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Transportation Security Administration

Office of Security Technology

Airport Perimeter Security Projects for FY06

FINAL REPORT

Indianapolis International Airport (IND)

Mobile Tower Monitoring System

U.S. Department of Homeland Security
Transportation Security Administration
Office of Security Technology
Advanced Surveillance Program
701 South 12th Street
Arlington, VA 20598-6016

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OVERVIEW

INTRODUCTION

In fiscal year (FY) 2006, the Transportation Security Administration (TSA) announced opportunities for general perimeter security enhancement projects at airports with typical configurations and existing barriers, such as fencing and concrete barricades. The announcement requested information from airport authorities on existing airport perimeter security vulnerabilities and proposals to mitigate those vulnerabilities through the inventive use of available technologies at intended perimeter access points (such as vehicle gates), perimeter boundaries, and terminals.

In FY 2008, TSA reissued the Airport Perimeter Security (APS) announcement to all airports, along with a second announcement addressing small to medium-sized airports with few or no barriers around their perimeters. The second announcement was for the Virtual Perimeter Monitoring System (VPMS) project intended to test a more elaborate solution that would better fit a smaller airport. The VPMS solution was developed by the Navy.

TSA requested airports provide white papers explaining the security deficiencies to be addressed and proposals, including technologies to be deployed and full life-cycle project cost estimates. 65 airports responded to the FY 2006 request and 35 airports responded to the FY 2008 requests. The airports proposed projects of varying complexity, from installation of a single piece of equipment to sophisticated, integrated systems.

Six airports were selected in FY 2006 to participate in the APS projects. In FY 2008 and 2009, TSA selected six additional airports for participation in APS and three airports for VPMS projects.

The attached report covers the test results of only one of the 15 total test sites. TSA plans to release each report singularly as the test results are completed and made available.

IMPLEMENTATION

Indianapolis International Airport (IND) utilized APS project resources to purchase and implement five mobile, independently powered perimeter tower units designed to monitor airport areas lacking power and communication infrastructure.

National Safe Skies Alliance (Safe Skies) provided independent verification and validation (IV&V) services and operated along with airport authorities to verify that the mobile perimeter tower enhancements met the airport's security expectations. The IV&V was concluded February 27, 2009.

IND expected that the mobile tower monitoring systems would be rapidly deployable devices that would provide effective surveillance and automatic intruder detection capabilities at air

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operations areas that had limited or no communication and power resources. Additionally, the enhancement was expected to possess a manageable turnaround deployment time (15-20 minutes), record and replay video footage, provide target summary information on each alarm event, and operate for prolonged periods of time with minimal maintenance. Features that were covered under this IV&V included the system's rapid deployment capabilities, independent power generation system, video analytics/automated surveillance, graphical user interface, and any operational maintenance issues.

The Safe Skies Lead Test Engineer (LTE) generated a site survey document based on a preliminary survey of the locations prior to the deployment of the security technology improvements. The LTE developed operational testing procedures used as the basis for determining if the system met the security requirements of IND airport authorities. Representatives of TSA, Safe Skies, and IND convened to discuss and verify the system requirements prior to the implementation of evaluation procedures. The resulting operational data was analyzed by the Safe Skies statistical team and combined with the site survey information to generate the final report.

SUMMARY

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The IND staff has been trained in the operation of the system, but has not had a chance to fully practice using the system due to a delay in the integration into the airport operations command center. Additional training will be provided prior to final integration.

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DHS/TSA 2600.02.01.09-071	**Indianapolis International Airport Perimeter Security Pilot Program: Mobile Tower Monitoring System IV&V Report**

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	March 2009 Final Report

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This report was prepared by John Hunsucker of National Safe Skies Alliance

17. Abstract

This report illustrates features of the mobile tower monitoring system and the operational functionality of the enhancement as it is currently installed and operated at the IND perimeter. Data was collected by National Safe Skies Alliance through the implementation of test scenarios, which were performed July 8 – 10, 2008 and February 24 – 27, 2009. The break in operational testing was due to limitations associated with finalizing software and airport activities associated with moving to a new terminal.

Testing of this system was made possible through funding and resources allotted from the TSA Airport Perimeter Security program. The statements included in this document are in reference to the Critical Issues that were approved in the project's Final Test Plan (DHS/TSA—2600.02.01.08-009, April 2008).

18. Key Words

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EXECUTIVE SUMMARY

Indianapolis International Airport (IND) utilized Airport Perimeter Security (APS) program resources, provided by the Transportation Security Administration (TSA), to purchase and implement five mobile, independently powered perimeter tower units, designed to monitor airport regions lacking power and communication infrastructure. As required under the APS program, National Safe Skies Alliance (Safe Skies) provided independent verification and validation (IV&V) services and operated along with airport authorities to verify that the mobile perimeter tower enhancements met the airport's security expectations. The IV&V was conducted July 8 – 10, 2008 and February 24 – 27, 2009. The break in testing periods was due to issues related to fine tuning the software, and airport activities associated with moving to the new terminal.

IND expected that the mobile tower monitoring systems would be rapidly deployable devices that would provide effective surveillance and automatic intruder detection capabilities at AOA areas that have limited or no communication and power resources. Additionally, the enhancement was expected to possess a manageable *turnaround deployment*[1] time (15 – 20 min), record and replay video footage, provide target summary information on each alarm event, and operate for prolonged periods of time with minimal maintenance. Features that were covered under this IV&V were the system's rapid deployment capabilities, independent power generation system, video analytics/automated surveillance, graphic user interface, and any operational maintenance issues. To this end, Safe Skies performed observation tasks and operational testing scenarios to assess these features.

The system consists of the following components:

- Mobile Towers –*Elevated Security, Inc (now owned by Critical Power Solutions International) – Appendix A*
- Wireless Infrastructure – *Alvarion Systems – Appendix B*
- Video Analytics – Ilex Server – *Aralia Systems, Inc. Appendix C*
- Command and Control Systems – Ilex Server – *Aralia Systems, Inc. – Appendix C*
- Long Range Thermal Imagers - *FLIR – Appendix D*
- Tower Cameras – *Bosch, Inc. – Appendix E*

Each "Mojo" class tower structure is equipped with 28-foot telescoping aluminum tower frames, four 130W solar panels, a 500W wind generator, steel outriggers, an electronics compartment, a battery array, and a cable winch for mechanically lowering and raising the tower. Once in a collapsed state, the unit can be attached to a trailer hitch for transport to the next deployment site. The unit can be deployed to full operational status[2] within minutes of reaching the deployment

[1] Turnaround deployment refers to the process of bringing a tower unit to its collapsed transport state, and bringing it back to its full operational state. This does not include transit time to a new deployment site.
[2] Full operational status is the state of the tower when all components have been deployed, power is activated and the unit is communicating across the wireless network.

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site, at which time the unit begins to send streaming video across the wireless network to the front end system. The front end system, known as the Ilex system, is where the video analytics software is implemented and provides automated surveillance of the viewable areas around the tower units. When the video analytics software detects an intruder or violation of some kind, an alarm is generated and prompts long-range thermal imagers, mounted to the top of the FAA tower, to slew to the coordinates of the alarm instance. This enables the end user to view and resolve alarm instances quickly.

The tower units were evaluated under two methods of observation. The first method pertained to the verification of the mechanical features of the units with respect to the turnaround deployment. Each tower unit was brought to a collapsed state and then deployed to full operational state multiple times to determine if any associate physical restrictions or mechanical issues. During testing, all towers were collapsed, but only one of the five towers was actually relocated to a new deployment area. Figure 1 illustrates a full operational deployment of two IND tower units. Table 1 shows the turnaround deployment times that were collected.

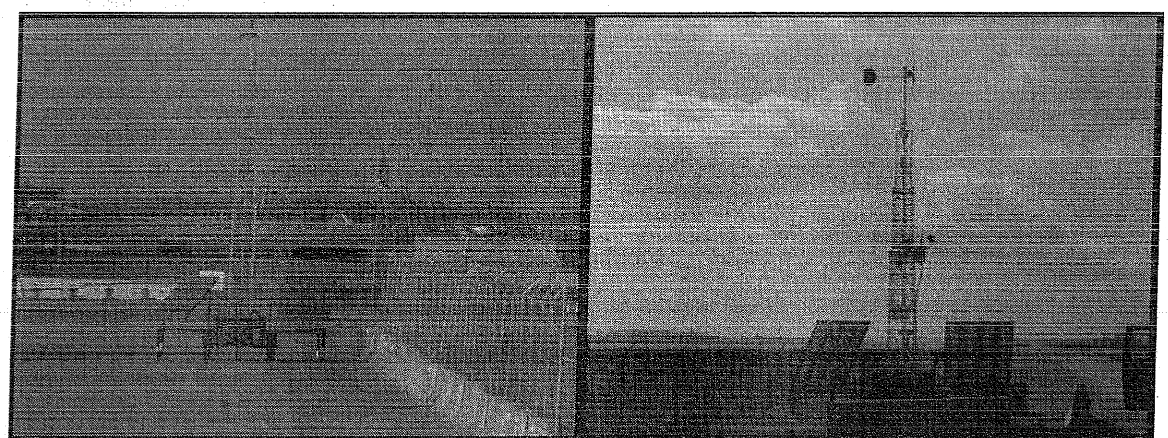

Figure 1. Fully Deployed Tower Units (L) FedEx Site (R) Mid-Field Service Road

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Table 1. Tower Deployment Time Summary

# Simulated Deployments	Time	Median Time (min:sec)	95% Confidence Interval on Median (min:sec)	Mean Time (min:sec)	95% Confidence Interval on Mean (min:sec)	Range (min:sec)
42	Collapse/Prep for Transport Time	4:00	[4:00, 4:00]	4:24	(3:58, 4:51)	[3:00, 8:00]
	Full Operational Deployment Time	6:00	[6:00, 7:00]	6:30	(5:59, 7:01)	[4:00, 14:00]
	Turnaround Deployment Time	10:00	[10:00, 11:00]	10:54	(10:05, 11:44)	[7:00, 22:00]

The median turnaround deployment time was 10 min, which does not include any transit time between locations.

