

# Truck & Cargo X-Ray Screening Gantry

Product Code: 1050-06



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## Key Features



**Pass Over Mode – Entire Truck & Container Scanned**  
Typical Throughput 20 Trucks Containers per hour



**Portal Mode – Containers Only Scanned**  
Typical Throughput 100 Trucks Container per hour



**3 Colour Material Separation**



**Steel Penetration 340 mm**



**Max Vehicle Size Height 4.7 metres x Wide 3.5 metres**



**Control & Analyst Work Stations**



## Overview

The Truck and Cargo X-Ray Scanning Gantry is a state-of-the-art dual-energy x-ray scanner for checking cargo compliance to manifest documentation and the detection of contraband, explosives, narcotics, and weapons.

The system has two modes of operation: –

**Pass Over Vehicle Mode** – The Gantry system is mounted on rails which enables the screening of the entire vehicle to take without the driver in the cabin.

The vehicle is parked the driver leaves the vehicle then the entire X-Ray Screening system moves on rails passing over the target vehicle, typical throughput 20 trucks with containers per hour.

**Portal Mode** – The Gantry system remains in a fixed position, the trucks drive through the portal, the truck cab is not scanned, when the container enters the gantry the X-ray system scans the container, typical throughput is 100+ trucks with containers per hour

### Features

Passover & Portal Modes

3 Colour Material Separation

Steel Penetration 340 mm

Maximum Vehicle Size Height 4.7 m  
x Wide 3.5 m

6 MeV Linear Accelerator

# Truck & Cargo X-Ray Screening Gantry

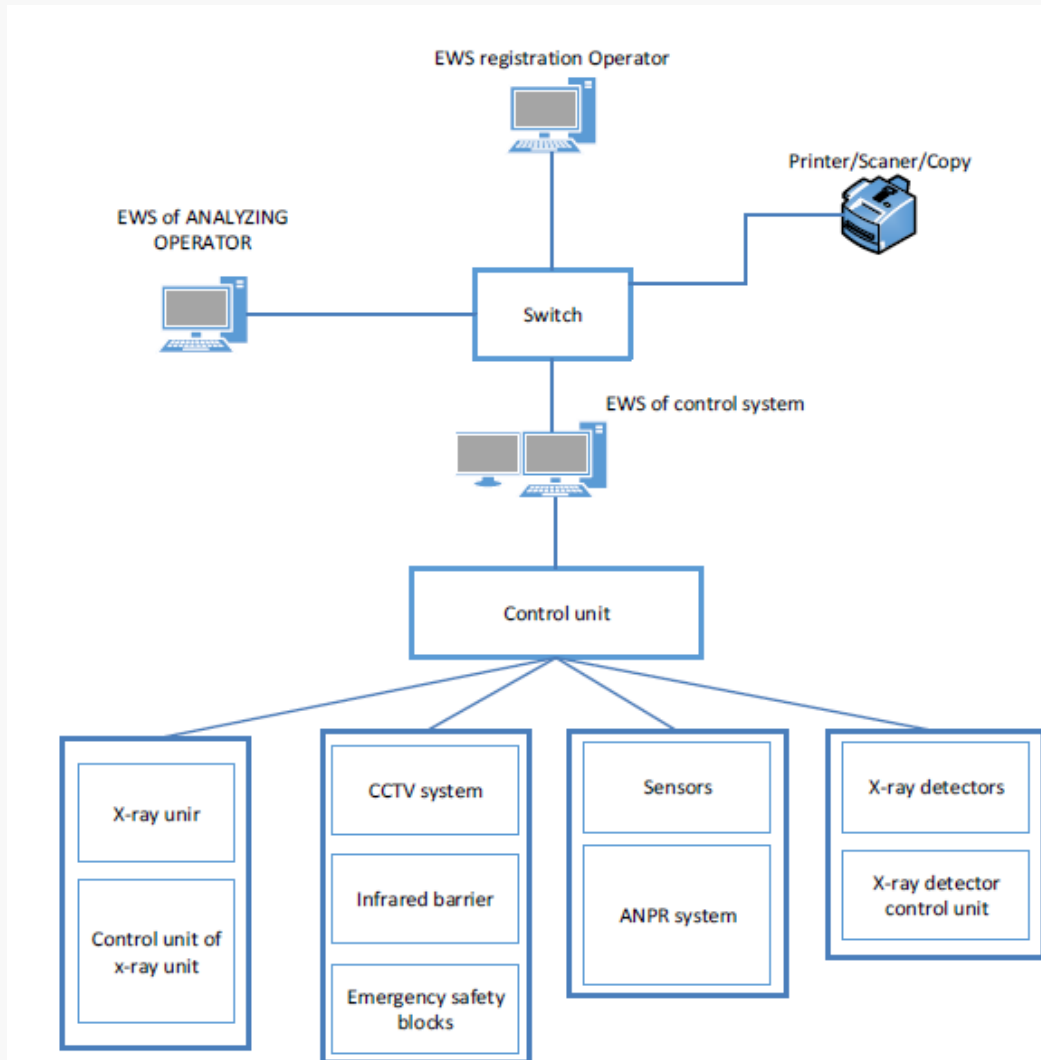


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## Applications

The Truck & Cargo X-Ray Scanning Gantry is an ideal solution for the inspection of containers for contraband, explosives, weapons and verification of contents to manifests at Ports, Critical infrastructure facilities, Customs inspection, Government facilities, Logistics facilities, Military bases, Seaports & VIP facilities..

## Control System



The Operator's AWS for system control is equipped with a hardware-and-software complex (workstation), which allows control the operation of inspection station, monitor its technical condition, perform system configuration and maintenance operations, display information from video monitoring and radiation safety systems with an emergency stop push button with a key.

## Control System Main Functions

The Control System main functions are: –

- Control entry traffic lights
- Registration of the vehicle and container
- Sense vehicle is correctly located in scanning area
- Monitor safety exclusion zone by infra-red beams & CCTV
- If persons detected in exclusion zone shut system down
- Operator – operate the microphone & loudspeaker system
- Operate the traversing of the gantry
- Operator – monitor the quality of the scanned image produced
- Operator – check image for contraband
