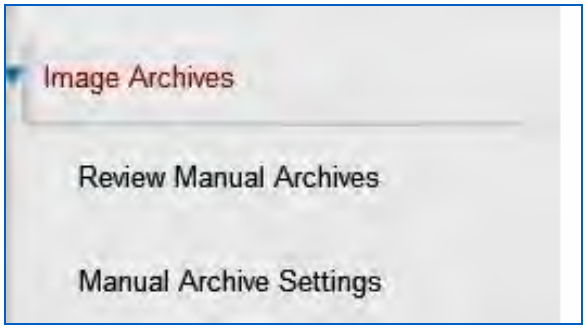

Figure 11-18: Image Archives

Selecting Review Manual Archives (Figure 180) brings up the Filter Options screen.
The Filter Options screen allows you to determine the criteria that can be used to search the manually or automatically archived imaged, criteria such as Operator ID, Site, Bag Count and Date options.

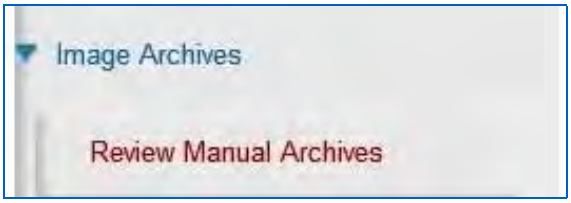

Figure 11-19: Review Manual Archives

Figure 11-20: Filter Options

Selecting “OK” on the Filter Options screen brings you to the Review Manual Archives Mode Within a few moments of entering the Review Manual Archives mode, archived images will begin to scroll across the screen from left to right. These archived images can be manipulated by using image enhancement functions such as Crystal Clear, Organic Material or Black and White.

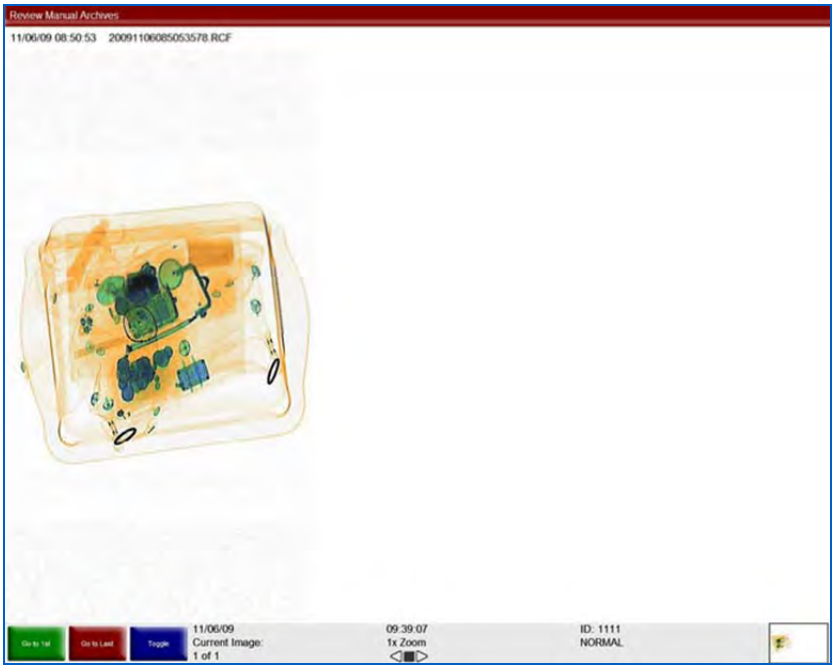

Figure 11-21: Review Manual Archives mode

Press the red Stop (ST) key on the operator control panel to stop the images from scrolling. Left click the mouse button and the Review Manual Archives menu will slide into view from the right side of the screen.

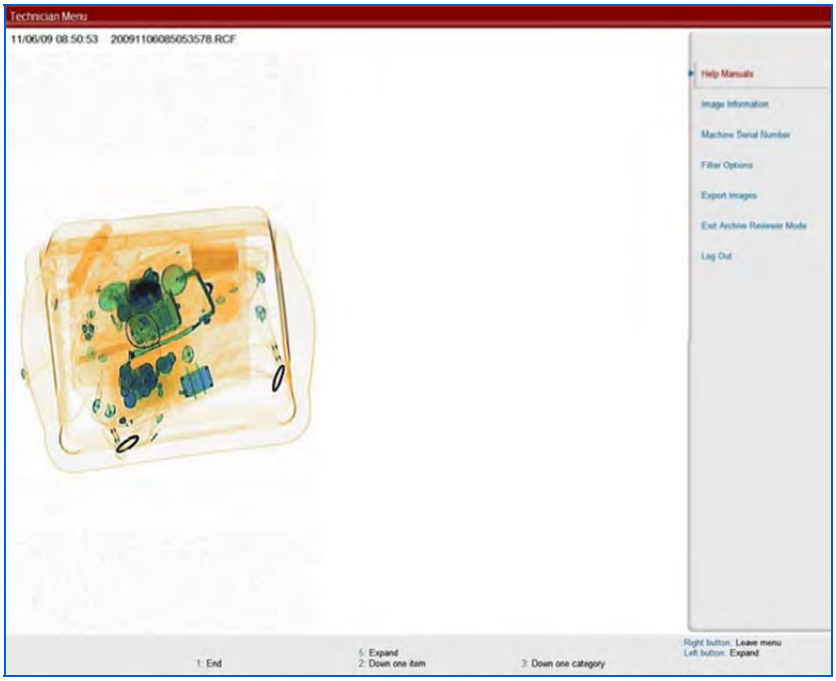

Figure 11-22: Review Manual Archive menu

Selecting Help Manuals will bring up the option to see the Operator and Supervisor manuals.

Figure 11-23: Help Manuals

Selecting Image Information (Figure 185) brings up the screen shown in Figure 186.

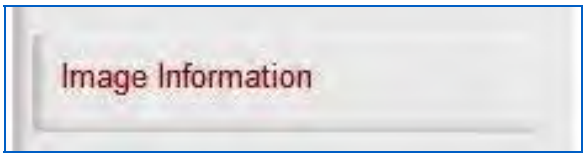

Figure 11-24: Image Information button

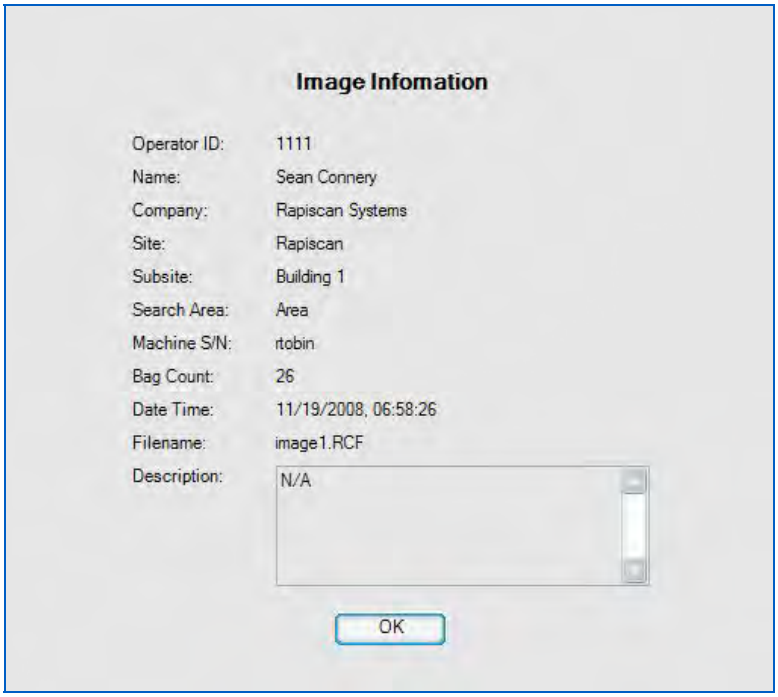

Figure 11-25: Image Information screen

This screen shows the Machine Serial Number option.

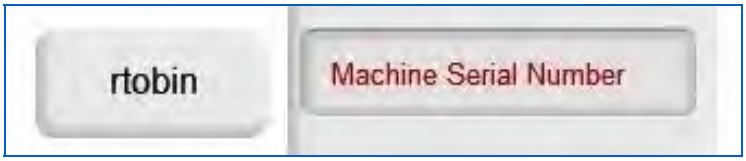

Figure 11-26: Machine Serial Number

Selecting Filter Options (Figure 188) brings up the Filter Options screen.

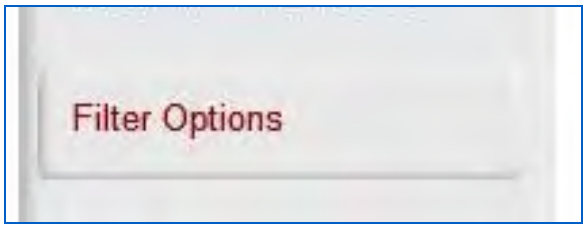

Figure 11-27: Filter Options

Figure 11-28: Filter Options

Selecting Export Images brings up the screen shown below.

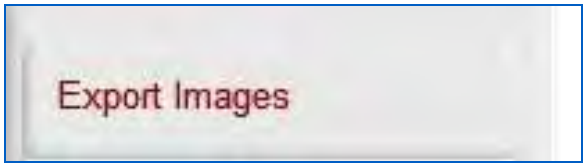

Figure 11-29: Export Images

This screen shows the Export Images screen with options for Image Selection, File Format, Output Files and Destination Path.

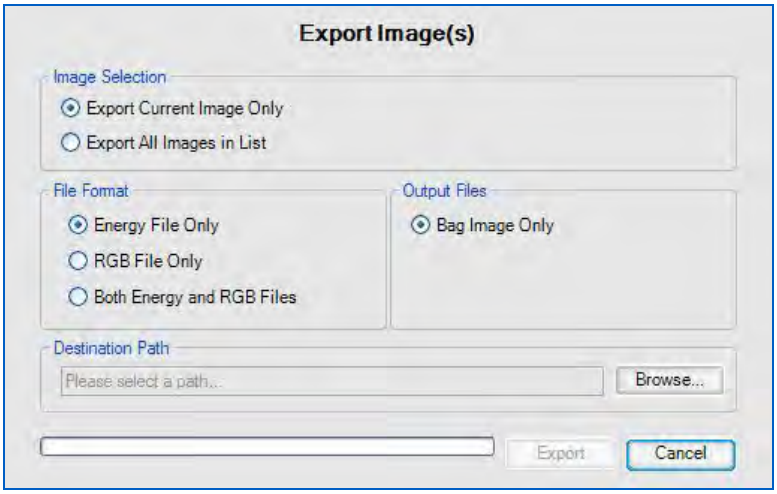

Figure 11-30: Export Image(s) screen

Selecting Exit Archive Reviewer Mode takes you out of the Review Manual Archives mode.

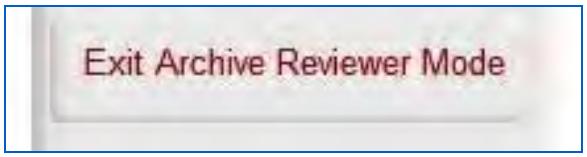

Figure 11-31: Exit Archive Reviewer Mode

This screen shows the Manual Archive Settings which allows you to decide: whether to enable or disable the function; the format in which to archive the images and; whether to enable or disable the “archive with DTA” feature.

Figure 11-32: Manual Archive Settings

11.8 Location Setup

This screen shows Location Setup and its three sub-options: Site, Station and Station Settings.

Figure 11-33: Location Setup

This screen shows the Site sub-option. When selected it takes you to the Site screen shown below.

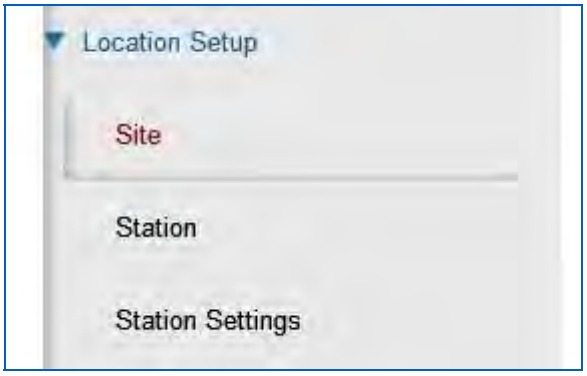

Figure 11-34: Location Setup - Site

The screen shown below allows you to modify site information and to list all the current sites.