Based on the observations and time data, the towers performed consistently well during stages of collapse/preparation for transport and full operational deployment. However, during the implementation of the turnaround scenarios, it was discovered that there were some mechanical issues with the towers' winch lifting mechanisms[3]. Over the course of several turnaround deployment scenarios, the cable inside the winch housing bunched up and kinked the cable in several places. This in turn created slack in the cable that, as it unwound, released and caused the tower to jerk when it was lowered. As a result, the cable on one of the towers eventually broke as it was being lowered. Neither the tower structure nor electronic equipment suffered any form of damage that would require repair or replacement. The tail of the wind generator was bent slightly and was replaced. Because this issue was present in several other tower units, testing was not performed on those towers to avoid harming personnel or equipment.

The second method of evaluation pertained to the response of the video analytics/automated surveillance system, Ilex, [redacted] Ten coverage areas, one per camera, were set up in the video analytics software by the integration team[5]. To verify detection capabilities of the Ilex, Safe Skies marked two zones—close and far—within each coverage area, to make a total of 20 zones [redacted]

[3] The tower winch lift was responsible for raising the tower from horizontal position to a vertical.

[redacted]

[5] The thresholds had been established and tested by Arinc prior to the arrival of Safe Skies

[redacted]

[redacted]

The wireless communication network proved consistently proficient to meet IND's functional needs. The video stream was clear and continuous at all times of testing. The only limitation observed was the configuration of the directional antennas. The antennas have signal power controls that regulate transmission power consumption. Proper alignment is vital during tower relocation, and could require additional installation time. Antenna alignment estimations were not included in the IV&V because alignment is strictly dependent on distance from a node antenna and terrain.

The front end system used by security personnel, the Ilex, features the Graphic User Interface (GUI), video analytics/automated surveillance software, and camera controls. Of the several display configurations Ilex can support, IND chose the GUI shown in Figure 2, below. The left screen shows a geospatial reference map of the airport, where tower locations and coverage areas

[redacted]

[redacted]

are superimposed on the map and labeled for easy viewing. Below the geospatial map is the alarm queue, which provides location information, tower unit ID, a description of the object that was detected, and a link to video log associated with the event. To the right of the geospatial map is an enlarged video window showing one of the camera views. The windows for the video, geospatial map, and alarm queue can be customized. The right screen is strictly limited to show the entire array of current camera views simultaneously. No other windows or screens can overlap these views.

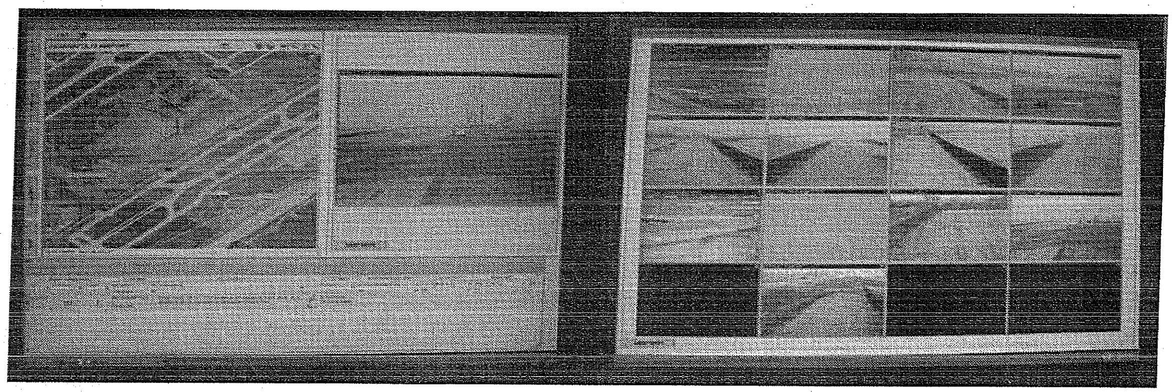

Figure 2. Front End Terminal (Ilex) GUI Geospatial Map, Enlarged Video Window (L), and Alarm Queue Array of all Camera Views (R)

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ACRONYMS

AOA	Air Operations Area
AOC	Air Operations Center
APS	Airport Perimeter Security Program
CI	Critical Issue
COTS	Commercial Off-the-Shelf
FAA	Federal Aviation Administration
FAR	False Alarm Rate
GUI	Graphic User Interface
IND	Indianapolis International Airport – FAA designation
IV&V	Independent Verification and Validation
MOE	Measure of Effectiveness
MOP	Measure of Performance
NAR	Nuisance Alarm Rate
PTZ	Pan/Tilt/Zoom
TSA	Transportation Security Administration

[redacted]

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1. INTRODUCTION

Indianapolis International Airport (IND) utilized Airport Perimeter Security (APS) program resources, provided by the Transportation Security Administration (TSA), to purchase and implement five mobile, independently powered perimeter tower units, designed to monitor Air Operations Areas (AOA) that lack power and communication infrastructure. As required under the APS program, National Safe Skies Alliance (Safe Skies) provided independent verification and validation (IV&V) services and operated along with airport authorities to verify that the mobile perimeter tower enhancements met the airport's security expectations.

1.1 Background

The TSA established the APS program to support the expansion and implementation of security technology at the perimeters of United States airports. Through this program, airports may purchase and integrate commercial off-the-shelf technologies to enhance their overall perimeter security infrastructure. IND participated in the program and developed a solution to enhance surveillance limitations in and around the AOA.

1.2 Purpose of Document

This IV&V Report illustrates the implementation and performance of the mobile tower monitoring system with respect to IND security expectations. The results reference Critical Issues (CI) that were approved in the project's Final Test Plan (DHS/TSA 2600.02.01.08-009, April 2008).

2. SCOPE

2.1 Objective

IND expected that the mobile tower monitoring systems would be rapidly deployable devices that would provide effective surveillance and automatic intruder detection capabilities at AOA that has limited or no communication and power resources. Additionally, the enhancement was expected to possess a manageable turnaround deployment[6] time of 15 – 20 minutes, record and replay video footage, provide target summary information on each alarm event, and operate for prolonged periods of time with minimal maintenance. To validate and verify the system met these expectations, Safe Skies collected data regarding:

- Mechanical constraints associated with turnaround
- Assessment of front-end (Ilex) system and video analytics

[6] Turnaround deployment refers to the process of bringing a tower unit to its collapsed transport state, and bringing it back to its full operational state. This does not include transit time to a new deployment site.

[redacted]

- Verification of long-range camera functionality and slew-to-queue operation
- Equipment maintenance
- Environmental impacts
- Power limitations and constraints
- Communications and video quality
- Feedback from security personnel and general observations

2.2 Limitations and Assumptions

The CIs were developed under the assumption that the mobile tower monitoring systems would be operational at all times of the evaluation. The combination of wind, solar, and battery power sources should have been sufficient to operate the towers during both day and night testing periods.[redacted]

IND's stated performance expectations were primarily qualitative and generally worded, which reflects in Safe Skies' analysis. Though quantitative analysis was performed to verify the turnaround deployment time, which the vendor specified, the remaining report information is a combination of qualitative and quantitative results that attempt to illustrate operational features of the system.

During the third and fourth quarter of 2008 and the first quarter of 2009, IND was transitioning operations to a new terminal facility. The Airport Operations Center (AOC) was relocated, and the incorporation of all the previous equipment remains in progress. Because of the relocation, the front end system has not been fully integrated into the AOC configuration. As a result, the system has not been used by the IND security personnel, and feedback from security personnel is not available.

3. SYSTEM INSTALLATION

3.1 System Description and Operation Overview

The mobile tower monitoring system is an independently powered perimeter monitoring tool that consists of the following components:

- Mobile Towers –*Elevated Security, Inc (now owned by Critical Power Solutions International). – Appendix A*
- Wireless Infrastructure – *Alvarion Systems – Appendix B*
- Video Analytics – Ilex Server – *Aralia Systems, Inc. -- Appendix C*
- Command and Control Systems – Ilex Server – *Aralia Systems, Inc. – Appendix C*
- Long-Range Thermal Imagers - *FLIR – Appendix D*
- Tower Cameras – *Bosch, Inc. – Appendix E*

[redacted]

The "Mojo" Class mobile tower, originally manufactured by Elevated Security, incorporates advancements in structural strength, power generation, and power electronics to provide a nearly self-sustaining unit requiring minimal maintenance for prolonged periods. When subject to sufficient environmental conditions, the systems solar and wind generation equipment can produce ample power to operate the video cameras, wireless transmission equipment, and supply power to recharge the array of lead acid batteries. The batteries supplement power during night conditions or when environmental conditions are poor for solar and wind generation, and are specified to operate for 100 hrs on a full charge.

Each tower is equipped with video and wireless transmission equipment. Two day/night Bosch DinionXF Monochrome Cameras were installed inside climate-controlled housing units at half the height of the tower (~15 ft). These cameras are fixed and can only be adjusted manually. Alvarion BreezeAccess VL broadband wireless antennas were installed on each tower to relay video and system information back to the front end terminal in the AOC. Specifications for the Bosch and Alvarion equipment can be found in Appendices E and B respectively.

The Ilex front end terminal was produced by Aralia, Inc. The Ilex system is a video analytics/automated surveillance and Graphic User Interface (GUI) that controls the automated video surveillance, analytics calibration, video logging, alarm target summary, and supports several display features for the end user.

Each camera view is fed to the Ilex server where the detection zones are drawn and calibrated in the software. Figure 3, below, illustrates how the system displays a detection zone within the view of the camera image. The sub-image on the left-hand side of the screen shows a human target and a light green box outlined along the grass area in front of the perimeter fence. The green box illustrates the detection zone for this particular camera. The enlarged video image on the right-hand side shows a bird's-eye view of the intruder from the long-range imagers mounted on the FAA tower.