- Operator – compare the image to delivery documentation / bills of lading
- Operator – direct track carrying suspicious contents for further manual inspection
- Operator – Images can be printed, allowing manual inspection pinpointing
- Record all vehicle & container numbers and images in database
- Database can be interrogated
- Control exit traffic lights

The control system includes all necessary sub-systems to perform screening of the vehicles and to ensure the safety of operating personnel.

## Emission System With Collimator Sub-System

The emission system with collimator subsystem consists of an X-ray source, a collimator system, an alignment system, a control system, a power supply system, and an air conditioning system. The x-ray source is designed to generate and form a working x-ray beam with a given quality, shape and direction.

A linear accelerator with the radiation power of 6 MeV is used as a radiation source, which ensures the penetration capability of not less than 340 mm of steel. Dual energy that provides recognition of materials by atomic numbers organic and non-organic items.

The linear accelerator includes an x-ray emission, an integrated ionisation chamber, a power supply and control unit, special protection against X-rays and a forced cooling unit.

The high-energy x-ray source in an x-ray protective housing is placed on a platform with electromechanics drives, which enables to remotely adjust the position of the radiation beam relative to the detectors of the radiation receiver from the operator's room during the adjustment of the system.

## X-Ray Detector Module with Data Acquisition Unit

The x-ray detector module with data acquisition unit consists of x-ray receivers, image generation and processing systems, alignment mechanisms.

It is designed to detect x-ray radiation that has passed through the inspected entity and transmit the registered signals to the control system.

The detection and data transmission system has a portal design containing x-ray sensitive modules of the high-energy x-ray receiver.

The adjustment mechanism in each receiver module allows to adjust the position of detectors relative to the radiation beam.

The housing of each detector protects the sensor modules from adverse weather effects and provides easy access to each module for maintenance and repair.



## Other Systems

### Gantry Transportation System

The gantry system for the transportation of x-ray emitter and receiver consists of electric motors, guide rails, control system and software.

It is mounted on a self-propelled electric motor-driven platform, which enables bidirectional scanning of the object inspected, moving along the object without any additional technical equipment

### Computerised System

The Computerised system for image generation, data collection and processing generates a shadow X-ray image and transmits it to the operator for analysis.