Figure 11-35: Site

This screen shows the Modify Site screen. To actually modify an entry, select a site from those listed on the screen, then click on “Modify.”

Figure 11-36: Modify Site

The Modify Site screen allows you to modify a particular entry, in this case a Site called RAP. As shown, you can change various data, from street name

to email address. You can also modify the subsite code and Search Area

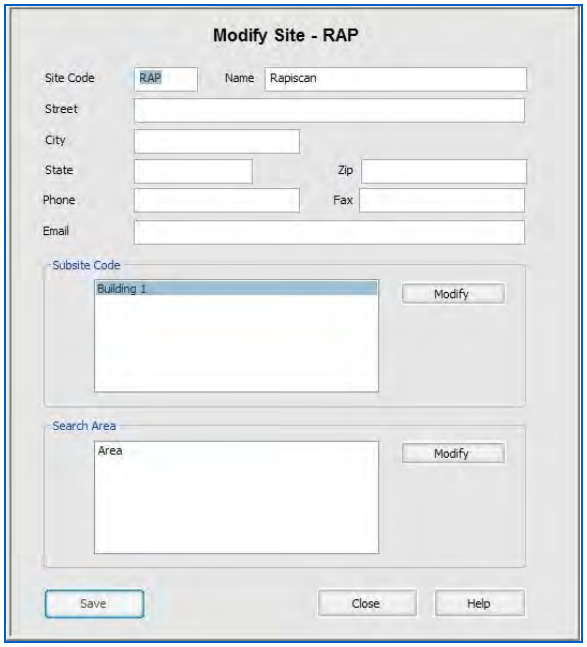

Figure 11-37: Modify Site – RAP

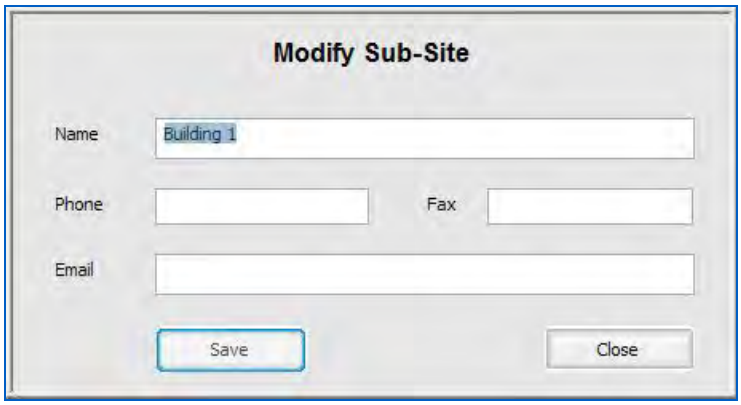

Figure 11-38: Modify Sub-Site

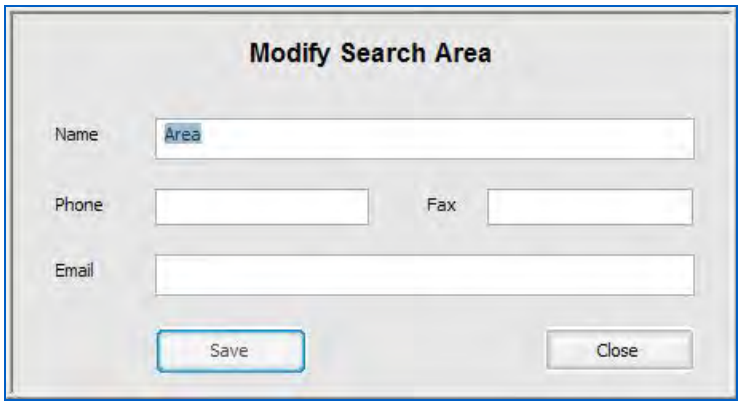

Figure 11-39: Modify Search Area

Choosing List All from the Site screen brings you to the screen shown in which lists all current sites. You can also view more detail about any particular site by selecting that site from the list and clicking View which brings you to the screen shown below.

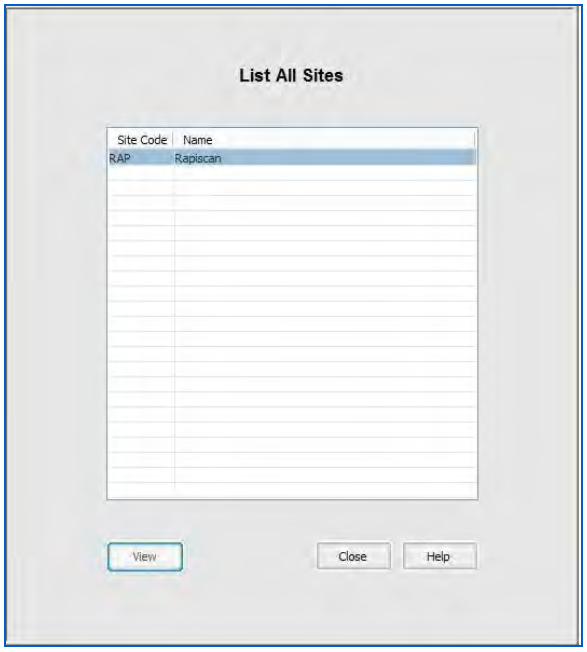

Figure 11-40: List All Sites

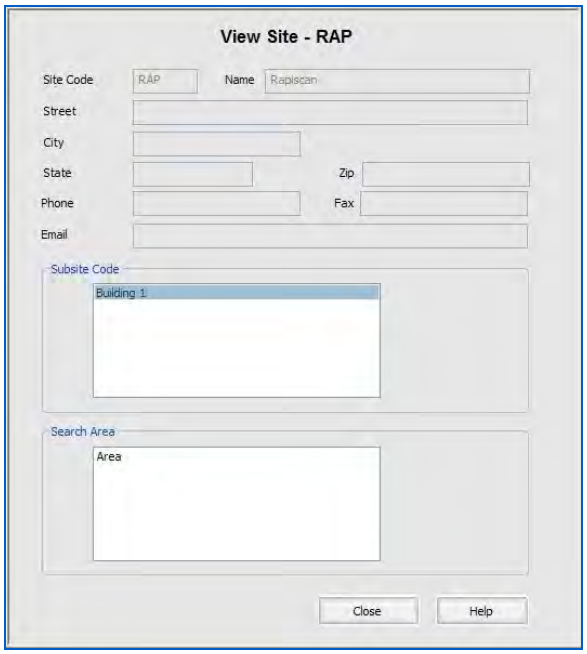

Figure 11-41: View Site

Choose Station the screen shown below.

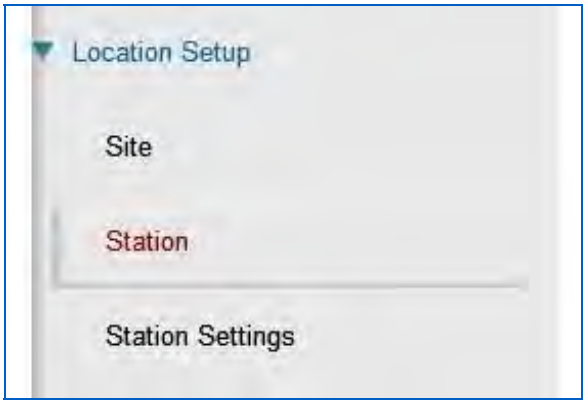

Figure 11-42: Station option

The Station screen allows you to modify and/or list all current stations.

Figure 11-43: Station

Choosing Modify from the Station screen brings up the Modify Station screen below Select the desired station from the list of stations, then click “Modify.”

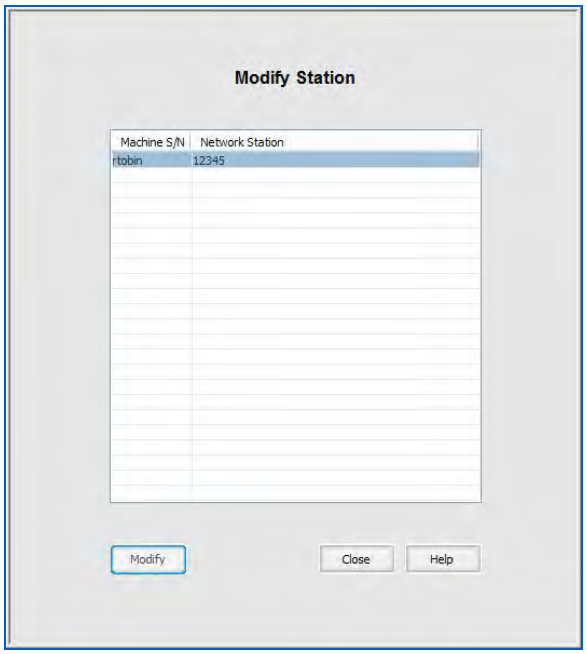

Figure 11-44: Modify Station

This screen shows the screen in which you can make changes to the Station information, from Station name to Sub-site Code and Equipment Type.

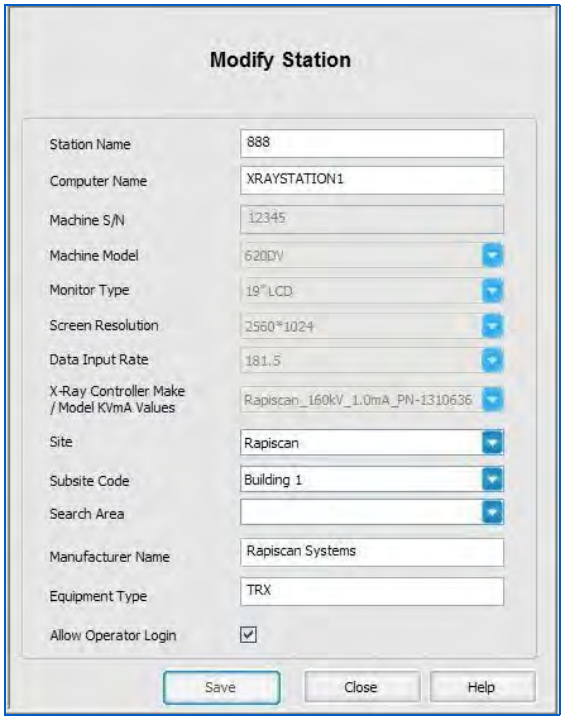

Figure 11-45: Modify Station

Choosing List All from the Station screen brings up the List All Stations screen. Select the station from the list of Stations and click View to see more detail.

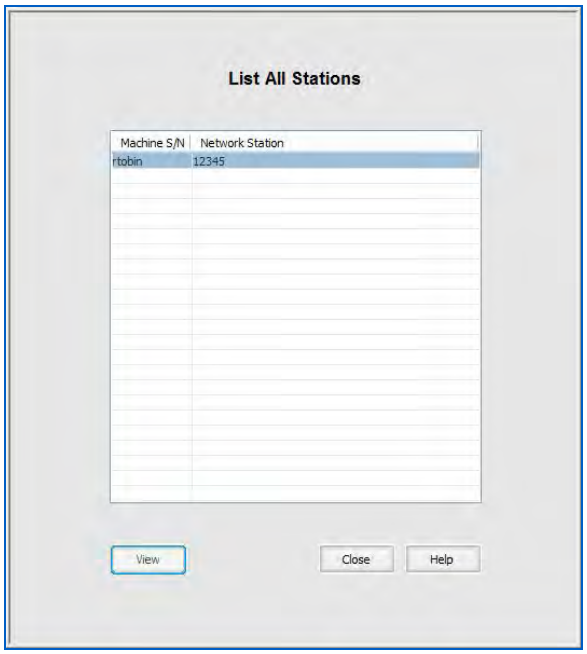

Figure 11-46: List All Stations

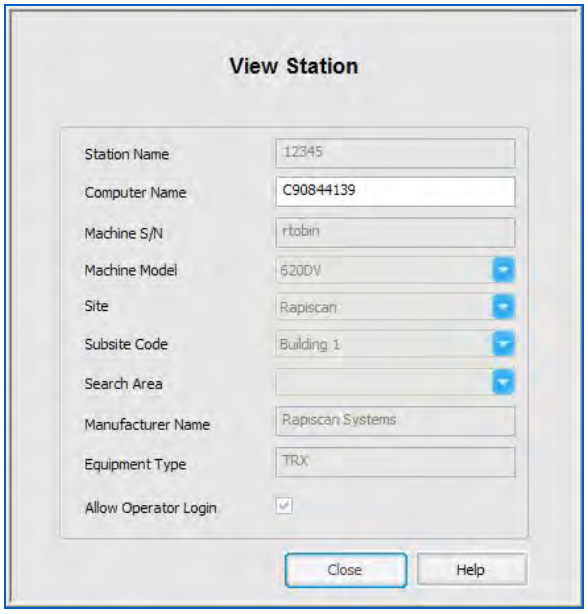

Figure 11-47: View Station

This screen shows the Station Settings screen which allows for the adjustment of: “Enable Idle Timers;” “Enable Session Timers;” “Session Review Time” and; “User Lockout Period.”