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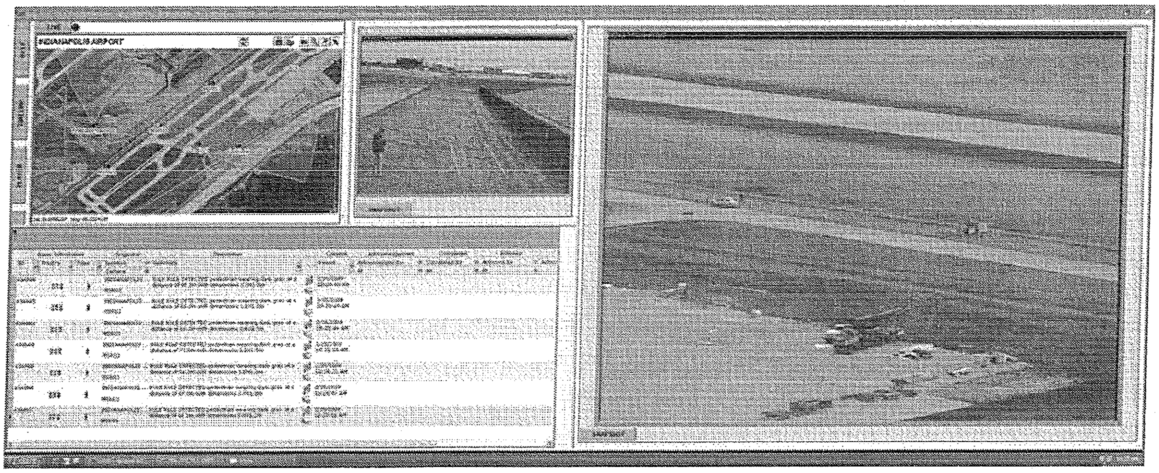

Figure 3. Ilex Screenshot with Outlined Detection Zone

Alarms that come into the system will always generate:

- A local video feed at the location of the event
- A history or target summary that describes the target in more detail
- A bird's-eye view from the long-range cameras on the FAA tower

Figure 4, below, illustrates the Ilex display screen, which has been tailored to meet IND requirements. Additional specifications can be found in Appendix C.

Figure 4. Front End Terminal (Ilex) Screens Geospatial Map, Enlarged Video Window (L), and Alarm Queue Array of All Camera Views (R)

Figure 5 shows the long-range imagers installed on the FAA tower: the FLIR Ranger® III (L) and the FLIR Sentinel® (R). Specifications can be found in Appendix D

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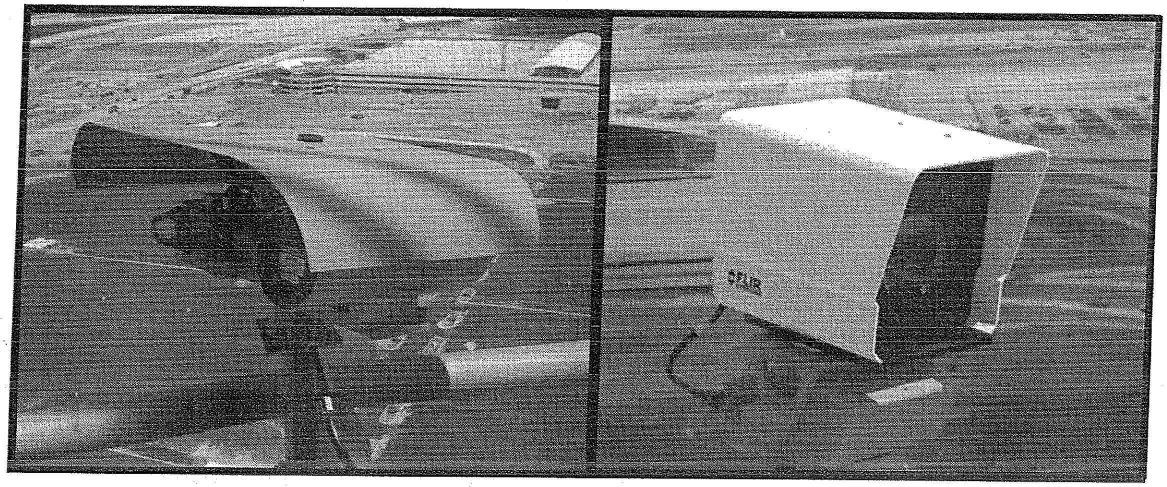

Figure 5. Long-Range Imagers on FAA Tower Ranger III (L) Sentinel (R)

3.2 Installation

The entire installation at IND consists of the following major components:

- 5 fully equipped[7] mobile tower units
- 2 Thermal Imagers: Sentinel and Ranger III
- Aralia – Ilex server and workstation
- Alvarion BreezeAccess Broadband wireless network
- 10 Bosch Day/Night Cameras

[redacted]

[7] *Fully equipped towers* include solar panels, wind generator, battery array, wireless communication equipment, and video cameras.

[redacted]

[redacted]

[redacted]

The Alvarion wireless network system utilizes directional antennas to communicate between the front end system and the towers. Each tower unit antenna is aligned to communicate with one of two node antennas mounted on the corner of the southernmost FedEx hangar or the FAA tower.

As of February 28, 2009, the front end workstation had not been fully integrated into the AOC. This is due to a vendor delay not associated with the program.

4. METHODOLOGY

4.1 Site and Schedule

The primary system components were installed in Summer 2008 [redacted] on top of the FAA tower, and in the prior AOC of IND. However, technical delays kept the system from being reliable and usable until August 2008. At that time, operational data was collected on the mechanical features of the system pertaining to turnaround deployment. In Fall and Winter 2008, IND transitioned to a new terminal, which delayed the remainder of the operational testing until the final week of February 2009. During that time, final documentation of the enhancement and the operational testing of the video analytics portion of the enhancement were conducted. The evaluation was conducted July 8 – 10, 2008 and February 24 – 27, 2009.

[redacted]

[redacted]

[redacted]

4.3 Critical Issues

Procedures and data collection processes are based on Measures of Effectiveness (MOE) and Measure of Performance (MOP) to generate qualitative and quantitative data that can be used to address the identified CIs. Missions and tasks are used to develop methods for collecting quantitative and/or qualitative information that does not lend itself to statistical analysis.

- **CI 1: Do the mobile tower system enhancements meet current perimeter security needs of IND?**
- **CI 2: Do the mobile tower system enhancements meet the specific operational/mechanical requirements?**

CI 1: Do the mobile tower system enhancements meet current perimeter security needs of IND?			
MOE		**MOP**	
1.1	Does the video analytics software provide effective automated alarm coverage?	[redacted]	
1.2	Does the video analytics software perform consistently throughout the testing period?	**1.2.1**	What Nuisance Alarm Rate (NAR[9]) does the MPSS exhibit?
		1.2.2	What False Alarm Rate (FAR[10]) does the MPSS exhibit?

[redacted]

[9] The *NAR* is the hourly rate at which environmental forces appeared to cause the perimeter intrusion detection device to alarm. Environmental effects include weather conditions such as high winds, heavy rain, hail; small objects such as debris (trash and leaves); small animals such as birds and rabbits; and excessive noise.

[10] The *FAR* is the rate of alarms for which there is no apparent cause for the alarm event. Investigation requires both video and current environmental data. After exhaustive review, the event may be classified as False.

[redacted]

CI 2: Do the mobile tower system enhancements meet the specific operational/mechanical requirements?			
MOE		**MOP**	
2.1	Does the enhancement integrate with the existing network and operations infrastructure?	2.1.1	Determine if there are operational issues relating to the deployment or maintenance of the enhancement?
2.2	Does the enhancement exhibit rapid deployment capabilities that are operationally feasible?	2.2.1	Determine the time required to bring a tower to full operational deployment?
		2.2.2	Determine the time required to bring a tower's electronics and communication equipment to full operability?
		2.2.3	Determine that the video analytics are operable after each deployment?
		2.2.4	Determine the time required to prepare the tower for redeployment or transportation state.
2.3	Does the enhancement possess the independent power generation and energy storage capacity dictated by the IND requirements?	2.3.1	Determine the approximate time the towers operate under a fully charged battery.
		2.3.2	Determine if the "Power Drop" warnings of the enhancement meet IND requirements.

5. RESULTS

5.1 CI 1

CI 1 addresses the issue of whether the mobile tower enhancement meets the current perimeter security needs of the facility. IND expected that the mobile tower enhancement would be rapidly deployable devices that could provide surveillance and automatic intruder detection at areas within the AOA where there is insufficient or no communication and power infrastructure. Additionally, the towers were expected to possess a short turnaround time of 15 – 20 min, long-range thermal imagers to slew to alarm events, record and replay video footage, provide target summary information on each alarm event, and operate for prolonged periods with minimal maintenance.

5.1.1 MOE 1.1

[redacted]

[redacted]

[redacted]

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[redacted]

[redacted]

[redacted]

[redacted]

5.2 CI 2

CI 2 addresses the overall performance of the mobile tower system and determines through observation and operational data collection whether the system meets IND facility and personnel requirements. Due to the limitations stated in Section 2.2, some aspects of the original test plan could not be implemented.

5.2.1 MOE 2.1

This measure was designed to illustrate how the system integrates with the existing network and operations infrastructure, and whether there are any mechanical or software issues with the system.

[redacted]

[redacted]

[redacted]

5.2.2 MOE 2.2

This measure deals with the portability component of the towers and whether the mobile tower system meets the immediate needs of IND security.

[redacted]

[redacted]

Table 4. Tower Deployment Time Summary

# Simulated Deployments	Time	Median Time (min:sec)	95% Confidence Interval on Median (min:sec)	Mean Time (min:sec)	95% Confidence Interval on Mean (min:sec)	Range (min:sec)
42	Collapse/Prep for Transport Time	4:00	[4:00, 4:00]	4:24	(3:58, 4:51)	[3:00, 8:00]
	Full Operational Deployment Time	6:00	[6:00, 7:00]	6:30	(5:59, 7:01)	[4:00, 14:00]
	Turnaround Deployment Time	10:00	[10:00, 11:00]	10:54	(10:05, 11:44)	[7:00, 22:00]

Confidence intervals for the mean processing times above were calculated using the normal distribution methodology (NIST, 2006, 7.1.4). Confidence intervals for the median processing times above were calculated using distribution-free methods (SAS). The interpretation remains the same as with other confidence intervals. For example, if the true median total time for turnaround deployment was, in fact, 10 min, we would

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expect 95% of all confidence intervals for samples of data taken under similar conditions to contain the true median value of 10 min. In the case of the median total deployment time, for example, the confidence interval bounds indicate that with 95% confidence we can narrow our estimate's confidence interval to a range of [10:00, 11:00], a width of 1 min.