### Radiation Safety System

The Radiation safety system includes vehicle presence sensors, radiation emergency stop buttons, audible and visual alarms, a dose meter and an optional perimeter control system (depending on the system layout).

### Communication System

The Communication system provides transmission of audio signals to the driver using a loudspeaker and includes an intercom system between the operator's room and the security gateway.

### Traffic Control System

The Traffic control system includes traffic lights, road signs, barriers.

### Power Supply System

The Power supply system allows connecting the system to an industrial AC power network with a voltage of 400 V and has protection from voltage surges and drops. If necessary, the system can be charged by autonomous diesel generator.

### Video Monitoring System

The Video monitoring system includes monitoring cameras located in the inspection gateway, a video recorder and a CCTV system monitor located at the operator's AWS for the control of system operation.

### Software

The Software provides management of the screening process, receiving, storing and processing of shadow X-ray images. The outward of the system can be changed depending on the customers' requirements

### Image Manipulation

The system is provided with: –

- Ability to choose between a black and white, or a pseudo-colour image, with a palette of at least ten combinations
- Adjustment of the contrast and brightness
- Digital filters for the improvement of the quality of the image
- Improvement of the image at the edges and at selected sections
- Automatic scrolling of the entire image
- Marking and making text notes in order to highlight suspicious areas, these marks and notes are stored together with the scan image and are printable
- Alternate viewing of original and processed image in the same window in order to compare them
- Showing colours according to the intensity of their shade in digital expression
- The image conversion tool provides exporting the image in the JPEG format and can convert the image format to the TIFF or the BMP
- Digital zoom in/out 1/4x, 1/2x, 1x, 2x; 4x; 8x of a selected place

### Communication System

Ensures transmission of audio signals to the driver using a loudspeaker and includes an intercom system between the operator's room and the security gateway.

### Traffic Control System

Includes traffic lights, road signs, barriers.

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## Other Systems

### Power Supply System

That allows connection to a 400 V AC power network that has voltage surge and spike protection from voltage surges and drops. The system can be powered from an autonomous diesel generator.

### Video Monitoring System

Includes monitoring cameras located in the inspection gateway, a video recorder and a CCTV system monitor located at the operator's AWS for the control of system operation

### System Software

The automated workstation's image analysis suite allows for an external network data storage device, as well as a data backup and recovery device.

The data storage device is accessible via LAN by the image analysis operators and system administrators.

The Software provides search and recovery of images based on identifying characteristics; the data backup and recovery process does not affect the image data collection process.

## Technical Specifications

### Operating, Transportation & Storage

Ambient temperature range: -30°C to +55°C

Air humidity: 0 to 99%

Transportation & storage: -30°C to +55°C

Air humidity transportation & storage: 0 to 99% without condensation

### Power Supply

Emission module: 380 V +10/-15%, 3 phases, 50 Hz +/-1%,

Peripheral components and computer equipment: 230 V +10/-15%, 50 Hz +/-1%

Power consumption: Up to 55 kW

### Operating Dimensions & Mode

Maximum vehicle dimensions: Height 4.7 x Width 3.5 x Length 25 metres

Dimensions of scanning tunnel: Height 4.8 x Width 3.8 metres

Scanning speed: 0.13 m/sec, 0.2 m/sec, 0.1 m/sec

Maximum screening height: 0 cm from ground level

Number & type of projections: one, side view

Operation mode: 24/7 with option of temporary stopping the system

### Throughput, Direction & Warmup

Pass over mode: 20 vehicles per hour (cab not scanned)

Portal mode: 100+ vehicles per hour

Scanning direction: Forward & reverse

Warmup: 30 minutes

### X-Ray Source

Source: Linear accelerator

Radiation source energy: 6 MeV

Input resolution modes: 4.0 / 6.0 MeV

### X-Ray Image Quality

Steel Penetration: 340 mm

Wire resolution - Copper Wire: 1.5 mm

Spatial resolution - vertical & horizontal: 4 mm

Contrast sensitivity: 1%

## Technical Specifications

### Power Supply System

That allows connection to a 400 V AC power network that has voltage surge and spike protection from voltage surges and drops. The system can be powered from an autonomous diesel generator.