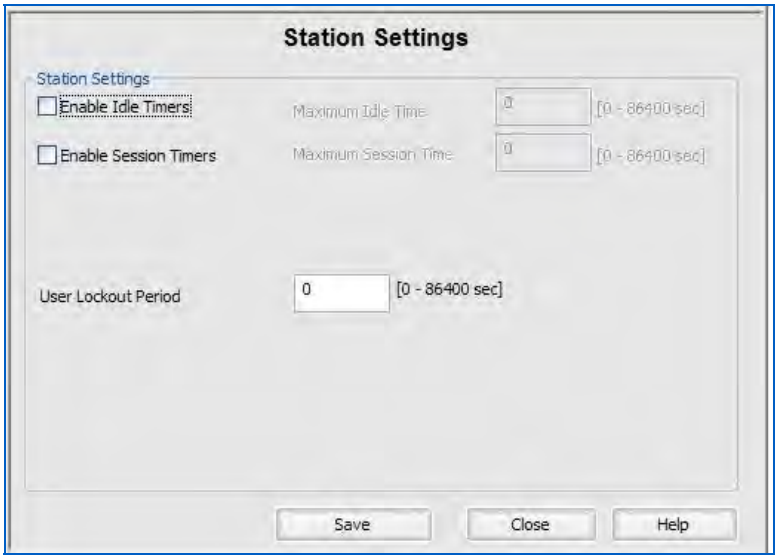

Figure 11-48: Station Settings

11.9 Machine Configuration

This screen shows the Machine Configurations option with several sub-options.

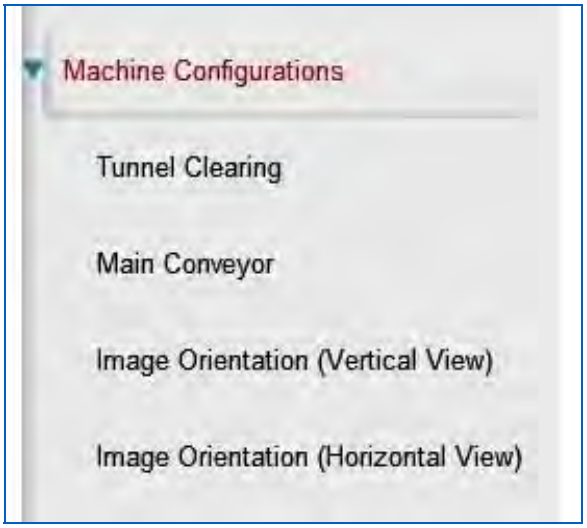

Figure 11-49: Machine Configurations

This screen shows the Tunnel Clearing option. This option allows you to decide whether to disable the function altogether, or to assign it to the “S” or “Q” keys on the operator control panel.

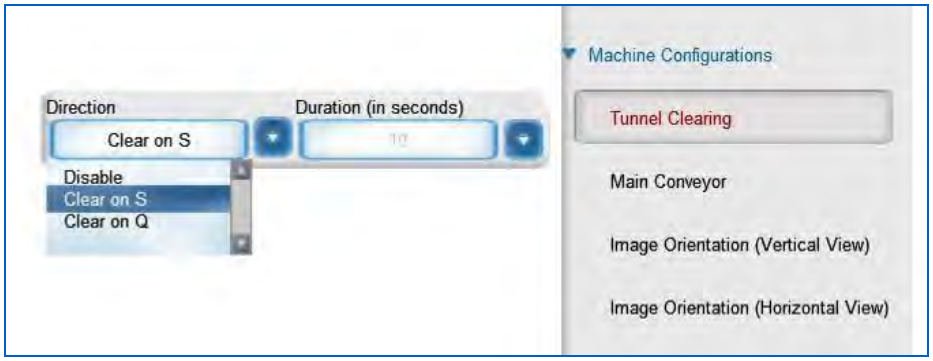

Figure 11-50: Tunnel Clearing

This screen shows the Main Conveyor option. This allows you to decide to: swap (toggle) the direction the belt runs in; whether to assign that toggling function to the “S” or “Q” key on the Operator Control Panel and; whether to scroll the images right or left (to accommodate the direction in which you have chosen the belt to run).

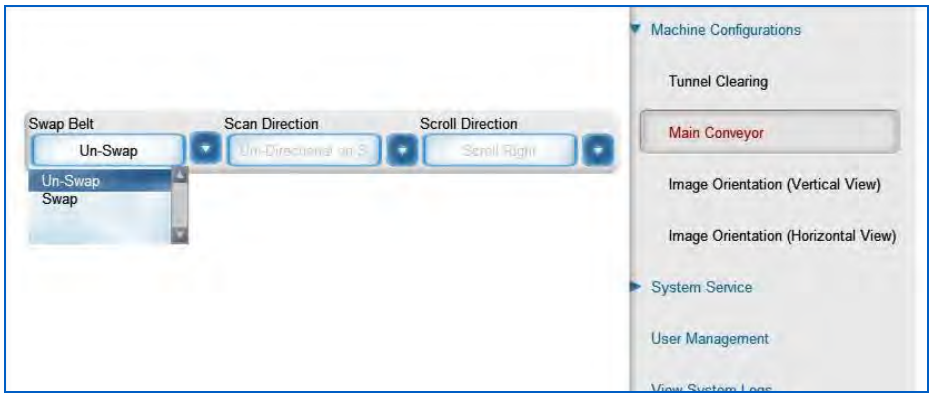

Figure 11-51: Main Conveyor

These screens show the Image Orientation function for the vertical and horizontal views. This function allows you to have the image appear normal or to have it vertically flipped for easier viewing.

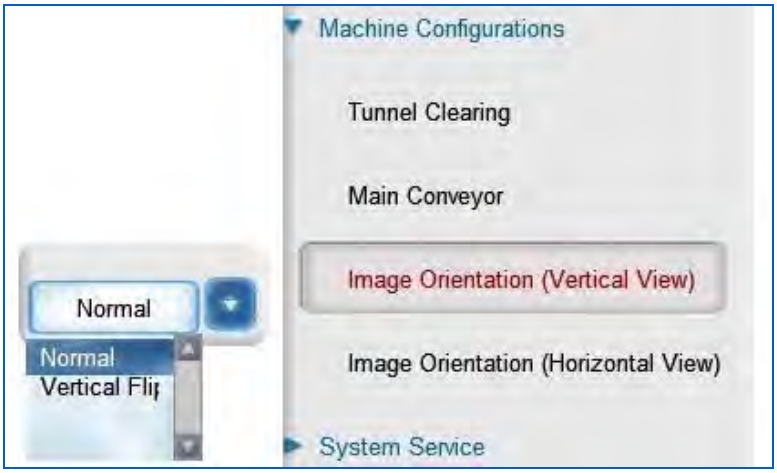

Figure 11-52: Image Orientation Vertical View

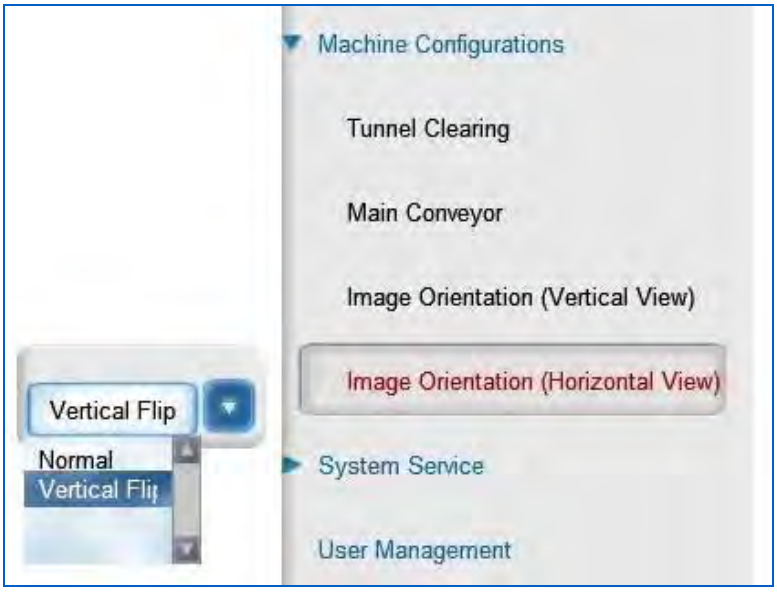

Figure 11-53: Image Orientation Horizontal View

11.10 System Service

⚠CAUTION

The various screens and options available under System Service allow modifications that can seriously affect the performance of the X-ray Machine and the quality of the scanned images. Do not perform any of these functions or modifications unless adequately trained to do so.

This screen shows the System Service option with its two sub-options: Diagnostics and; X-Ray On Time.

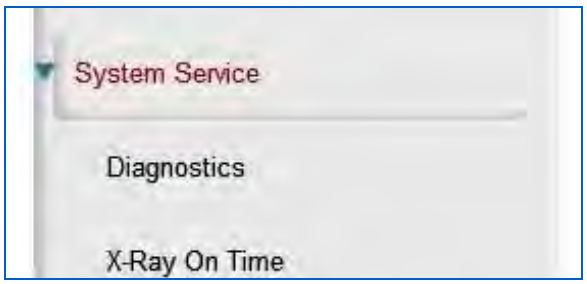

Figure 11-54: System Service

Selecting Diagnostics brings you to the screen shown below.

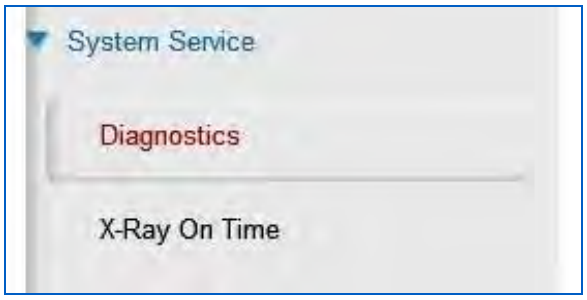

Figure 11-55: Diagnostics

Selecting Diagnostics does not bring the user to the main Diagnostics screen but rather to the Radiation Survey screen. This is because the Radiation Survey screen is the most frequently accessed screen. The Radiation Survey screen contains a simple set of instructions for carrying out such a survey.

Selecting Exit Radiation Survey brings up the main Diagnostics screen.