The only feature that was not evaluated was the approximate time associated with verifying that the video analytics were operable. Upon redeployment, the video analytics are custom drawn to cover a new area; the time required to implement a new detection zone depends greatly on the area being covered and the experience of the end user in establishing new zones.

5.2.3 MOE 2.3

This measure deals with the power generation and energy storage capacity requirements that IND needed for the system to be success.

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6. SUMMARY

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The IND staff has been trained in the operation of the system, but has not had a chance to fully practice using the system due to a delay in the integration into the AOC command center. Additional training will be provided prior to final integration. Installation into the AOC control room is planned, and the images below show where the screen will be located with respect to the controllers. Two of the monitors included in the array of observation monitors shown in Figure 9, below, will be dedicated to the new system. One of the controllers will manage those alarms and cameras.

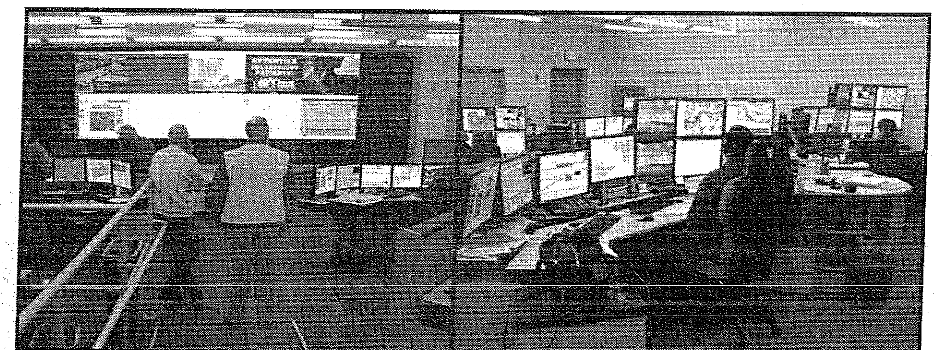

Figure 9. AOC Command Center (L) Main View Screen (R) Operations Workstation

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7. REFERENCES

Fleiss, J.L. (2003). Statistical *Methods for Rates and Proportions* (3rd ed.). Hoboken, New Jersey: John Wiley & Sons, Inc.

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APPENDIX A – ELEVATED SECURITY MOBILE TOWERS TECHNICAL SPECIFICATIONS

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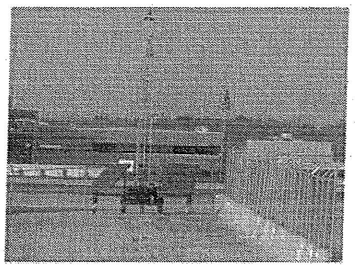
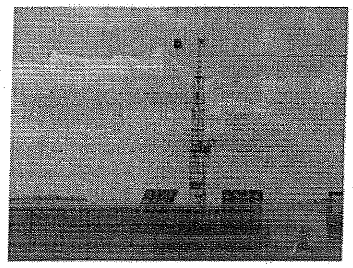
Critical Power Solutions International

Product User Guide – Indy MoJo Platform





About This Guide

This user guide is designed to provide a reference for installation, maintenance and safety issues regarding one of CPSI's rapidly deployable renewable energy products. The "Quick Install" section may be referred to for experienced users, however, all first time users MUST read the "Safety" section first to familiarize themselves with potential dangers that could be encountered during setting up and short term usage. The power being generated by renewable energy can at times be significant and can be dangerous if proper safety precautions are not followed. Trailer and tower systems must be deployed properly. Hazardous situations could be created during any step of the deployment process if one is not familiar with the proper method of deployment. You will find these CPSI products to be very useful, extremely reliable, and safe if used and maintained in the proper manner. This guide will help the users understand what is required to keep these systems working effectively for years to come.

About Renewable Energy

Definition: *Renewable Energy* is a natural power source, i.e. wind and sun, that can be replenished naturally with the passage of time.

In the security and communications world, rarely is there enough "time" to wait for power to be replenished. To build systems using renewable power sources that are effective in mission critical applications, we must add power storage (batteries) to store the power in order to extend the runtime of the required devices. We also must control the power consumption. With the proper mix of power generation, power storage and power consumption, applications that are critical in nature may be accomplished. The CPSI goal with all renewable energy based power systems is to effectively build a "predictable" power generation systems that will work for years to come.

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Batteries don't just "die" like generators and our grid based power systems do. They can be monitored so that when they get to a point where they may drop the power to the devices, they can easily be recharged. Having an effective management plan to handle these systems during times when the sun is gone for extended periods of time is very important. Batteries are also affected by the temperature. During the extreme cold months, it may be necessary to rotate systems in for a full charge of the batteries. Battery life will be extended and the effectiveness of the mission will be maintained.

There is a certain degree of common sense that must be employed with renewable energy. Solar panels must be able to "see" the sun. Wind generators must be exposed to the wind. Please take care while deploying these systems to orient the solar arms where the panels will take full advantage of the greatest amount of sun. As the power system inside the unit has been maximized for peak efficiency, so must the orientation of the platform.

Indy MoJo Product Specifications

Physical Dimensions

In transport mode	Length	16'
	Width	6'
	Height	7'7'
	Weight	2750 lbs
	Tongue weight	220 lbs
Deployed w/outriggers extended		13' x 13' square

Indy MoJo Product Power Sheet

Input power	Solar	500 watts	Wind	600 watts
Power Storage		330 Amp hours (24voltsDC)		
Power Consumption		2.5 amps (65 watts)		

75% available amp hours = 250 amp hours
250 amp hours / 2.5 amp = 100 hours of run time without wind and sun

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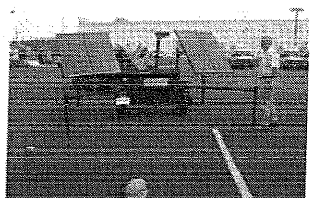
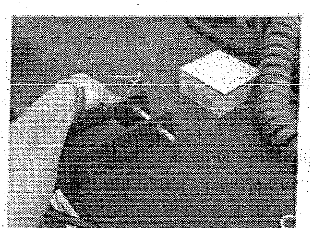
Safety Issues

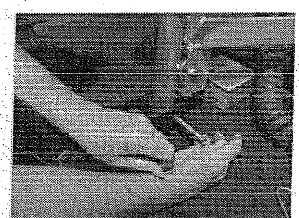
The MoJo platforms are designed for rapid deployment, easy set up and simple operation. They are designed for single operator deployments, but it is recommended to always have at least two people present when setting up or taking down these trailer and tower based systems.

All MoJo platforms are designed for military/helicopter deployments. The center point of weight distribution is directly over the axle. ***This makes it absolutely imperative that all the outriggers be deployed prior to raising or elevating the tower.*** A tower that is elevated to a vertical position without the outriggers being deployed could create a dangerous situation if caught by a heavy gust of wind or the inappropriate act of a careless operator. There is no rear stability without the outriggers deployed.



Care must be taken while the tower is being elevated from the horizontal transport state to the vertical position. The "un-pinned" leg of the tower that gets pinned to the base when in it's vertical position can pinch cables, fingers, hands, etc. if in the path of the tower leg as it approaches the base. Make sure there is nothing in the way of the tower as it is being elevated. In the event that something is in the direct path, the controlling winch can be stopped or reversed immediately to remove the obstruction.





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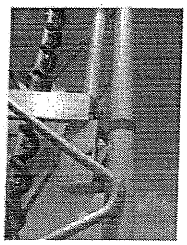
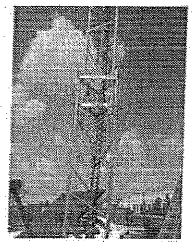
When raising the tower from it's nested vertical position the tower must not be overextended. The cable may slip off the pulley if the tower is raised passed its intended stop point. There must be at least 16-18" overlap on the two towers to make sure the cable operates properly. The stop point is marked by a red ring around the tower. Do not let the rollers of the inside tower pass the red.





Quick Set-up Guide

1) Find the most level spot within the area of deployment. Determine the sun exposure and the most effective direction for the mission apparatus.
2) Drop the front jack on the tongue of the MoJo next to the hitch of the tow vehicle and remove the hitch from the vehicle.
3) Remove the rear outriggers from the top of the MoJo base and deploy them in the receiver tubes located at the rear of the base.
4) Deploy the front outriggers and level the platform with the level located in the middle of the top of the MoJo base.
5) Deploy the solar panels and tighten the T bolts.
6) Install mission apparatus on the tower system.
7) Turn on the main power breaker in the winch saddle box, the main power switch in the electronics box, and the breakers for the load control
8) Test the mission apparatus for power – then turn the load breaker back off and the main power switch.

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9) Turn on the main power breaker and the breakers for the winches.
10) Remove the winch remote control from the electronics box and connect it to the "raise tower" connector.
11) Raise the tower and pin the third leg of the tower to the base. The winch line should be pulled firm to provide tower support
12) Move the remote control to the "elevate tower" connector and elevate the tower.
13) When the tower is at the required height, disconnect the remote control and return it to the electronics box.
14) Turn on the main power switch breakers for the mission
15) The system is deployed

General Maintenance

Solar Panels

It is estimated that dust collecting on the surface of the panels can reduce the system's performance by as much as 7% annually. While rain can provide some amount of cleaning, it is recommended that the panels are rinsed at least four times a year, more in the high-producing summer months. More cleaning may be required depending on the location. Areas with a large amount of construction development and/or agriculture might require a more consistent cleaning.

Manufacturers recommend washing the solar panels with warm water and a rag, soap may be added if panels are uncharacteristically dirty. The panels should be rinsed in the cool or the morning to avoid drastic temperature changes that could result in damaging the delicate cells.

In times of inclement weather such as snow, sleet, and other forms of solid precipitation, panels may need to be cleaned accordingly.

