AUTOMATIC TRAIN UNDERCARRIAGE INSPECTION SYSTEM



GKH-TR11



Product Summary

The GKH-TR11 Automatic Train Undercarriage Inspection Systems (ATUIS) does as the name suggests; automatically inspects the undercarriage of a train's rail cars. The system is embedded between the rail tracks in such a position to allow trains to pass over either a dual-or single-view scanner so that the undercarriage of the individual rail cars is captured.

Trains pass over the environmentally-sealed scanner while Gatekeeper's system scans and compiles one or two (depending on scanner type selected) high-resolution image(s) of the train's rail car undercarriage to create individual undercarriage digital "fingerprint(s)". An overview image of each rail car is displayed on a high-resolution monitor along with the resulting scans of the rail car undercarriage.

After each rail car has cleared the scanner, it takes between 2 and 3 seconds for Gatekeeper's Automatic Foreign Object Detection [AFOD] software to automatically compare and display the newly scanned rail car image to a "safe" rail car image stored in the system database. The system then immediately identifies any foreign object(s) or modification(s) to the undercarriage by circling them with a red ring see below AND activating an audio and/or visual alarm.



Operator Screen

The system can be integrated with tracking technologies such as automatic container number readers (ACNR) & RFID readers.

The GKH-TR11 has such standard features as the ability to identify each rail car configuration and size, number of carriages in a train, date and time of the arrival of individual rail cars over the scanner, activity reports and in addition are network enabled requiring only to connect the systems to a common network for remote monitoring or operation.

Overview of Technology

Below are the primary features & capabilities of Gatekeeper's under vehicle inspection systems. In combination with these is the actual performance record of the Gatekeeper systems gained from deployment worldwide.

Core Technology

Gatekeeper's technology uses Area Scan Image Processing technology which allows vehicle images to be normalized regardless of the speed of the vehicle as it crosses the scanning platform. Image capture and processing technologies such as recorded video streams, or line scanning processing are not capable of automatic identification and searching because they require the human operator to view/compare the images and decide if there is any object or modifications that



Scanning Rail Car

could pose a threat. Live/recorded video and line scanning systems have been proven to be unreliable as an inspection technology due to poor performance and that they rely heavily on human knowledge, attention span and intervention.

Two Views of the Vehicle Under Carriage

Virtual 3D Images– Gatekeeper's systems compile two high resolution digital images of a vehicle under carriage and create a virtual "finger print" of the vehicle. Two independent views are necessary to provide the maximum amount of visual information to



Scanning Hopper Rail Car

permit automatic identification and automatic searching. The two views or virtual 3D image makes it more difficult to hide objects, explosives etc on top of an axel or cross beam under a vehicle.

Automatic Vehicle Identification

Gatekeeper's system uses the vehicle finger print to automatically identify the vehicle by matching the image against a data base of vehicle finger prints. The system does not rely on license plates or RFID etc to recall the vehicle from the database it is done via Gatekeeper's patented pattern recognition algorithms. The two images are converted into a digital computer file and stored in a SQL data base where they can be matched against the entire data base. When a match is found the identity of the vehicle make & model can be (user defined) displayed on the operator terminal.



Top view of Rail Car Scanning Process

System Performance Requirements	
Maximum Vehicle Speed	20 Kilometers per hour
Rail Car length	to very large/long trucks and train carriages
Decision Response Time	(the length of time from when the vehicle clears the scanning platform until the system automatically identifies the vehicle, automatically searches the under carriage and displays the decision results on the operator terminal) 4 - 5 seconds

Gatekeeper TR11 Specifications

Software Operating System	
Automatic Foreign Object Detection System (AFODS)	Patented digital "stitching" of continuous motion vehicle or rail car image to create high-resolution digital image regardless of vehicle speed up to 20 KPH
	Patented digital image algorithms automatically match scanned rail car "fingerprint" with vehicle database, detect foreign objects and provide audible and visual alerts to the operator terminal.
	Patented bi directional (contemporaneous dual inspection view – forward and backward) scanner providing a virtual 3D view of the undercarriage of a vehicle
Operating System	Windows XDE
Database	Windows XPE Windows SQL
System Architecture	Open
Opling Assistance	Clabel Deceb M
Online Assistance	Giobal Reach 11
Features	Patent Pending ability to Identify Vehicle/rail car models based on under vehicle image only.
	System automatically distinguishes between rail car types (tanker, flat deck. hopper etc) without operator assistance and produces composite stitched images of identical high quality without the need to adjust scanner settings or lighting.
	User defined – multi language GUI
Language	Keyboard and LPR



System Physical Properties

Embedded Frame

Unit mounts between the rail tracks and extends 35.5cm below grade. The embedded unit is poured on site and includes drainage and conduit exit points as per attached drawings. The site is isolated from the surrounding ground by the use of sheets of polycarbonate. The system frame consists of a mounting platform suspended on 8 mounting rods that are



attached to anti-vibration mounts. The light rails mountings are hinged and allow for adjustment of the light rails to match the viewing angle of the scanner.