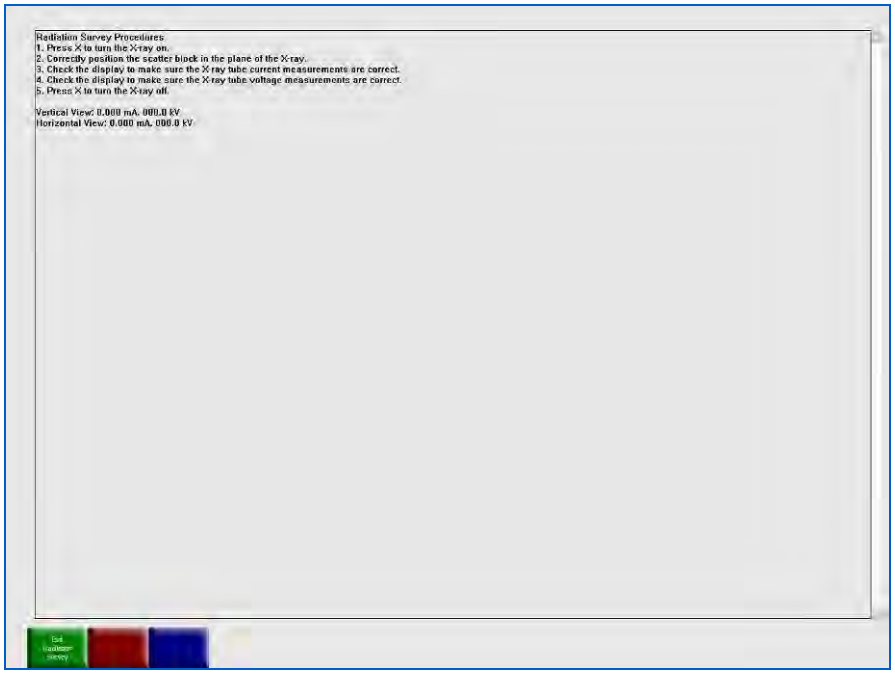

Figure 11-56: Radiation Survey

Figure 11-57: Main Diagnostics Screen

The first option on the Diagnostics menu is “Board gain”.

Figure 11-58: Board Gain

To set gain:

1. Select “board gain” from the top left corner of the Diagnostics Menu.
2. Once in the board gain mode:
   a. Use “P” key on the control panel to select the energy (high or low energy). Only data from the selected energy will be displayed.
   b. Use the “2” or “8” key on the control panel to select the appropriate DAB for gain adjustment. The signal of the selected DAB will be highlighted in light green.
   c. Use the “4” key to lower the gain of the selected DAB.
   d. Use the “6” key to increase the gain of the selected DAB.
   e. Use the “Save Gain” (green) button to save the current setting of the DAB’s gain.
   f. Use “Cancel Gain” (red button) to discard current changes.
   g. It is suggested to set gain of the DAB to shift its signal to the right side without making saturation. The recommended setting is 85% of full screen signal.

If a line is observed on the screen while scanning an object, this can indicate a faulty channel. It is possible that the auto map-out software does not detect the problem, but a manual map-out can be performed.

Figure 11-59: Mapout

There is a very thin yellow line at the top of the channel mapout screen.

Manually mapping out a channel involves using the up and down arrow buttons on the operator control panel to move the yellow line one channel at a time or using the Page Up and Page Down buttons to move 64 channels each time.

NOTE: Automatically mapped channels show up in white. Manually mapped channels show up in black.

To manually map out a channel:

1. Use P to select the energy (high or low).
2. Use 2 or 8 to select the channel to be mapped out. A yellow cross will point out the data of selected channel.
3. When only one energy is displayed, the cross hair will be at the data of the selected channel.
4. When both energies are displayed, the cross hair will be in the middle of data of the two energies.
5. Use 5 to map out the channel at the cross hair.
6. The position of the mapped out channel will be highlighted by a black horizontal line this shows both the moved yellow line and two black lines from previously mapped channels).

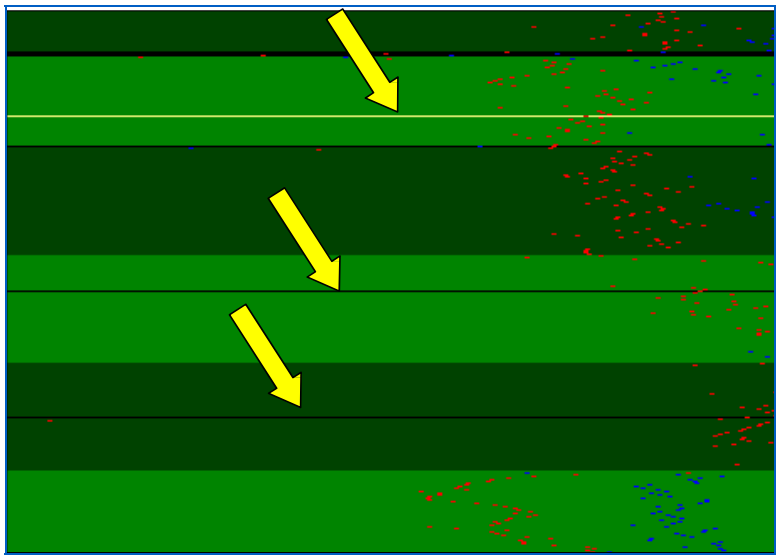

Figure 11-60: Mapped Channels

7. Use “Save Gain” (green button) to save the current setting of the DAB’s gain.
   7. Use “Cancel Gain” (red button) to discard the current changes.

This screen shows the control panel test screen. To test the control panel and the panel's individual keys, press each key on the control panel one at a time, each time checking to see if that key flashes on the control panel test screen. The flashing of the corresponding key on the screen indicates that that key and its associated function are operative.

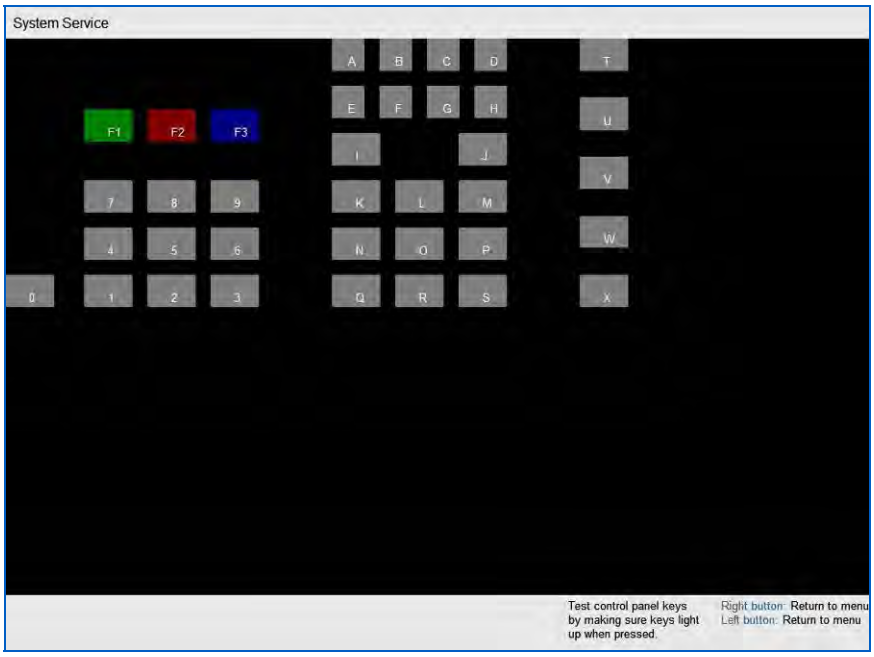

Figure 11-61: Control Panel Test Screen

This screen shows the Generator Ramp screen. This screen measures the ramp up time for the X-ray generator's kV and mA when the generator begins generating X- rays. Most Rapiscan 600 series X-ray machines use 140kV generators. If a customer requests it, a 160kV generator is used instead. If a 140kV generator takes significantly longer than .5 seconds to ramp up, this is an indication of a problem with the generator. If a 160kV generator takes significantly longer than .75 seconds to ramp up, this is also an indication of a problem with the generator.

⚠CAUTION This screen is for use by only Rapiscan-trained engineers

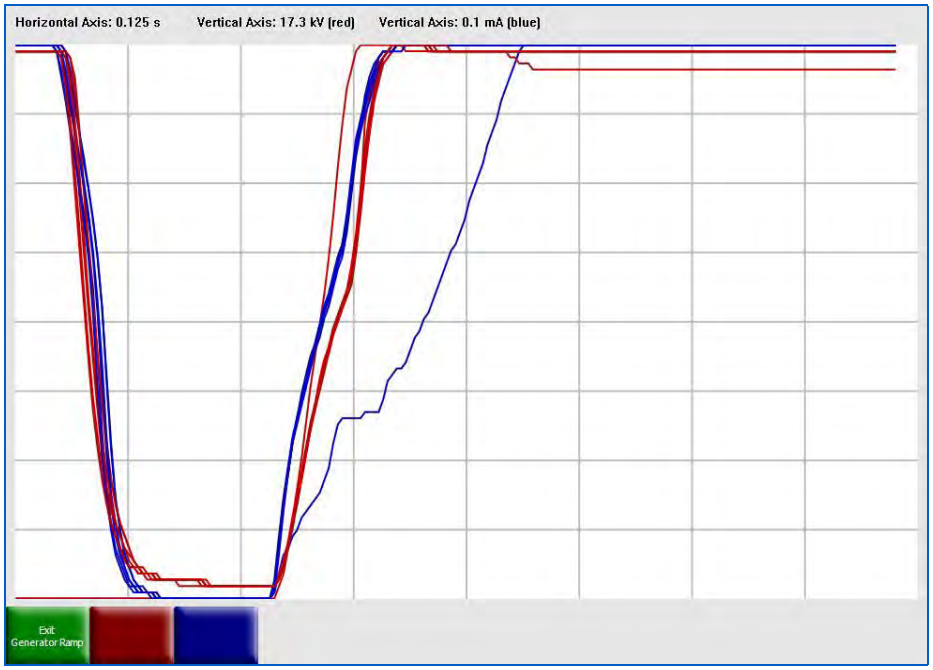

Figure 11-62: Generator Ramp

This screen shows the QA Report screen. This report shows the actual and acceptable values for a number of generator functions, including Rise Time, Settle Time, Fall Time and Settle Value.

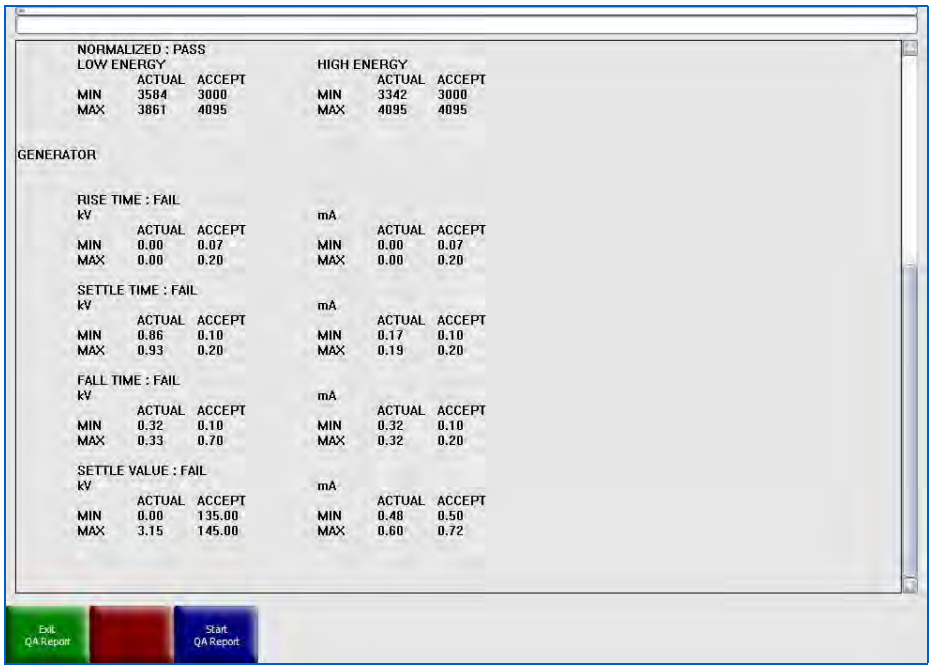

Figure 11-63: QA Report

This screen shows the Radiation Survey which is a simple set of instructions for carrying out such a survey.

This screen shows the Self Test screen. This shows the actual and acceptable X-ray Generator kV and ma values while the generator is on and when it's off. It also lists a pass/fail report for various components such as inverter motor, channels (with x- rays off), x-ray controller and conveyor.