Batteries

Your system is designed to keep the batteries in a charged condition, without extreme deep cycle discharges while operating in normal operating conditions. However, extended use of the lights or extended periods of no sun will result in a deeper discharge of the batteries. The monitoring system will allow you to check the batteries regularly

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and take action if the batteries are in a very low state-of-charge. The systems are designed to be recharged in the field, or they may be rotated into a storage area and charged for an extended period. Never store batteries in an "un-charged" state. Before parking these trailer systems in an area where they will not be exposed to the sun, charge the batteries fully. We recommend any extended storage to be done outside with the solar panels extended, the load off, and the units fully exposed to the sun.

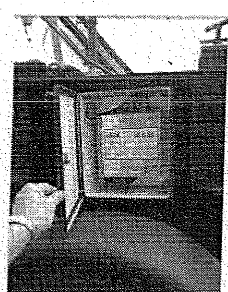
Recharge Instructions

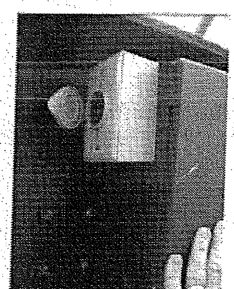
If the weather is not supplying sufficient energy to recharge the platform, or when the system has been stored/unused for more than thirty days, the platform may require a recharge. It is also recommended that a top-off charge be applied every three months to maintain battery integrity.

Equipment Needed:
- Generator
- Extension Cord

Directions:
1) plug the "female" end of the extension cord into the power socket located on the side of the saddle box mounted on the door of the battery box
2) Plug the "male" end of the extension cord into the generator
3) Turn the generator on
4) Let charge for at least 4 hours – longer if necessary
5) Turn the generator off and remove the extension cord.

The MoJo systems may also be plugged into 110v AC power outlet using an extension cord just as with the generator. The solar panel power input breakers should be turned off when charging directly from the grid. The mission apparatus may remain on if necessary, during the charging cycle.





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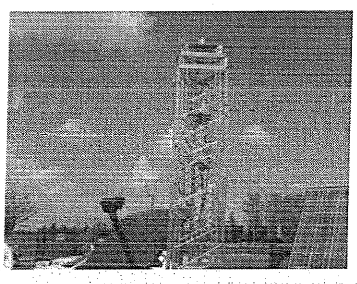
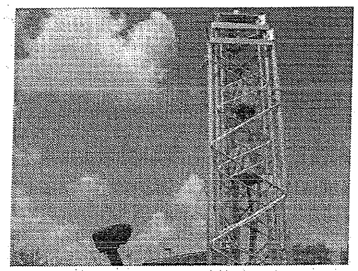
Monthly Maintenance Check

1) Walk around the system and visually check for any evident damage
2) Check to see that the T-bolts are tight (Solar panels, Jacks, etc.)
3) Check to see that there is no corrosion on or near the battery terminals
4) Clean surface of solar panels with warm water if necessary
5) Make sure no slack exists between the winch arm and the tower





Initial System Check

MoJo VIN ____________________ Physical Location (current) ______________

The purpose of this test is to confirm the power generation, the power storage, the monitoring capability and the overall functionality of the tower systems installed at the international airport in Indianapolis, Indiana.

Power Generation -capabilities
Solar Panels __________ watts each __________ watts total
Wind Generator __________ watts rated
Monitor operational solar ______ wind ______
Comments:

Power Storage – by design
Batteries __________ amp hours per battery _________ total amp hours
Batteries wired _________ volts DC Available amp hours __________

Power Consumption
Power Consumption ___________

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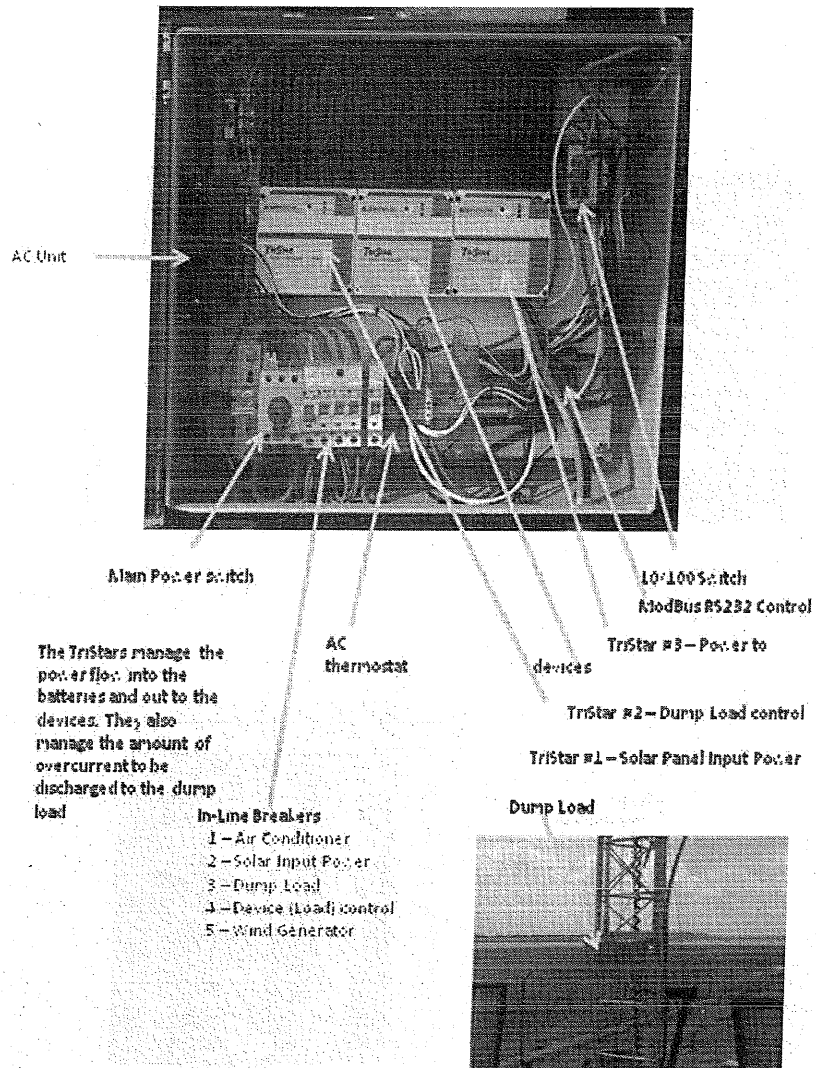

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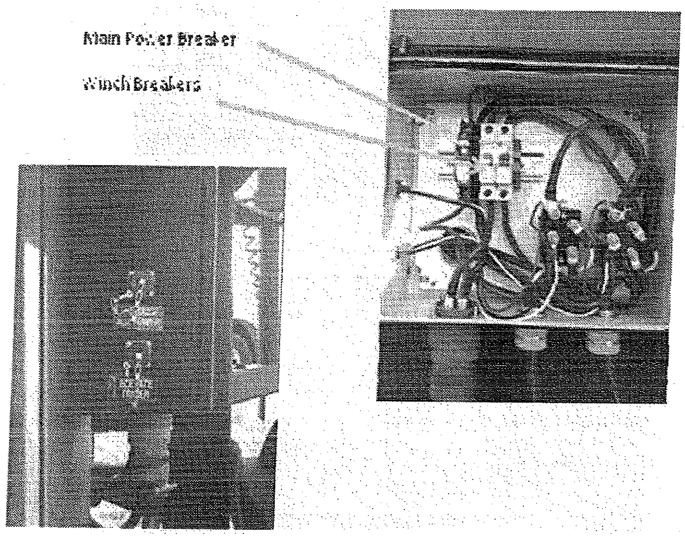

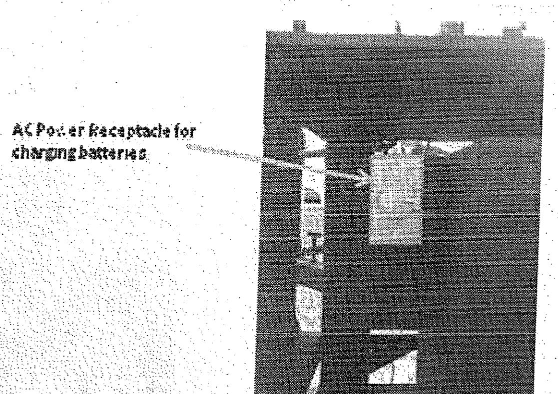

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System Monitoring

CPSI remote platform monitoring application was developed to give an overall status of each platform deployed into one convenient interface.

Minimum system requirements:
Windows Vista® Home Basic/ Home Premium/Business/Ultimate**
Windows® XP with Service Pack 2 Home/XP Pro/XP Media Center Edition

- 1.2GHz or higher processor
- 1Gig of RAM
- 300MB of available hard disk space

** Must meet minimum Windows Vista operating system requirements.

Installation:

1. Do one of the following:

- If you purchased a CD, insert the CD into the CD-ROM drive, and then click **Setup**.
- If you downloaded your copy of Monitor Application, double-click the file that you downloaded. Unless you saved it elsewhere, the installation file is on the Windows desktop.

2. Read the License Agreement(s), and then click **I Agree.**

If you do not click I Agree, you cannot continue the installation.