### Database

Server: HP Proliant ML30

Storage capacity: 16 TB

Image storage capacity: 100,000

Back up capacity: 8TB

Back up storage capacity: 200,000

Images can be exported to: DVD / CD

### Operators AWS

Processor: Intel Core i7

Hard disc capacity: 1TB

Ram: 16 GB

Display: 27", 3840 x 2160, contrast – 1300:1, brightness – 350kd/sq.m)

Operating system: Microsoft

UPS: 1 x 670 watts

## System Operation Software

The Cargo- Manager software provides interaction of individual components of the Cargo-Vision software suite and consists of Cargo-Reg for vehicle and cargo registration, Cargo- Scan for the scanning process and X-ray module control, and Cargo- View for the processing and analysis of the x-ray image.

In the regular operational mode, the software modules switch automatically according to the developed algorithm for operators' work. It is also possible to change from one module to another from the software suite in any sequence. The Cargo Manager allows dividing operators by their functions and setting up accounts.

There are four access groups of operators within the system:

- 1. Administrators** – This group of operators has all the system control right, they can run any software and functions of the system, as well as perform software updates and system recovery.
- 2. Registration operators** – Operators in this group have the right to register vehicles and cargoes, check accompanying documents, and use the Cargo-Reg software module.
- 3. System operators** – Operators in this group have the right to view and change vehicle registration data, perform the scanning procedure, control video monitoring cameras, view image archives, and use the Cargo-Scan software module.
- 4. Image analysis operators** – These operators use the Cargo-View software module and analyse the received x-ray images with the help of software tools, prepare a report on the findings of analysis.

### UPS

All operator workstations are connected to uninterrupted power sources with an autonomous operation time of 10 minutes. Power supply switching is automatic in case of failure of the main power supply or in emergency situations. The control system automatically monitors the shutdown or restart of the entire system to rule out operator errors.

### Backup

The following measures ensure uninterrupted software operation: –

- Regular data backup from operator workstations hard disk for fast data recovery.
- All operator workstations are equipped with the data recovery function.

## Radiation Safety

The radiation safety system is designed to ensure the safety of people inside and outside the controlled area, it ensures radiation protection of people, operators, drivers and passengers and the environment within and around the system.

The system includes an x-ray controller that collects information from all safety units, analyses it, and either allows or disallows x-ray system, the following are components of the controller:

- Radiation source on/off unit
- Scanning area perimeter control with optional IR barriers
- X-ray radiation indicator

The boundaries of the radiation exclusion area are selected for the deployment and operation of the system based on the following radiation safety requirements: –

- The ionising radiation dose beyond the controlled area may not exceed 0.5  $\mu\text{Sv}$  on average during one hour of system operation.
- The combined annual dose may not exceed the allowable limit of 1 mSv (ICRP 103), provided that no person is exposed to radiation for more than 2,000 hours per year.

Radiation safety system components:

- Blocking system
- Dose meter
- Emergency stop buttons
- Intercom communication
- Internal communication system
- Sound and light alarms
- Vehicle presence detector
- Video monitoring system
- X-ray protection

### Radiation Safety

- Dose rate inside operators room: Not more than 0.5  $\mu\text{Sv/h}$ , Not more than 1 mSv/year,
- Dose per scanning entity: Not more than 20  $\mu\text{Sv}$
- Exposure dose of ionising radiation at the boundary of her zone: Not more than 0.5  $\mu\text{Sv}$  average during 1 hour of system operation

A lead shield is installed around the high-energy X-ray source to reduce scattered radiation, on the vertical part of the arm behind the detectors a lead plate is located to ensure protection against ionising radiation and reduce the scattered radiation area. If the system is deployed inside a building, this will provide additional protection against ionising radiation.

### System Safety

**Emergency Stop buttons** – The Emergency Stop buttons immediately stop the x-ray system when pressed, pressed, information about the button will appear on the operator's display.

**Sound & Light Alarm** – An Audio (siren) and Light signal located on the system's body will activate when the scanning process starts and throughout the scanning procedure.

**Dose Meter** – A portable Dose Meter is located in the operator's room that monitors the dose rate within the room. If the maximum allowable x-ray dose rate is exceeded, the device triggers a visual and sound alarm, it will automatically disable the x-ray source. When the dosimeter alarm is triggered, a corresponding message is displayed on the operator's display.