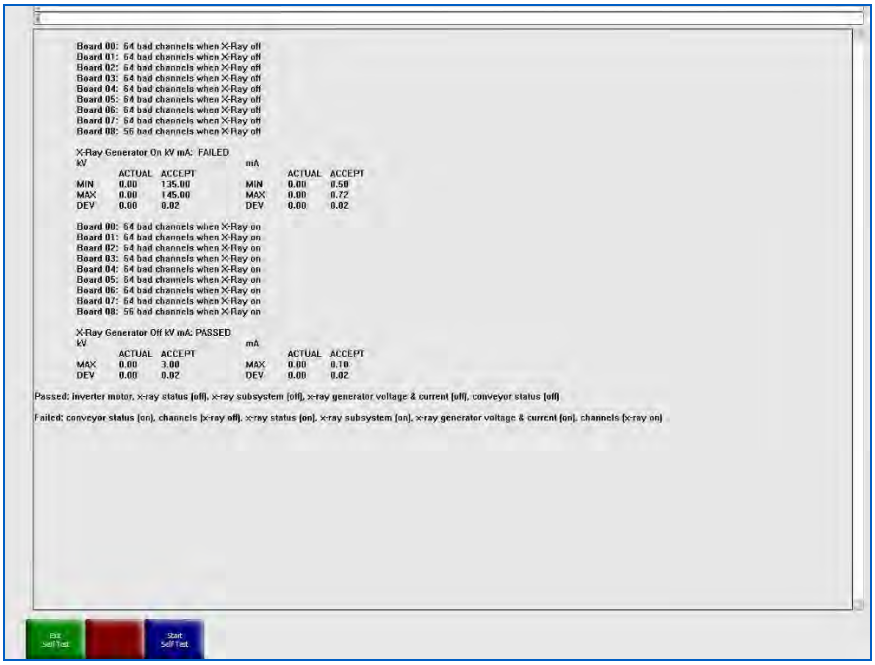

Figure 11-64: Self-Test

This screen shows the System Burn-in screen. Selecting the "Start Burn-in" button will cause the system to begin the burn-in process. The burn-in process lasts 24 hours once it is started, although it is possible to terminate the burn-in at any time and obtain a partial burn-in report.

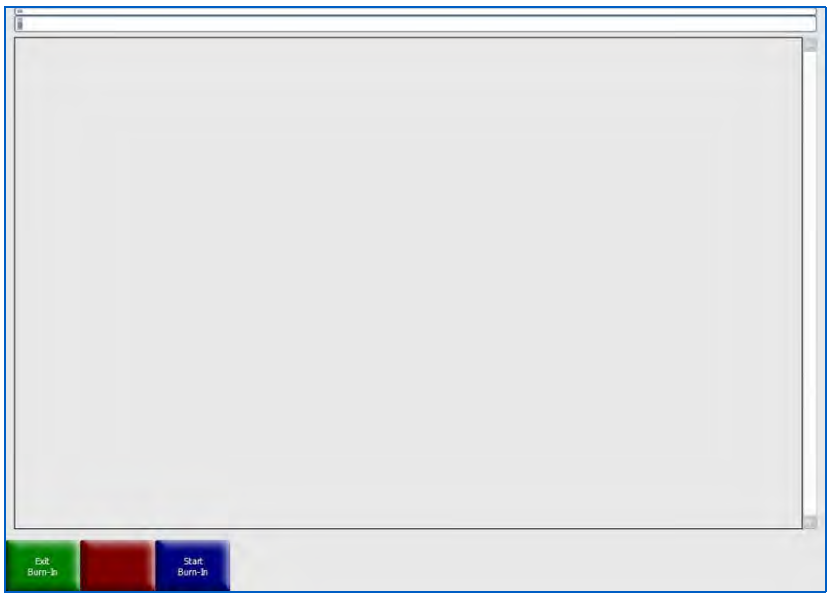

Figure 11-65: Burn-in Screen

This screen shows the Video Test Screen along with instructions (Figure 228) on how to adjust your monitor's image clarity by using the test screen.

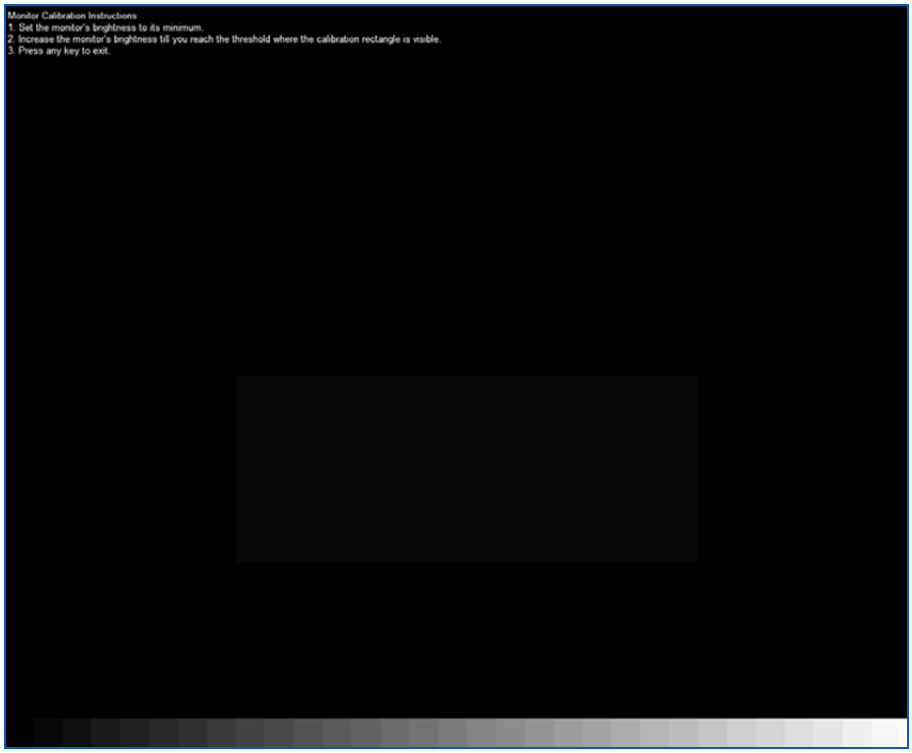

Figure 11-66: Video Test Screen

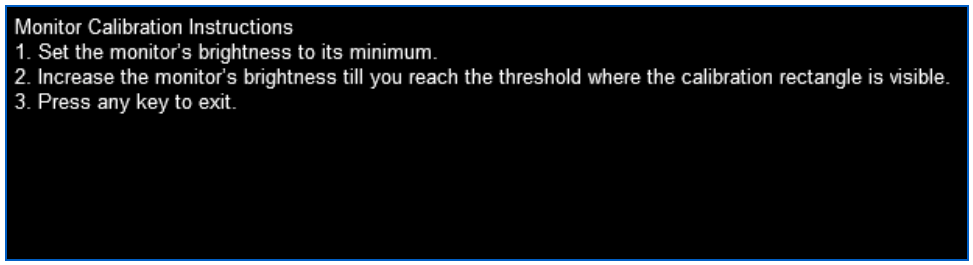

Figure 11-67: Video Test screen text

Press any key to exit the Video Test screen. This screen shows the X-ray On time function which is not available in this mode at the time of writing this manual.

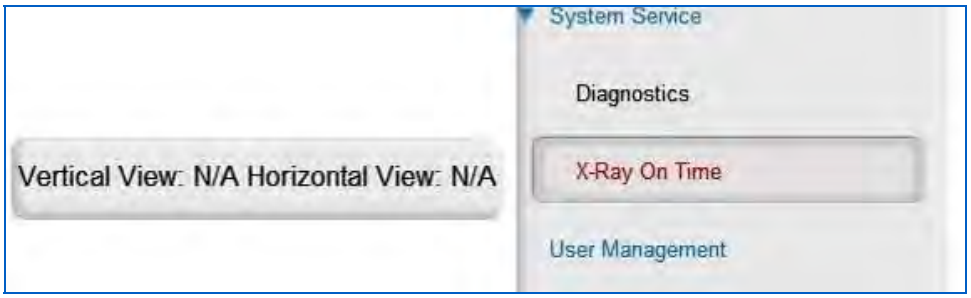

Figure 11-68: X-ray on Time

11.11 User Management

This screen shows the User Management option.

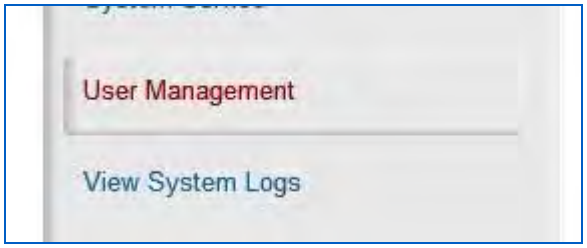

Figure 11-69: User Management

Selecting the “User Management” option brings you to the “Users” screen shown below.

Figure 11-70: Users

The “Users” Window allows users’ info to be viewed, added, deactivated, modified, activated, deleted, listed, imported and exported. Selecting Add brings up the screen shown below.

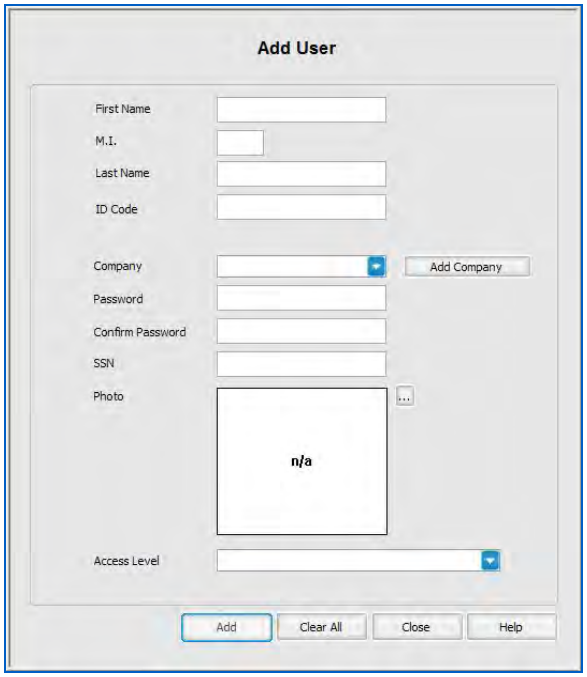

Figure 11-71: Add User

Selecting Add Company brings up the Add Company screen:

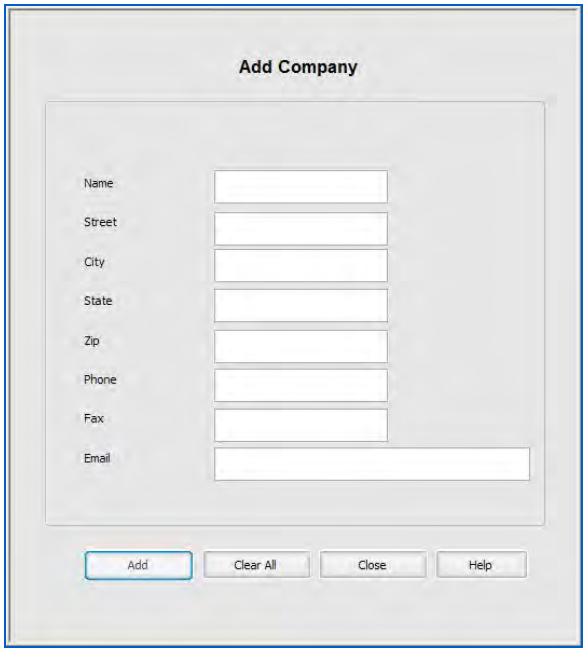

Figure 11-72: Add Company

Selecting Deactivate brings up the following screen:

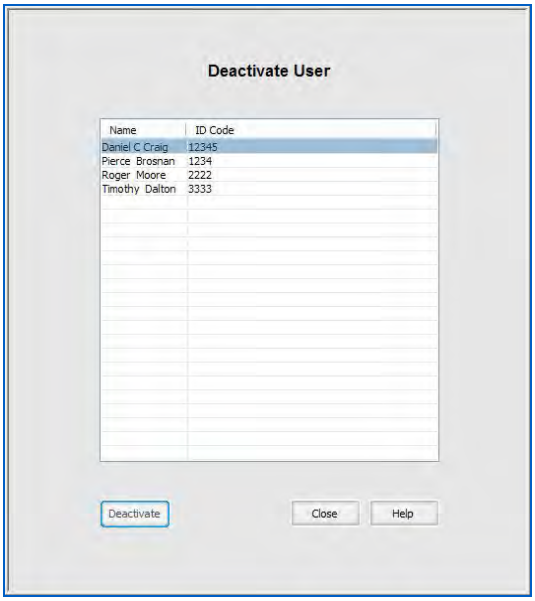

Figure 11-73: Deactivate User

Selecting Deactivate from the Deactivate User screen brings up a warning message:

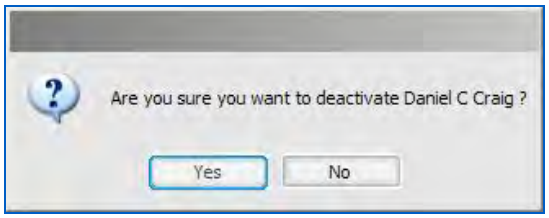

Figure 11-74: Deactivate User message

Selecting “Yes” will cause the selected user to be deactivated as shown below.