3. Follow the on-screen instructions.

<u>Launch the Monitor Application:</u>

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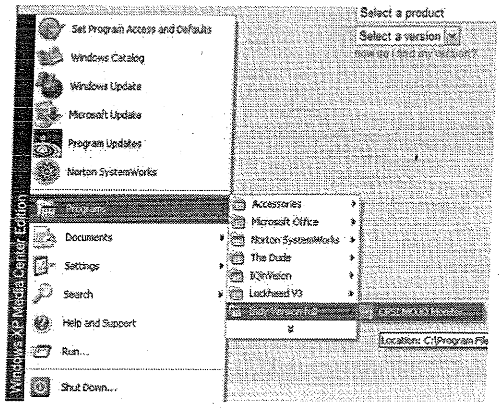
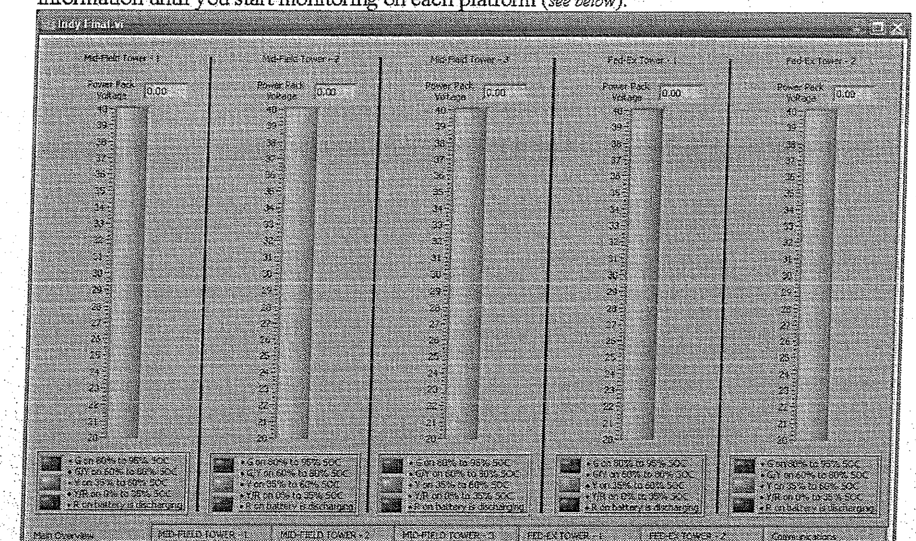


Main Screen:
The main screen (below) will show an overall status of each platform power pack voltage, when the program first launches it will be in a stand by state and not display any information until you start monitoring on each platform (*see below*).



Platform Screen(s):
By clicking on the bottom tabs you will be able to see a more detailed overview of each individual platform.

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Displayed:

Battery Voltage – displays current power pack voltage.
Time to Charge – displays time to bring the power pack back to 90% SOC; current input and output are accounted.
Battery Capacity – displays total amp-hours available in power pack; current input and output are accounted.
Solar Voltage – displays current voltage of solar panels.
Solar Current – displays current amps input from solar panels.
Load Voltage – displays client side voltage.
Load Current – displays client side current draw on the system.

Starting – Stopping monitoring:

The "green" toggle button in the upper left corner will Start or Stop monitoring of that platform "default is off"; you have to click on the toggle button for each platform to start monitoring.

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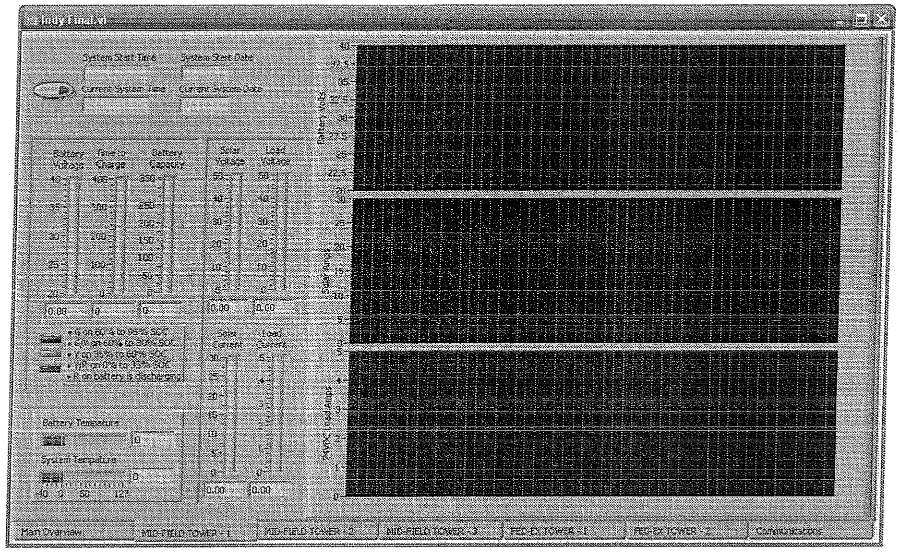

<u>Viewing monitor application on remote PC:</u>

While you can run this application on two different computers, it is not recommended. In order to view the application remotely (more than one viewer), a simple web browser is used.

By default the setup is:

http port = 8081

url = http://"computer ipaddress":8081/indana.html

For custom configuration(s) or help with accessing the web portion of this application please call CPSI-INC support at (1) 571.223.0038 x204

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APPENDIX B – ALVARION WIRELESS NETWORK TECHNICAL SPECIFICATIONS

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alvarion®
We're on your wavelength.

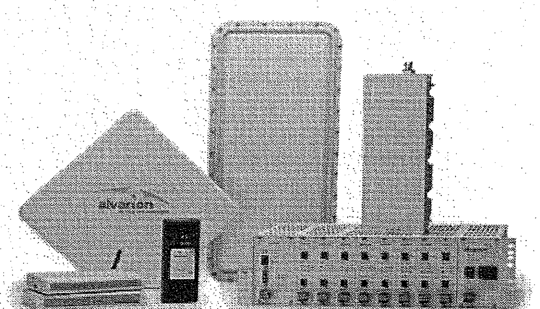
BreezeACCESS® VL

Broadband Wireless Access with Toll Quality Voice

BreezeACCESS VL, Alvarion's broadband wireless platform in the 5 GHz frequency, is part of the BreezeACCESS product family, the world's most deployed wireless broadband platform. Superior features such as non-line-of-sight (NLOS), extended reach, high capacity in all packet sizes, encryption, and end-to-end QoS for time critical applications are key to its success in deployments worldwide.

Increase revenue from offering toll quality voice over IP (VoIP) and other triple play services through the use of quality of service algorithms (QoS), multimedia application prioritization (MAP) for wireless link prioritization, and unprecedented high capacity in all packet sizes. BreezeACCESS VL supports hundreds of simultaneous calls per sector.

With BreezeACCESS VL, operators offer a wide variety of services and applications, including VoIP, wireless leased line, hotspot feeding, gaming services, secure VPNs, video surveillance and wireless xDSL in urban and rural environments, and all at reduced capital and operating costs than wired alternatives.



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Specifications

Radio

Frequency	4.900 - 5.100 GHz, 5.15 - 5.35 GHz, 5.47 - 5.725 GHz, 5.725 - 5.850 GHz
Radio access method	Time Division Duplex (TDD)
Channel	10 MHz, 20 MHz
Central frequency resolution	5 MHz, 10 MHz
Max output power (at antenna port)	AU: -10 dBm to 21 dBm, 1 dB steps SU: -10 dBm to 21 dBm, automatically adjusted by ATPC Actual max power may be limited for compliance with local regulation
Sensitivity, typical (dBm at antenna port)	see table below
Modulation scheme (Adaptive)	OFDM: BPSK, QPSK, QAM 16, QAM 64
Antenna port (AU-RE)	N-Type 50 ohm
Subscriber integrated antenna	21 dBi (19 dBi in 4.9-5.1 GHz band), 10.5° H/V, Integrated flat panel
AU antennas	60°: 16 dBi, Sector 60° horizontal, 10° vertical 90°: 16 dBi, Sector 90° horizontal, 6° vertical 120°: 15 dBi, Sector 120° horizontal, 6° vertical , 360°: 8 dBi, Sector 360° horizontal, 9° vertical (AU-SA only)

Sensitivity, typical (dBm at antenna port):

Modulation	1	2	3	4	5	6	7	8
Level* (20 MHz)	-89	-88	-86	-84	-81	-77	-73	-71
Level* (10 MHz)	-92	-91	-89	-87	-84	-80	-76	-74

* Modulation Level combines modulation scheme and coding gain.

Data Communication

VLAN support	Based on IEEE 802.1q , QinQ 802.3ad
Layer-2 traffic prioritization	Based on IEEE 802.1p
Layer-3 traffic prioritization	IP ToS according to RFC791 and DSCP according to RFC2474
Layer-4 traffic prioritization	UDP/TCP port range
Security	WEP 128-bit authentication, AES 128, WEP 128, and certified FIPS-197 mode built in encryption

Configuration and Management

Local & remote management	SNMP based NMS and windows based configuration utility, Telnet
Remote management access	From wired LAN, wireless link
Management access protection	Multilevel password Configuration of remote direction (from Ethernet only, wireless only or both sides) Configuration of IP addresses of authorized stations
Software upgrade	Via TFTP and FTP
Configuration up/download	Via TFTP and FTP
SNMP agents	SNMP v1 client, MIB II, Bridge MIB, Private BreezeACCESS VL MIB

Physical and Electrical

Type		Connectors	Electrical
SU-NI, AU-NI	Ethernet	10/100BaseT RJ-45, 2 embedded LEDs	Power consumption 25W
	Radio	10/100BaseT Ethernet RJ-45	AC input: 100-240VAC, 50/60Hz
	AC IN	3-pin AC power plug	
SU-RA, AU-RE	Indoor	10/100Base RJ-45 with waterproof sealing assembly	54 VDC from indoor to outdoor
AU-BS	Ethernet	10/100BaseT RJ-45, 2 embedded LEDs	Power consumption 30W (module plus outdoor unit) AC input 100-240VAC, 50/60Hz 3.3VDC, 54V from power supply in backplane
	Radio	10/100BaseT Ethernet RJ-45	
BS-PS AC (AC power supply)	AC-IN	3-pin power plug	Power consumption: 240W, full chassis (1 PS, 6 AU) AC input: 85-265VAC, 47-65Hz DC output: 54V, 3.3V
BS-PS-DC (DC power supply)	-48 VDC	3-pin DC D-Type 3 power pin plug Amphenol	Power consumption: 240W, full chassis (1 PS, 6 AU) DC input: -48 VDC nominal (-34 to -72), 10 A max. DC output: 54V, 3.3V

Standards Compliance

Type	Standard	
EMC	FCC Part 15 class B, CE ETSI EN 301 489-1/4	
Safety	UL 60950-1, EN 60950-1	
Environmental	Operation	ETS 300 019 part 2-3 class 3.2E for indoor units ETS 300 019 part 2-4 class 4.1E for outdoor units
	Storage	ETS 300 019-2-1 class 1.2E
	Transportation	ETS 300 019-2-2 class 2.3
Lightning protection	EN 61000-4-5, class 3 (2kV)	
Radio	FCC part 15	EN 301 753 EN 301 021 EN 301 893 (V 1.3.1)