**Door locks** – The front door of the X-ray source module is equipped with a magnetic-type safety lock and triggers when the door is opened. Radiation can only be activated when the doors are closed, and the locks are in place. The x-ray source can only be activated when the doors to the entrance / exit area are closed in the inspection room

## System Safety

### Vehicle Presence Sensor

When the gantry remains in stationary mode, whilst the vehicle drives through the gantry without the cab being screened, the vehicles are fitted with reflective type sensors, the system uses these sensors to monitor the position of the vehicle and container relative to the scanner to ensure the x-ray radiation is only activated when the driver's cabin has left the scanning beam area. The sensors also assist in traffic monitoring, giving the position of individual vehicles to prevent collisions occurring.

### Safety Radiation Exclusion Area

To protect third party persons during scanning operation, a safety radiation exclusion area must be formed around the system. The radiation dose at the edge of the safety zone must not exceed the maximum permissible level. The dimensions of the safety radiation exclusion area do not exceed the size of the scanning room.

Warning signs that are visible from a distance of at least 3 metres must be placed at the perimeter safety radiation exclusion area

The CCTV monitoring system enables the system operator to monitor the preparation for and progress of the scanning process. The system consists of colour cameras and video displays and ensures control of the entry, exit to and from the inspection tunnel and scanning room during the inspection and includes six cameras and video displays and a recorder.

## Options

### Optional OCR Container Number Recognition

An optional 3 cameras for container code recognition can be included, they will provide automatic container code recognition (ACCR) to ISO 6346.

Reading of shipping containers numbers makes logistic environments more intelligent by building comprehensive databases of traffic movement, automating and simplifying airport, railways or harbours, managing border control inventory and container surveillance systems. The ACCR reads the container codes from digital still images, digital image flow or live video signal. The unique serial number with check digit, owner, country code, size, type and equipment category as well as operational marks (if any) of every cargo container with the highest accuracy. The number detail is saved in the data base with the scanned x-ray image.

### Optional ANPR Licence Plate Number

An optional ANPR can be included that automatically reads the vehicle license plate from many camera images with very high recognition accuracy. The system can read Arabic, Cyrillic, Chinese, English, Latin, Korean, Thai and many other character sets. The number plate detail is saved in the data base with the scanned x-ray image.

### Optional Integrated Radiation Detector

An optional Integrated Radiation Detector can be included that will detect radioactive and nuclear materials being transported through the x-ray area of the system. The radiation detection system overlays the x-ray scan with the profile of the gamma and neutron



Example – Red Section of Graph Showing Radioactive Material Present

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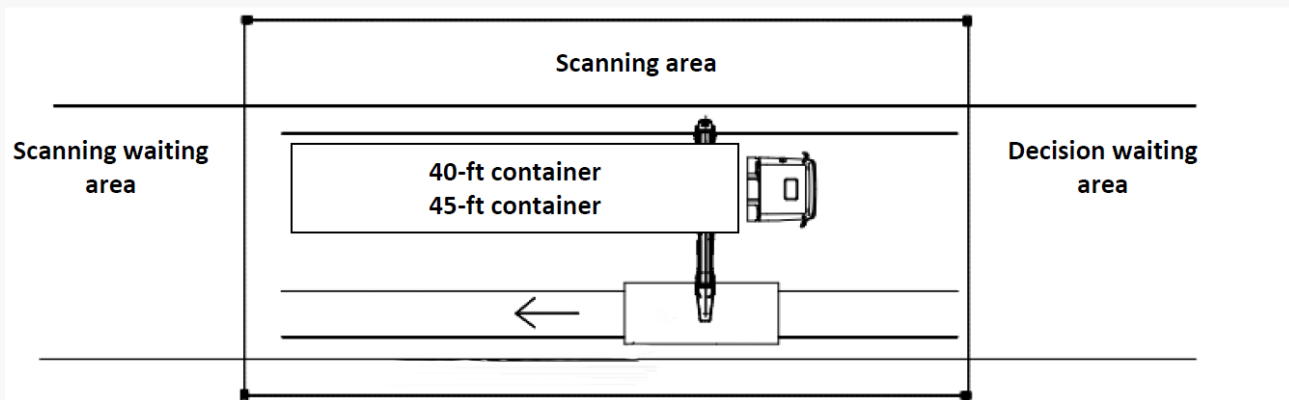


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## System Layout

There are three working areas shown in the diagram below: –

- **Scanning waiting area** – Where vehicles wait for traffic signal permission to enter the scanning area
- **Scanning area** – Where the vehicle is scanned
- **Decision waiting area** – Parking space whilst inspection results are determined



If the system is to be installed in the customs building the overall dimensions must not be less than Length 30 metres x Width 12 metres x Height 6 metres.