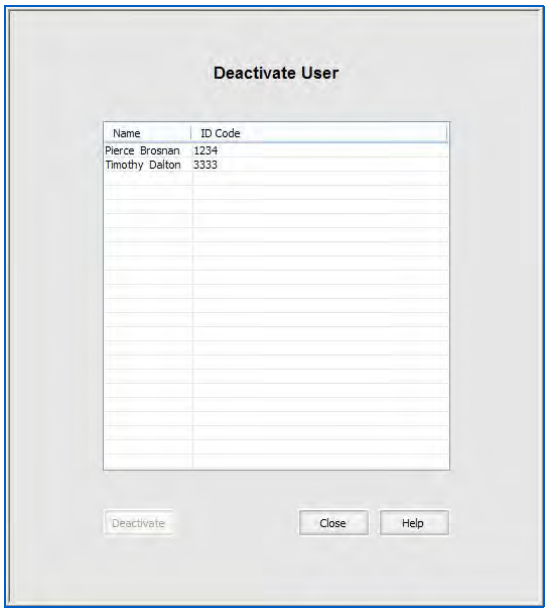

Figure 11-75: Deactivated user

Selecting Modify brings up the Modify User screen

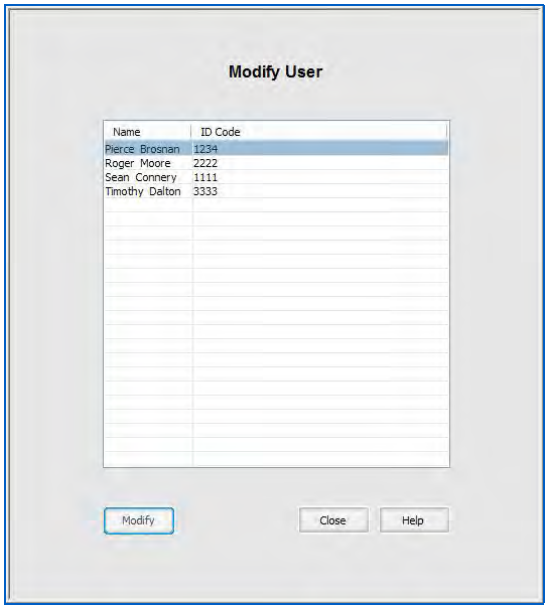

Figure 11-76: Modify User

Select the desired user and click on Modify where information on the user can be modified:

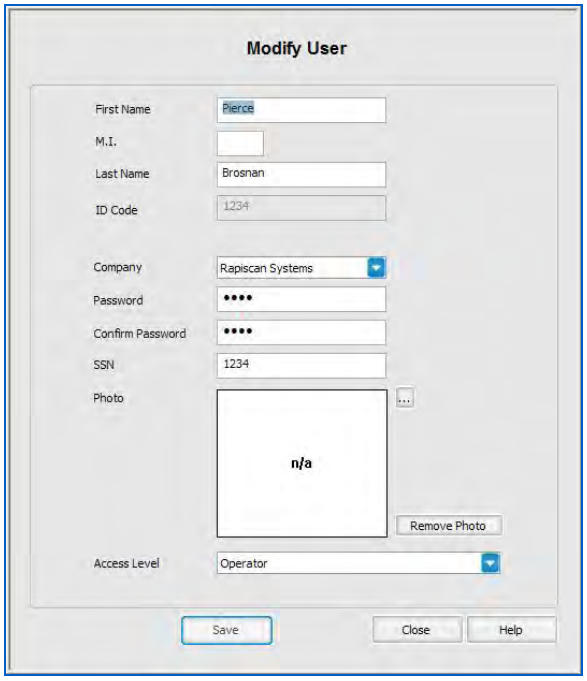

Figure 11-77: Modify User screen

Selecting Activate brings up the Activate User screen:

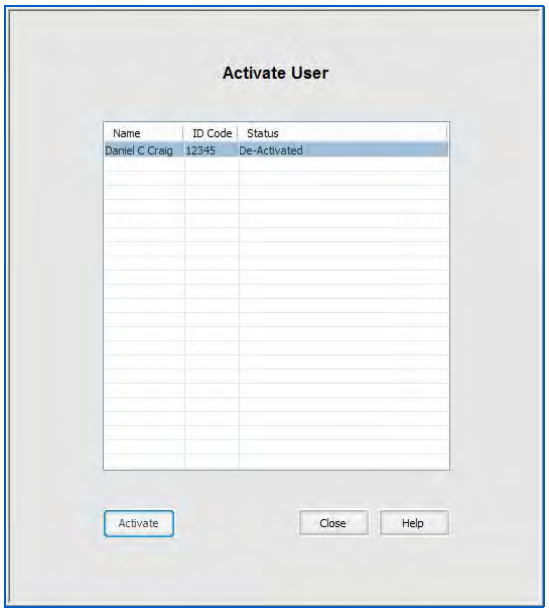

Figure 11-78: Activate User screen

Selecting Activate from the Activate User screen brings up a warning message:

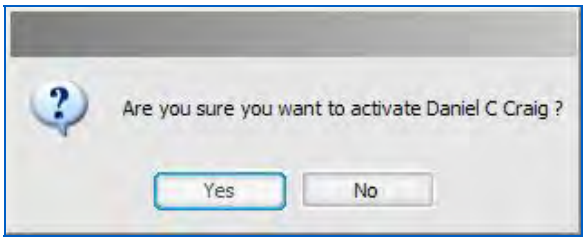

Figure 11-79: Activate User message

Selecting Delete brings up the Delete User screen:

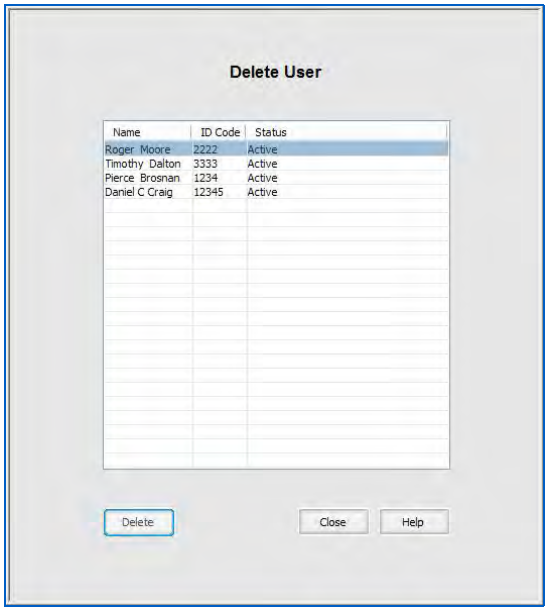

Figure 11-80: Delete User screen

Selecting Delete from the Delete User screen brings up a warning message:

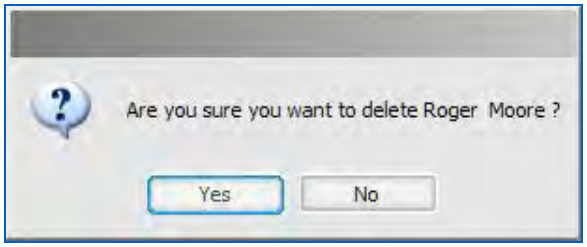

Figure 11-81: Delete User message

Selecting List All brings up the List All screen.

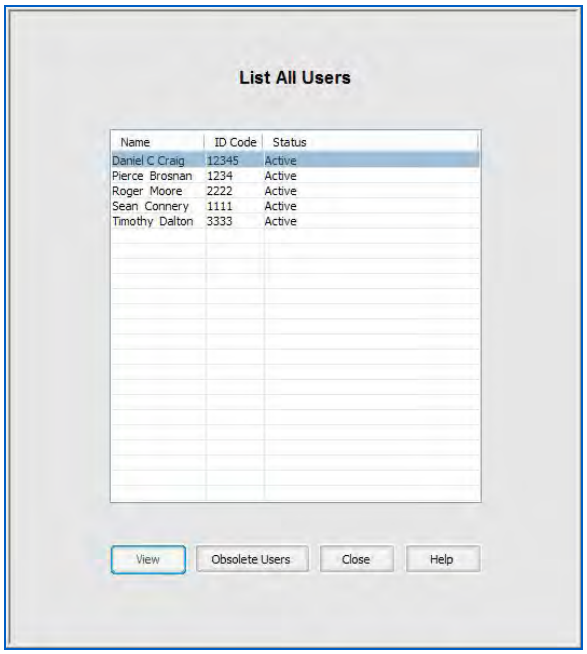

Figure 11-82: List All Users

Selecting View from the List All users screen brings up a more detailed screen:

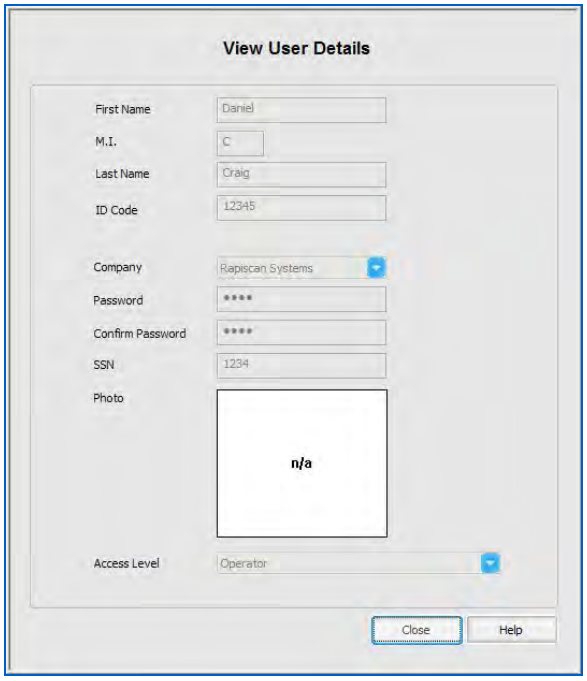

Figure 11-83: View User Details

Selecting Export/Import brings up the following screen:

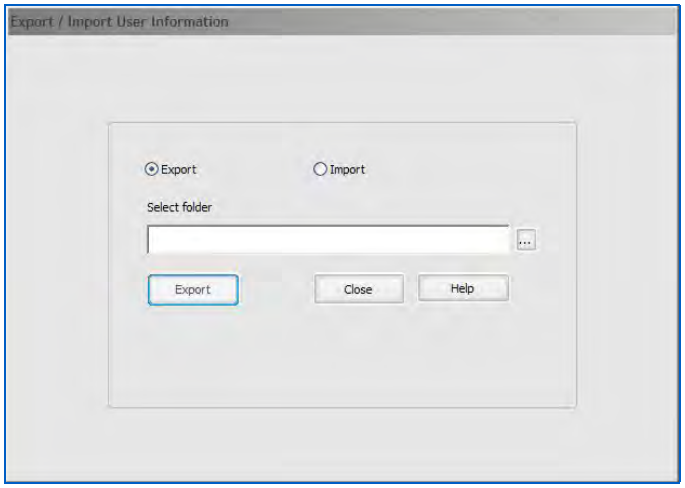

Figure 11-84: Export/Import User Information

This screen shows the View System Logs button. Selecting this button brings you to the screen shown below.