Note: Not all options are available in all regions and some features require software licensing key. Please contact your local representative for further information

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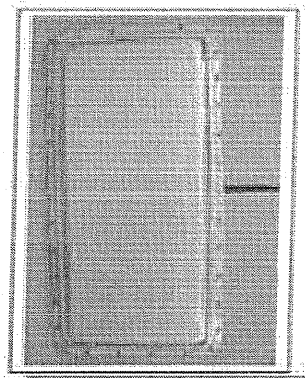

Sector Antenna

AU-5G-SECT-17V-90

P/N 858170

Technical Specifications

Specifications	
Purpose	For use only with BreezeACCESS VL AU-BS or AU Stand Alone Units
Frequency Range	5.15 – 5.8750 GHz
VSWR	1.7:1 (max)
Gain	17 dBi (typ)
Power	6 Watts
H-Plane Beamwidth	90°
E-Plane Beamwidth	7°
Input Impedance	50 ohms
Cross Polarization, min.	20 dB
F/B Ratio, min.	30 dB
Polarization	Vertical
Lightning protection	DC grounded
Termination	N-type female connector. Includes 3 ft (1 m) Jumper cable.
Mechanical & Environmental	
Dimensions	21 x 10 x 0.5 in / 530 x 260 x 11 mm
Radome	Plastic
Base Plate	Aluminum with chemical conversion coating
Temperature Range	-55° to +71°
Ice Loading	1 in / 25 mm
Wind Speed Survival	136 MPH / 220 KPH
Wind Load : Front Thrust Side Thrust	110 lb / 50 kg 3.7 lb / 1.7 kg
Weight	5.5 lb / 2.5 kg
Mounting Bracket	For 2 3/4" – 3.5" Pole Mount, ±10° Tilt

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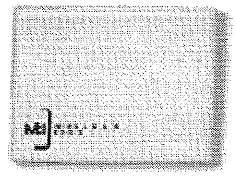
Wireless Edge Ltd

MT-486001

5.15-5.975 GHz 28dBi Subscriber Antenna



Specifications

MTI PART NUMBER		MT – 486001		
ELECTRICAL				
FREQUENCY RANGE		5.15-5.875 GHz		
GAIN		28 dBi (min)		
VSWR		1.7 : 1 (max)		
3 dB BEAMWIDTH		4.5° (typ)		
POLARIZATION		Linear (Vertical or Horizontal)		
SIDELOBES LEVEL		ETSI EN 302 085 V1.1.2, (2001-02) TS1-TS5		
CROSS POLARIZATION		ETSI EN 302 085 V1.1.2, (2001-02) TS1-TS5		
F/B RATIO		-40dB (max)		
INPUT IMPEDANCE		50 (ohm)		
INPUT POWER		6W (max)		
LIGHTNING PROTECTION		DC Grounded		
MECHANICAL				
DIMENSIONS (LxWxD)		600x600X50mm (max)		
WEIGHT		5 Kg (max)		
CONNECTOR		N-Type Female		
RADOME		Plastic		
BASE PLATE		Aluminum with chemical conversion coating		
OUTLINE DRAWING		See page 2		
MOUNTING KIT		MT-120019		
ENVIRONMENTAL				
TEST	STANDARD	DURATION	TEMPERTURE	NOTES
LOW TEMPERATURE	IEC 68-2-1	72 h	-45°C	-
HIGH TEMPERATURE	IEC 68-2-2	72 h	+70°C	-
TEMP. CYCLING	IEC 68-2-14	1 h	-45°C +70°C	3 Cycles
VIBRATION	IEC 60721-3-4	30 min/axis	-	Random4M3
SHOCK MECHANICAL	IEC 60721-3-4	-	-	4M3
HUMIDITY	ETSI EN300-2-4 T4.1E	144 h	-	95%
WATER TIGHTNESS	IEC 529	-	-	IP67
SOLAR RADIATION	ASTM G53	1000 h	-	-
FLAMMABILITY	UL 94	-	-	Class HB
SALT SPRAY	IEC 68-2-11 Ka	500 h	-	-
ICE AND SNOW	-	-	-	25mm Radial
WIND SPEED	SURVIVAL	-	-	220 Km/h
	OPERATION	-	-	160 Km/h

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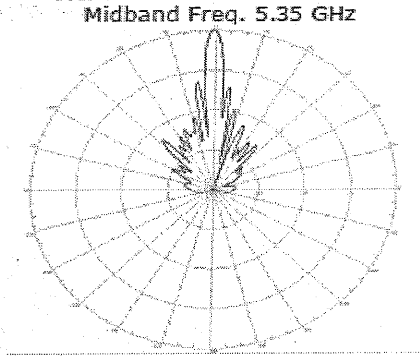
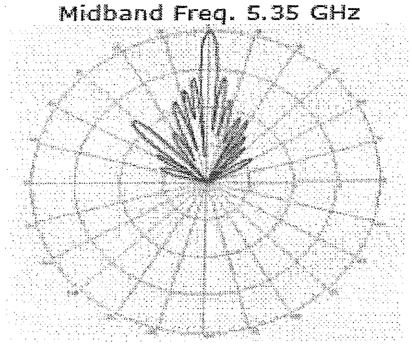
MT-486001

5.15-5.975 GHz 28dBi Subscriber Antenna

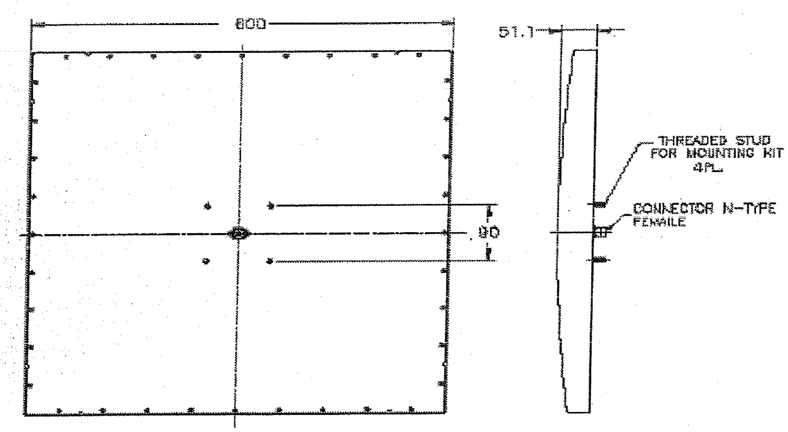
Azimuth Radiation Pattern
Midband Freq. 5.35 GHz



Elevation Radiation Pattern
Midband Freq. 5.35 GHz



Dimensions [mm]



Existing Antenna Versions

MT-486001	With N - Type Female connector & DC grounding

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APPENDIX C – ARALIA ILEX VIDEO ANALYTICS AND COMMAND & CONTROL TECHNICAL SPECIFICATIONS

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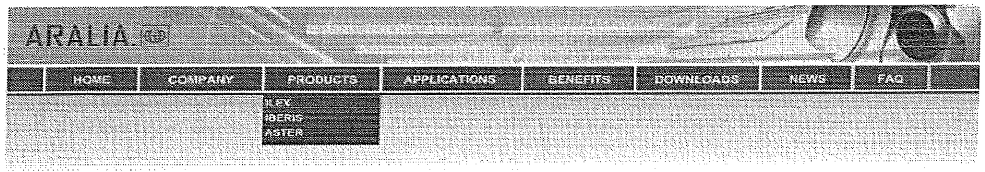


SCENE CONTENT ANALYSIS

VIDEO SEARCH ENGINE

Easy integration of any third party software: facial, biometric software, or tracking devices

ILEX - ADVANCED VIDEO SURVEILLANCE

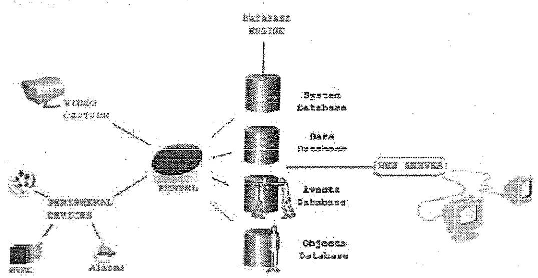
ilex is an advanced, intelligent and scalable video surveillance system that can integrate with existing CCTV infrastructures, as well as the latest digital systems. ilex records into a distributed relational database incorporating real time cataloging within video picture, automatic reporting of alarms and rapid SQL-based querying of the entire stored video data.

Key features:

- Recording into a distributed relational database at evidential quality
- Automatic real-time cataloging of picture content
- Automatic reporting of alarms
- Automatic video data reduction using 'intelligent' data thinning
- Rapid SQL-based querying of the entire stored video data
- Object analysis on PTZ cameras
- Allows for multiple compression technologies

DATABASES

Pioneered by Aralia to store all configuration and video data enables querying and data processing capabilities of a large scale SQL database. The relational database is divided into Video, Evidential, and Object databases.



SYSTEMS DATABASE	VIDEO DATABASE	OBJECTS DATABASE	EVIDENTIAL DATABASE
Holds complete video surveillance system Deployed fully or partially across network Redundancy provided by other additional systems database Changes in state create alarms	Variable compression Uses JPEG2000 Standard IT hardware	Automatically catalogs the content Compressed into relational databases Alarms on complex image content Automated target tracking Rapid search through the SQL engines	Store events observed within the video database This data cannot be recycled Data retained with a full audit trail

SCENE CONTENT ANALYSIS Top

As content is captured the data is automatically analyzed.

- Standard objects: Person, Group, Car, Truck, Train
- Additional object: Left luggage, Police vehicles, Person bleeding, Loitering, Crowding, License Plate Recognition
- Additional objects can be assigned a set of properties
- Feasible to develop customized algorithms for specific scenarios

VIDEO SEARCH ENGINE Top

All the data recorded in the relational databases can searched through the Video Search Engine.