## Typical Scanned Images



## Maintenance Service

The Warranty Period for the system equipment is one year during the warranty period Westminster will repair or replace defective system parts at no cost to the customer.

Westminster recommends that a system Maintenance contract be entered into to cover second and third level maintenance by Westminster Engineers and fair wear and tear parts

Since the system can be used 24/7 to inspect vehicles and cargoes, the main task of maintenance is to minimise downtime and maintenance time.

The following three levels of maintenance service have been developed for this purpose: –

1. The **first level** includes simple operations that can be performed using computer tools or commands available to the system operator. This type of work can be performed by the user's technical specialists.
2. The **second level** of maintenance envisages analysis of the system performance, replacement of components or parts with the use of a set of spare parts according to the maintenance plan. This work is normally performed by engineers of the local representative of Westminster, that have been trained at the company and have appropriate certificates. This level is focused on the preventive maintenance of the system.
3. The **third level** is aimed at analysing and eliminating faults and replacing parts of the system that are not included in the set of spare parts supplied with the system. This work is performed by Westminster Engineers.

These three levels are **arranged in** the increasing order of system maintenance complexity.

Preventive maintenance is required to maintain the system in working order, thereby reducing the risk of system downtime or deterioration in performance. This type of maintenance belongs to the first and second maintenance levels.

Westminster provides maintenance and warranty service of the system using trained engineers, who have been trained by manufacturers of the main critical components and have the appropriate certificates.

Maintenance service of the system is recommended once every six months.

The operational parameters of the system must be tested once a year.

Service Period	Required Activities	Recommended Personnel
Daily	If the system is not used, it must be activated and warmed up on a daily basis.	User's personnel
Weekly	If the system is not used, it must be activated on a daily basis and the scanning process run on a weekly basis.	User's personnel
Quarterly	Preventative system maintenance, this will take approximately 16 hours down time.	Westminster's Engineer or User's Engineer trained & approved by Westminster
Half-yearly or after 1,000 of operation – whichever occurs first	Full system maintenance and calibration, this will take approximately 24 hours down time.	Westminster Engineer



## Training

Westminster provides operator & engineer training at the operational site, the training programme for operators includes theoretical and practical courses with training materials and guidelines; the training is conducted in English.

Upon completion of training, the Customer's personnel will be issued documents certifying the completion of training and the right to operate the inspection system.

## Customer Responsibilities

The following are the responsibility of the customer or others and not included in Westminster's pricing:

- All customs clearance, import duties, insurance, inland transportation of the equipment to safe and secure storage on site
- Assist with Visa applications
- All licenses and permissions required to allow Westminster staff access to the installation site and to undertake the required works
- Provide PPE protective equipment where necessary
- Provide two towers / cherry to reach to 6 metre height
- Provide forklift truck, minimum 1.5 tonne lifting capacity
- Provision of hardstanding base to the agreed design drawings
- Provision of fencing around the scanning area to the agreed design drawings
- Provision of buildings to house the equipment where required / radiation protection walls to the agreed design drawings
- Provision of access roads
- Provision of underground conduits with draw wires, prior to hardstanding base and access roads being laid to the agreed design drawings
- Provision of mains electrical power supplies
- Provision of Wi-Fi and/or data links where required
- Provision of personnel / engineers to be present at the handover and acceptance of the completed installation and to undergo maintenance training
- Provision of suitable operators and engineers to undergo operator training
- Provide vehicles and drivers for scanning targets
- Provision of facilities to carryout theoretical training
- Provision of control operation room with lighting, air conditioning and heating, four 13-amp capacity electrical sockets, for control equipment and up to two operator's positions including desks and chairs.