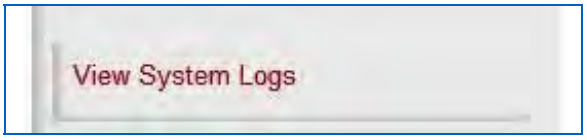

Figure 11-85: View System Logs

To exit System Logs, select File in the upper left corner, then choose Exit from the pull- down File menu.

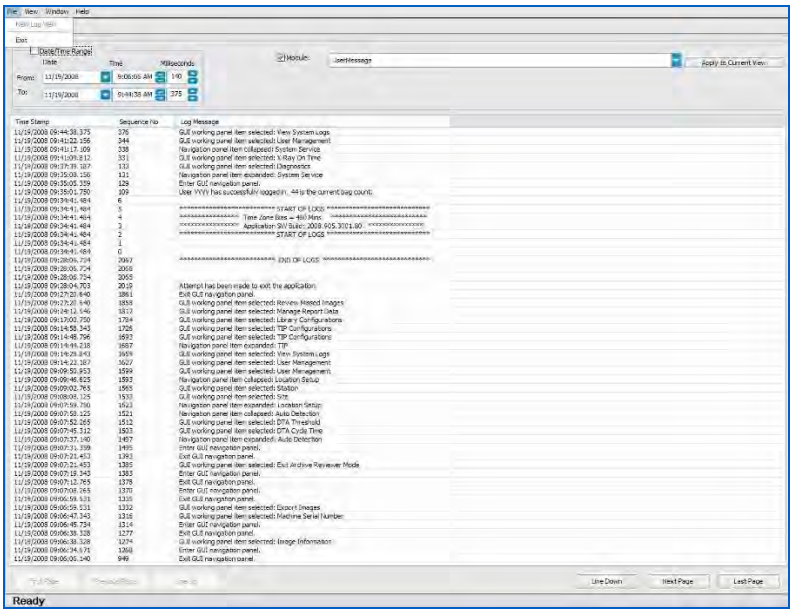

Figure 11-86: System Logs

11.12 Screen Saver

This screen shows the Screen Saver option which allows you to set the wait time and/or to disable the function, and also whether or not to require a login.

Figure 11-87: Screen Saver

11.13 Help Manuals

This screen shows the Help Manuals button and the Operator and Supervisor Manual option. When selected, this brings up online versions of the Operator and Supervisor manuals.

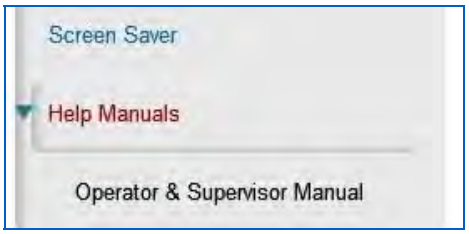

Figure 11-88: Help Manuals

Figure 11-89: Operator's Manual (Dual View)

11.14 Language Selection

The Language Selection option allows you to show the various menus and screens in a number of languages.

Figure 11-90: Language Selection

Machine Serial Number

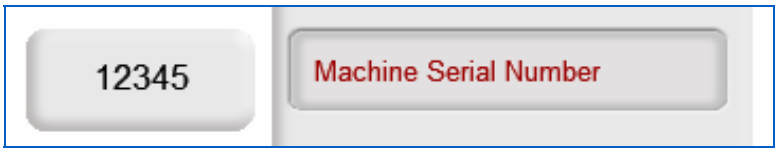

Figure 11-91: Machine Serial Number

This screen shows the Machine Serial Number option. It is important to know the service and maintenance history of a machine and the machine's serial number is the best way to match a machine with its service/maintenance history.

Log Out

This screen shows the Log Out function that returns you to the Log In screen.

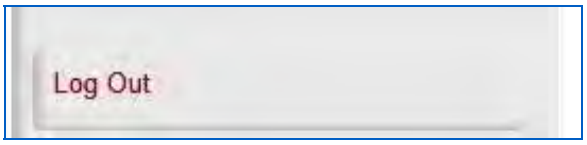

Figure 11-92: Log Out

12 Shutdown the System

12.1 X-ray System Close Up

Close up the Drive Roller Bed

1. Make sure the curtains are fully inside the unit.
2. Raise the drive roller bed until the bed is securely inside the unit.

Close up the Roller Bed

1. Make sure the curtains are all inside the unit.
2. Raise the roller bed.
3. Make sure the support cables do not get trapped behind the roller bed.
4. Fasten the support clips.

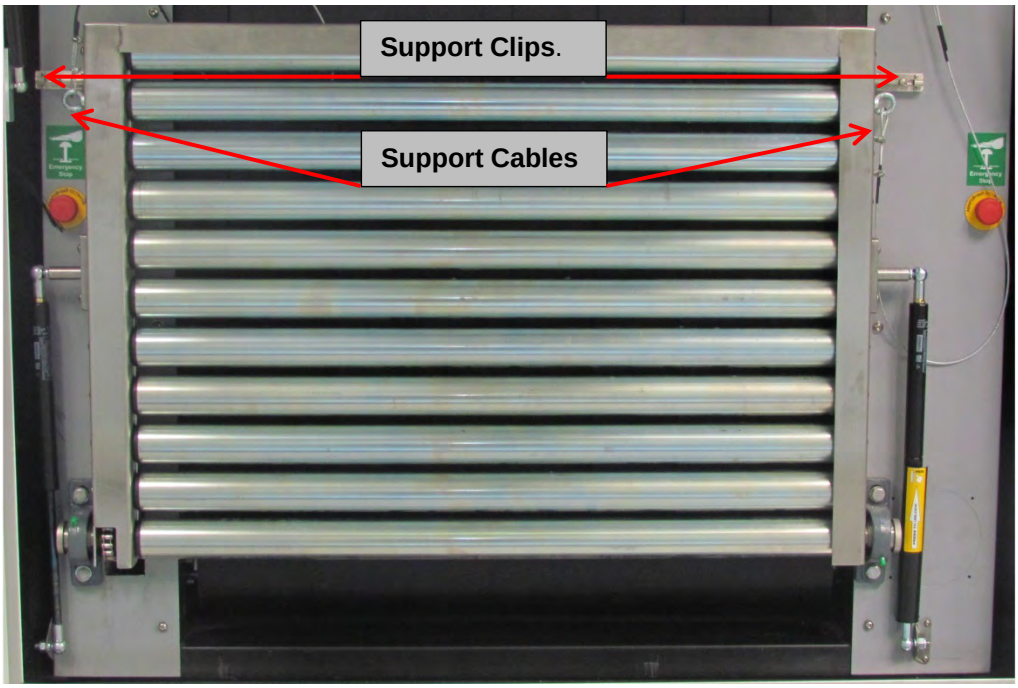

Figure 12-1 Roller Bed Support locks.

12.2 Switching Off

Shut off the System

1. Make sure there is no baggage in the tunnel..
2. Rotate the key switch on the power control panel and push the power to Off.
3. The Power On light at the end of the machine will go off.
4. Turn the main power supply off.
5. Disconnect the power lead.
6. Rotate the key switch on the power control panel and push the “Power On” button.
    i. The X-ray system will begin its power-up sequence, as follows:
7. The Power On light at the end of the machine should also light.

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13 Planned Preventive Maintenance

⚠WARNING Care must be taken to prevent water or any other liquid entering the system. Make sure any cleaning cloth is wrung out before use.

If the system is to be dismantled in any way, or if an internal inspection of the tunnel is necessary, then the system must be switched off and disconnected from the mains supply. The keyboard key is to be in the possession of the maintenance engineer.

Some parts of the X-ray system are heavy and require two persons during removal.

13.1 Weekly Maintenance

The weekly maintenance routines consists of visual inspection and cleanliness of the system; they are detailed in sequential order. If the operating environment warrants it, they should be performed more regularly. This is usually performed by the system's operators.

Preparation

- Read the warnings at the beginning of this chapter before proceeding.
- Switch off the system and remove the keyboard key.
- Remove the mains supply to the system.

⚠CAUTION Care must be taken to prevent water or any other liquid entering the system. Make sure any cleaning cloth is wrung out before use.

Visual Inspection

Visually inspect all the covers and panels for damage and security- damaged covers and panels and any missing fasteners must be replaced.

Conveyor Belt and Video Monitor casing

Using a damp lint-free cloth (soap suds may be used if required) wipe clean the surface of the conveyor belt and the casing of the monitor. Dry all surfaces that have been cleaned with a dry lint free cloth.

Video Monitor Screen

Clean the screen with an anti-static spray or liquid and a lint-free cloth.

13.2 Three Month Maintenance

Preparation

Read the warnings at the beginning of this chapter before proceeding. Switch off the system and remove the keyboard key. Remove the mains supply to the system.

⚠CAUTION Care must be taken to prevent water or any other liquid entering the system. Make sure any cleaning cloth is wrung out before use.

System housing

Using a damp lint-free cloth (soap suds may be used if required) wipe clean the surface of the system housing. Dry all surfaces that have been cleaned with a dry lint free cloth.

Lead Curtains

Visually inspect the lead curtains screening at the entrance and exit of the inspection tunnel for damage. Replace any strips found to be damaged.

Conveyor Visual Inspection

Visually inspect the conveyor belt for tears and holes, replace the belt if excessive damage is found.

Visually inspect the rollers of the discharge conveyor (if fitted) for signs of damage.

Conveyor Motion Checks

Press the forward button (“S”) on the operator control panel, and observe that the associated indicator is lit and the conveyor moves in the forward direction.

Check for excessive noise from each roller bearing- this will indicate that the bearing is defective.

Check the conveyor belt central deviation at each end. The maximum deviation allowable is 20mm.

Press the STOP button (“R”) on the operator control panel.

Press the reverse button (“Q”) on the operator control panel, and observe that the associated indicator is lit and the conveyor moves in the reverse direction.

Check the conveyor belt central deviation at each end. The maximum deviation allowable is 20mm.

Following is the standard Rapiscan Preventive Maintenance checklist, followed by a preventive maintenance work instruction.

14 Troubleshooting

14.1 Limitation on Liability and Warranty

Rapiscan Systems will not accept liability for damage or personal injury caused directly or indirectly by either incorrect or poor quality termination of the local main power supply or power cables. Rapiscan Systems is not responsible for damage or injury caused by unauthorized modification, maintenance, operation or tampering with this equipment.

Service of Rapiscan machines shall be performed only by Rapiscan Systems authorized service personnel. Any modification/alteration made to the system after purchase, by the customers or their agents without written authorization from Rapiscan Systems Management will void any warranty issued to the customer. Additionally Rapiscan Systems is not liable for any damage that might be caused by any unapproved changes."

Rapiscan Systems is an ISO9001: 2000 compliant company and adheres to the guidelines for inspection and testing for all materials prior to assembly. Rapiscan 600 series X-ray machines meet stringent quality control and testing criteria at both the component and system level.

Rapiscan Systems maintains sales and service offices worldwide. If you have questions or need assistance with any product manufactured by Rapiscan Systems, feel free to contact one of the offices listed under "Service Departments" or "Sales Offices."

The following checks are to be carried out by a trained and qualified maintenance technician only. No maintenance panel is to be opened while the system is connected to the power supply since hazardous voltages exist on circuit boards inside the system. Remove the power lead from the wall socket before opening any panel.

14.2 System does not switch on

Check:

- Power-On key on the input end of the system (or on the console) is turned clockwise.
- Power cable is connected firmly to power inlet, and other end is connected to a live power socket.
- Trip indicator on circuit breaker is set correctly.
- The fuse in the power plug is O.K. (if fitted)
- All emergency stop switches are not activated i.e. rotated to the 'out' position.

Remove the power cable from the mains supply, and unlock the access panels to reveal the electronics chassis.

Check:

- Fuse FS1 on the Main Circuit Breaker Panel (MCB) is O.K.
- Voltage selector is set correctly.

If this switch is set incorrectly, check your serial number plate to make sure you have the appropriate voltage and frequency machine for your supply.