Specifications	
Dimensions	Length 168cm x Width 155cm x Depth 35.5cm
Weight	350 kg (approx)
Number of pieces	4
Environmental	Galvanized steel

Scanner

Patented Design	
Dimensions	70 cm wide x 12 cm high x 1 meter long, 1 piece
Power Source	24 VDC from Junction Box
Temperature range	-35c to 70c
Weight	14 kg (approx)
Environmental	Sealed unit to protect against heat, dust, water and vibration.
Humidity range	0 to 98% relative, non-condensing

Protection of scanner and light rails

As trains often drag chains and other items below the rail carriages a special cover is included to help protect the scanner and light rails. It is mounted in such a way to deflect any dragging object.





System Performance Properties

Max Vehicle Length	25 – 30 meters standard – longer vehicles can be scanned requires setup.	
Vehicle Width	2.75 meters standard – wider vehicles w/optional settings.	
Max Vehicle Speed	20 Km/hr	Sirie -
Networking	Two operational modes – stand alone or networked. Networking via CAT6 Ethernet local area network or wide area via Internet connection. Optional fiber optic cable connection for longer distance. Server(s) and additional data storage required for larger networked applications.	
Automatic Alerts	Visual alert on the operator terminal when system detects foreign object. Watch List can be created to automatically alert the operator when a vehicle of interest image is detected.	A THE
System Maintenance	The system is designed for fast, simple replacement of components and remote diagnostics via Internet connection to facilitate a low level of down time.	
System Manuals	The system comes complete with assembly/installation and operating manuals.	
Training Warranty	Full training is available to all staff operating the equipment at the quoted rates. 1 year warranty on all system electronics.	

Operating Environment

Environmental	Sealed unit to protect against heat/cold,	100
Temperature range	-35°C to 70°C	Million of the second
Humidity range	0 to 95% relative non-condensing	
runnarty runge	to to bo / relative, non condensing	1. 100 of 10 100 1
Viewing Angle	Patented 2 high resolution images at 60 degree angles for maximum visibility into hard to see areas of a vehicle undercarriage. One is looking forward and one looking backward producing a virtual 3D view of the undercarriage.	
Undercarriage illumination	6 x strips of High Performance programmable LEDs- lighting matched to scanner optimal light frequency. There are two shorter light rails on the external side of each track that can be adjusted to be angled up and toward the viewing angle of the scanner and then two longer light rails between the rails that can be adjusted to maximize illumination of the undercarriage.	
Scanning		
Camera		
Туре	Area Scan – high-resolution monochrome	
Frame Rate	150 - 200 FPS	
Connection	Gigabit	PERSONAL PROPERTY.
Filters	Band-pass	100000000000000000000000000000000000000
	10.00 ers Elet Oster Oster es	relation of the second
Screen Type	48.26 cm Flat, Color Screen	
Tomporaturo rango	1200 X 1024	1
Humidity range	0 to 90% relative non-condensing	
Rack mount	o to oo // relative, non-condensing.	A DESCRIPTION OF A DESC
server		
Processor	Intel Core Duo 2 0 GHz	
Memory	4.0 GB of SDRAM250	
Storage	500GB HD (larger HD Optional)	
Connections	2 Ethernet, 4 USB, DVI and printer ports.	
Rail Car Camera		
	IP camera – Color VGA - Optional 3 Megapixel	and the second sec
Туре	IP Camera	
Sensor	Sony CCD Image Sensor	
Lens	Auto Iris, 5/50mm lens	
Filter	IR Cut	
Video Compression		
Resolution	720 X 480 N I SC	
Protocol		
1 1010001	Optional environmental controls for temperature	
Enclosure	in extreme climates	
		A STATE AND
System Trigger	There are two system triggers required to control the GKH-TR11 – one when the train is first detected and then a second as the end of each carriage in the train is detected. These triggers are laser line of sight triggers.	