14.3 X-rays Do Not Come On

Turn the machine off and disconnect mains power to it. Unlock the access panels.

Check:

- Fuse FS7 is O.K. on the MCB panel.
- X-ray Control board Fuses FS 1 is O.K.
- Fuse F2 is OK in the Electronics Chassis.
- Array box door micro-switches are secure.

14.4 Conveyer does not operate

Check:

- Trip trays are not activated (if fitted).

Turn the machine off and disconnect mains power to it. Unlock the access panels.

Check:

- Check the inverter to make sure there is no fault message.

Operation of the ‘REV’ and ‘FWD’ pushbuttons on the CI board should start the drive roller manually if the system is switched on.

Some drive rollers have a thermal trip that stops the motor from overheating. If this trip has operated, the conveyor may start again after it has cooled. The cause of the overheating must be found and rectified by service personnel.

15 Options

The following features are optional features available on Rapiscan 600 XR machines upon customer request and at additional cost.

15.1 Threat Image Projection (TIP)

Threat Image Projection is a software program that will, according to pre-selected preferences, percentages and rates, project fictional threat images onto real bags, for the purpose of training and/or testing operators, exposing them to threats they might not regularly have a chance to see or react to.

15.2 Density Threat Alert (DTA)

The Density Threat Alert (DTA) highlights any areas that exceed a set density by coloring them purple. A setting of 0 turns the DTA off. The setting for the DTA varies according to machine type and items to be scanned. A typical value to highlight areas of non-penetration would be 20.

15.3 Auto Archive

Auto archive is an optional program that automatically archives scanned images of baggage, allowing those images to be recalled using criteria such as date, station and operator.

15.4 Operator Training Program (OTP)

OTP (Operator Training Program) is a software program that creates a virtual scanning environment for training purposes. Scanned images are “scanned” and scroll onto the user’s screen as if the conveyor belt is moving baggage through the security X-ray machine’s tunnels, but it is completely virtual without conveyors moving or X-rays being generated.

Figure 254 shows a screen shot of an OTP session, the two bags in the image having just scrolled onto the user’s screen as if scanned images of bags actually being moved into and through the X-ray tunnel.

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16 Appendices

Appendix A: Glossaries

Glossary of Acronyms:

Acronym	Description
ACCR	Automatic Cargo Container Recognition
ANPR	Automatic Number Plate Recognition
ANSI	American National Standards Institute (USA)
CB	Circuit Breaker
CBP	Customs and Border Patrol
CCTV	Closed Circuit Television
CPU	Central Processing Unit
DAB	Diode Array Board
DEF (AdBlue)	Diesel Exhaust Fluid, a urea-based chemical reactant designed specifically for use in SCR systems to reduce NOx emissions.
DHS	Department of Homeland Security
ESD	Electrostatic Discharge
GUI	Graphical User Interface, a user interface to a computer that has pictures (“graphics”) as well as words (text) on the computer display screen.
HMI	Human Machine Interface, a computer display screen that enables the operator to control, or check a systems status
ISO	International Organization for Standardization
JPEG	Joint Photographic Experts Group format
LCD	Liquid Crystal Display
LED	Light Emitting Diode
Linac	Linear Accelerator
MCB	Miniature Circuit Breaker
MeV	Mega Electron Volts (or Million Electronvolts)
NII	Non-Intrusive Inspection
NOx	Nitrogen Oxide
OEM	Original Equipment Manufacturer
PCB	Printed Circuit Board
PDM	Program Data Management
PE	Photoelectric
PLC	Programmable Logic Controller
PMI	Preventative Maintenance Inspection

Acronym	Description
PTZ	Point, Tilt, Zoom Camera
RCD	Residual Current Device
RF	Radio Frequency
SCR	Selective Catalytic Reduction
SI	Système International d'Unités (International System of Units)
TCU	Temperature Control Unit
TNA	Thermal Neutron Analysis
UPS	Uninterruptible Power Supply
VUI	Vehicle Under Inspection
WiFi	Wi-Fi is defined by the Wi-Fi Alliance as any "Wireless Local Area Network (WLAN)".

Glossary of Terms:

Term	Description
Automatic Cargo Container Recognition (ACCR)	ACCR is a mass surveillance method that uses optical character recognition on images to read the number on cargo containers. ACCR can be used to store the images captured by the cameras as well as the text from the container number plate.
Automatic Number Plate Recognition (ANPR)	ANPR is a mass surveillance method that uses optical character recognition on images to read the license plates on vehicles. ANPR can be used to store the images captured by the cameras as well as the text from the license plate.
Bit	A **bit** is the smallest unit of information in a computer, represented by either 0 or 1.
Cadmium Tungstate	A dense, chemically inert solid that is used as a scintillation crystal which is transparent and emits light when it is hit by gamma rays and X-rays, making it useful as a detector of ionizing radiation.
Collimate	To **collimate** is to direct into a narrow beam or column of parallel rays
Electron Volt (eV)	A unit for measuring the energy of tiny particles from atoms; 1eV is equal to the energy attained by an electron moving through a potential difference of 1 volt.
Histogram	A **histogram** is a graphic representation of a frequency distribution. It is a graph whose axes are the frequency of measurements and the actual measured values.
Joint Photographic Experts Group (JPEG or .jpg)	{Pronounced “jay-peg”} - This is a format for storing high-quality colour and grayscale photographs and other images; also the name of the group that developed it.
Linear Accelerator (LINAC)	A linear particle accelerator is an electrical device used for accelerating charged particles along a straight line path.
Non-intrusive Inspection (NII)	NII is a non-destructive method of inspecting and identifying goods in transportation systems.
Photodiode	A diode is any electronic device that restricts current flow to mainly one direction. A diode can function as a one-way valve. A photodiode is a light sensor (photo detector) that allows current to flow in one direction from one side to the other when it absorbs photons (light). The more light absorbed, the more the current produced. Used to detect light pulses in optical fibers and other light-sensitive applications, the photodiode detects light and creates a conductive path that allows electricity to flow.
Portable Network Graphics (PNG or .png)	{Pronounced “ping”} - This is a file format that employs lossless (“no loss in image quality”) data compression. PNG was created to improve upon and replace GIF (Graphics Interchange Format, owned by Unisys) as an image-file format not requiring a patent license.
Printed Circuit	An electrical circuit made by connecting the units with electrically conductive lines printed on a panel, this eliminates actual wire and the task of connecting it.

Term	Description
Printed Circuit Board (PCB)	A PCB is a thin board of insulating material on which the components and connections of an electronic circuit are formed by etching the metallic coating. It is also a thin plate on which electronic components are placed.
Programmable Logic Controller	A PLC is a programmable electronic device used for the automation of electromechanical processes, such as control of machinery on factory assembly lines, amusement rides, or lighting fixtures. PLCs are also used to control conveyor systems in airports and cargo handling facilities.
Scintillator	A scintillator is a material which emits light when excited by ionising radiation. The amount of light emitted is proportional to the intensity of the ionising radiation incident on the crystal.
Wi-Fi	Wi-Fi is a technology that allows an electronic device to exchange data wirelessly (using radio waves) over a computer network, including high-speed Internet connections.

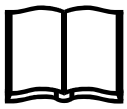
Appendix B: Definitions

Name	Description
ACCESS PANEL	Any barrier or panel which is designed to be removed or opened for maintenance or service purposes, requires tools to open, and permits access to the interior of the cabinet. Any barrier that is designed to be moveable or opened for routine operation is a **door** (defined below), not an access panel. Some cabinet x-ray systems have cosmetic covers that conceal electronics but do not allow access to the cabinet when opened. These covers are not access panels unless they are used to prevent access to interior system components that do allow access to the cabinet. Tools can be keys or common tools such as screwdrivers and wrenches.
APERTURE	Any opening in the outside surface of the cabinet, other than a port, which remains open during generation of x radiation. Apertures are usually holes for routing cables, ventilation, or wiring into or out of the cabinet.
CABINET	The enclosure that contains an x-ray tube and is intended to contain at least that portion of a material being irradiated, provide radiation attenuation, and exclude personnel from its interior during generation of x radiation. The cabinet is the only space within a cabinet x-ray system where radiation exposure greater than the emission limit is permitted.
DOOR	Any barrier which is designed to be movable or opened for routine operation purposes, does not generally require tools to open, and permits access to the interior of the cabinet. Inflexible hardware rigidly affixed to the door shall be considered part of the door. If the barrier is only opened for maintenance and service, then it is an access panel as defined above. However, if the barrier must be moved for the material being irradiated to be placed in or removed from the cabinet as part of routine operations, then the barrier is a door even if tools are needed.
EXTERNAL SURFACE	The outside surface of the cabinet x-ray system, including the high-voltage generator, doors, access panels, latches, control knobs, and other permanently mounted hardware and including the plane across any aperture or port.
FLOOR	The underside external surface of the cabinet.
GROUND FAULT	An accidental electrical grounding of an electrical conductor.
PORT	Any opening in the outside surface of the cabinet which is designed to remain open, during generation of x-rays, for the purpose of conveying material to be irradiated into and out of the cabinet, or for partial insertion for irradiation of an object whose dimensions do not permit complete insertion into the cabinet.
PRIMARY BEAM	The x radiation emitted directly from the target and passing through the window of the x-ray tube.
SAFETY INTERLOCK	A device which is intended to prevent the generation of x radiation when access by any part of the human body to the interior of the cabinet x-ray system through a door or access panel is possible
X-RAY TUBE	Any electron tube which is designed for the conversion of electrical energy into x-ray energy

Appendix C: Units of Radiation Measure

When radiation is measured, different terms are used based on whether we are:

- Measuring radiation emitted from a radiation source,
- Measuring the radiation dose absorbed by an individual, or
- Measuring the risk an individual may suffer biological effects from exposure to radiation.



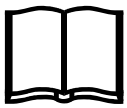
DEFINITION: Exposure

Exposure is a measure of the ability of electromagnetic radiation, such as X-rays, to produce ionization in air.

Traditionally, the unit of exposure is the **Roentgen (R)**.

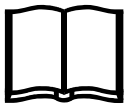
There is no System International (**SI**) unit defined for exposure.

A micro-Roentgen (**µR**) is one millionth of a Roentgen (R).



DEFINITION: SI (International System of Units)

Système International d'Unités (International System of Units) is the international standard set of units of measurement set by the 11th General Conference on Weights and Measures in 1960.

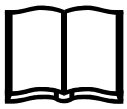


DEFINITION: Absorbed Dose

A measure of the amount of energy absorbed or deposited per unit of mass.

The unit **Rad** (R) can be applied to all types of radiation and is defined as the deposition of 100 ergs of energy in one gram (mass) of any material.

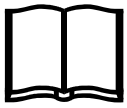
The SI unit of absorbed dose is the **Gray (Gy) = 100 Rad**.



DEFINITION: Dose Equivalent

A measurement that expresses, on a common scale for all ionising radiations, the magnitude of radiation effects likely to be incurred by exposed persons.

Dose equivalent is computed multiplying the absorbed dose in **Rad** by a **Quality Factor (QF).**



DEFINITION: Quality Factor (QF)

An energy dependent factor which relates:

(a) The amount of radiation effects likely to be incurred by exposed persons from the type of radiation absorbed, to

(b) The amount of radiation effects from the same dose of X-rays.

The **QF** is **1** for X-rays.

DEFINITION: Roentgen Equivalent Man (Rem)

A unit of measurement for dose equivalent, computed as:

- **1 Rem = 1 Rad × QF**

For X-rays (where the QF is 1):

- **1 Rad of exposure results in 1 Rem of dosage.**

A Rem is a large amount of radiation, so the milli-Rem (mRem), which is one thousandth of a Rem, is often used for the dosages commonly encountered, such as that from medical X-rays or background sources.

A micro-Rem (**µRem**) is one millionth of a Rem.

DEFINITION: Sievert (Sv)

The SI unit of dose equivalent, defined as:

- **1 Sv = 100 Rem**

In security equipment, a more applicable unit is the micro Sievert (µSv), which is one millionth of a Sievert (Sv).

- **1 µSv = 100 µRem**

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Appendix D: Rapiscan Systems Contact Information

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