- Uses standard IT servers
- Controlled and monitored through Internet Explorer
- Server contains the hardware capture, compression and processing required to support a number of analog video or digital camera inputs
- Server stores compressed video data, in the form of NAS, or part of SAN
- Uses a high performance, lightweight, distributed SQL relational database
- Easy integration of any third party software: facial, biometric software, or tracking devices

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APPENDIX D – FLIR THERMOVISION SENTINEL AND RANGER III TECHNICAL SPECIFICATIONS

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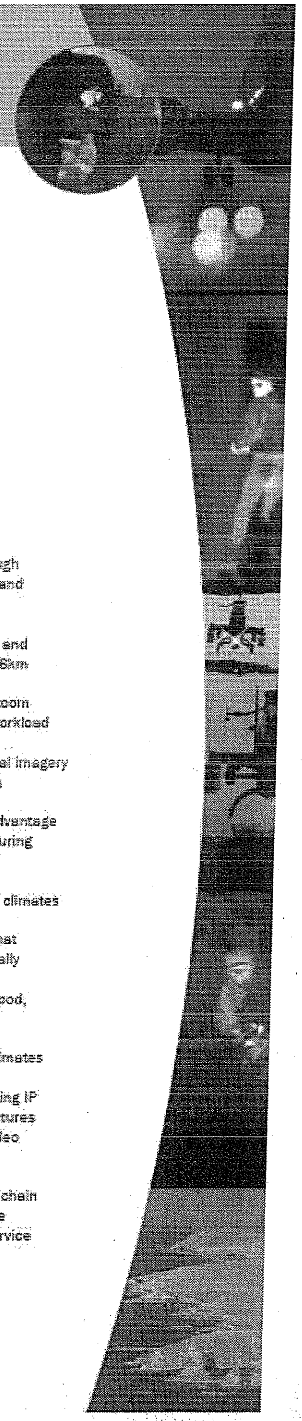
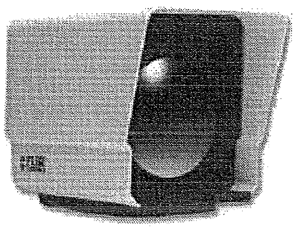
ThermoVision™ Sentinel™

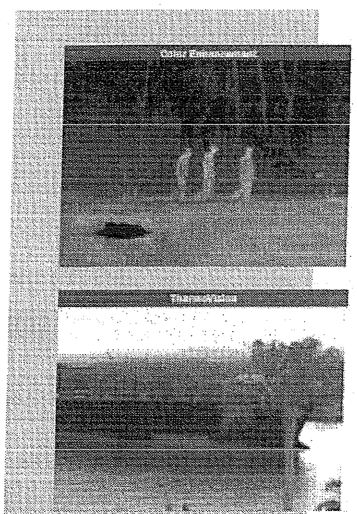
Medium to Long Range Multi-Sensor System





APPLICATIONS

- Force Protection
- Perimeter Security
- Border Security
- Coastal Surveillance



Crisp thermal imagery, regardless of scene dynamics

Features	Benefits
High-sensitivity, long wave thermal imaging sensor	Detect targets at range through total darkness, smoke, dust and most obscurants
Powerful 5/20 degree dual field of view optics	Get fast situation awareness and detect man-size targets at 2.6km
Auto Focus	Get sharp imagery between zoom settings: reduces operator workload
Digital Detail Enhancement	Automatically get crisp thermal imagery regardless of scene dynamics
Powerful daylight/lowlight TV	Provides additional tactical advantage and long range observation during daylight operation
Rugged, sealed enclosure	Insures performance in harsh climates
Built-in test (BIT)	Intelligent self test confirms that the system is operating optimally
Easy integration	Can be quickly fielded on a tripod, or onto existing pan/tilt heads
Built-in defrost	Keeps the lens clear in cold climates
Optional Nexus server	Provides connectivity to emerging IP standards and system architectures with full remote control and video over internet
It's all FLIR inside	FLIR controls the entire supply chain for the critical technology inside ThermoVision, ensuring fast service and long term support

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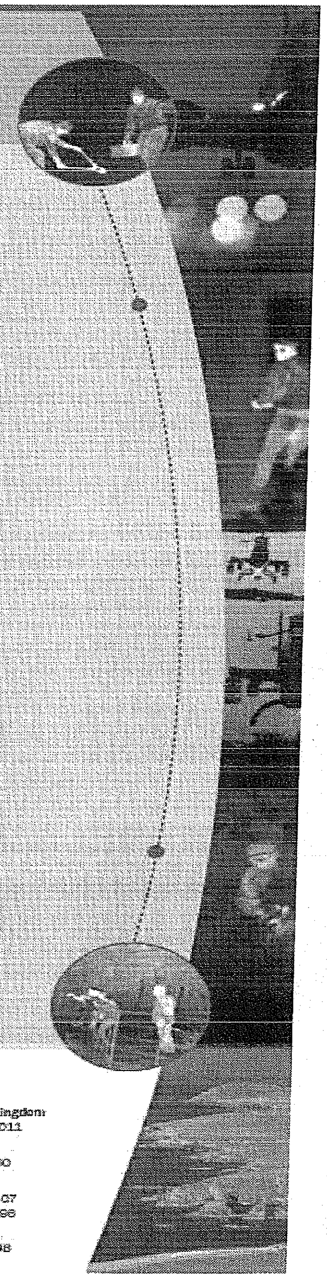
ThermoVision™ Sentinel™



Thermal Imaging Performance	
Sensor type	320 x 240 Long Wave VOx microbolometer
Number of "fields of view"	2
Wide FOV	20° x 15°
Narrow FOV	5° x 3.75°
E Zoom	1x to 4x Continuous
Image processing	Digital Detail Enchancment (DDE), Histogram Equalization (HEQ)
Pallettes	Black, white, rainbow, iron (+ inverted)
Focus Control	Auto or manual
Digital image resolution	14-bit
Spectral band	7.5-13 µm
Automatic Features	Focus, image optimization, temperature compensated focus, defrosting system
Daylight Imaging Performance	
Sensor type	1/4 in. CCD
Optical Zoom	(18x) 48° to 2.7° Continuous
E Zoom	12x, Continuous
Lines of resolution	460 television lines NTSC, 470 television lines PAL
Automatic Features	Auto focus, Advanced Image Processing Enhancements
System Features	
Remote Control	On/Off power save feature
Automatic Heater	Separate power supply supports arctic climate use
Built in Test (BIT)	Intelligent self diagnostics tests vital functions
Outputs	
Video	NTSC (RS-170) or PAL (CCIR), 14 bit digital thermal image data transfer via serial interface
Connector types	RS-232, BNC (2)
Power	
Power Requirements	18-32 VDC
Power Consumption	12 W typical, without heaters 150 W, at 28 VDC, with heaters
Environmental	
IP Rating	IP 65
Operating Temp	-32°C to 55°C (-26°F to 131°F)
Bump, Vibration	Detailed specifications available
Dimensions, Weights and Mounting	
Dimensions	254 x 220 x 320 mm (10" x 8.7" x 12.6")
Weight	6.7 kg (14.8 lb.)
Mounting	2 at 1/4-20 mouting holes
Interfaces	
Command and Control (all functions)	RS 232
Included Accessories in Standard Package	
Power box, 15m (50 ft.) camera system cable, operator's manual, video cable, transport case	

Equipment described herein may require US Government authorization for export purposes. Diversion contrary to US law is prohibited.

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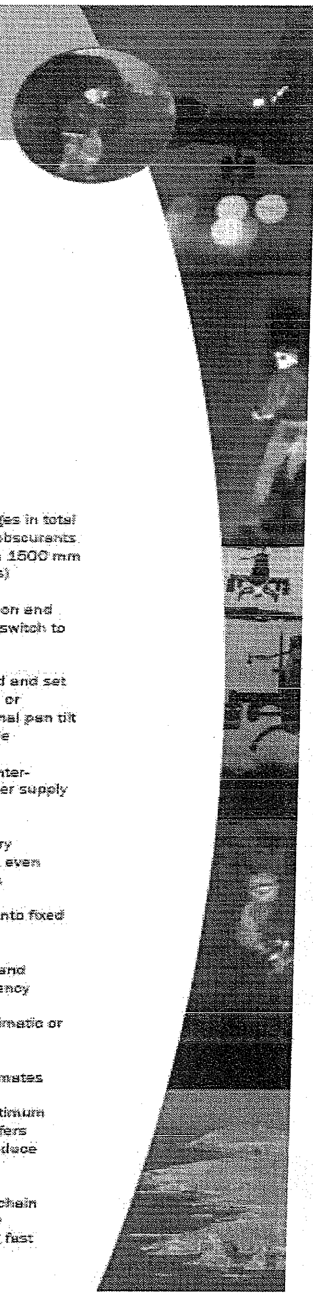
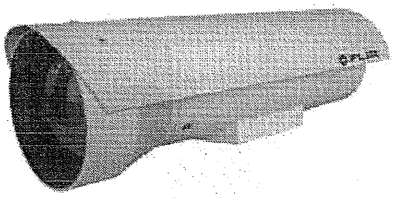
ThermoVision Ranger® II/III

Portable, Lightweight, Long Range, Thermal Imager

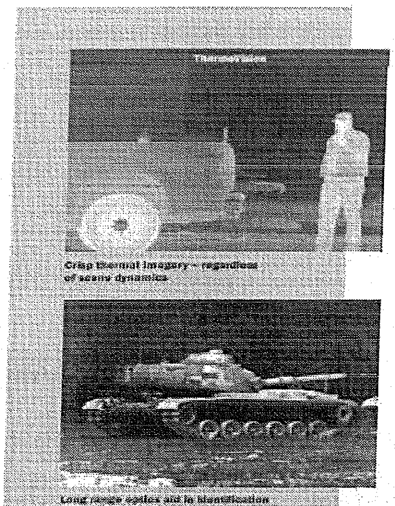




Ranger III with XR Plus extender (shown)

APPLICATIONS

- Vehicle Viewer
- Forward Area Line of Defense
- Force Protection
- Border Security
- Coastal Surveillance



Crisp thermal imagery – regardless of scene dynamics

Long range optics aid in identification

Features	Benefits
Powerful mid and large format 50/250 mm, 100/500 mm, or 150/750 mm long range imaging system	Track targets at extreme ranges in total darkness and through most obscurants with performance on par with 1500 mm systems (large format XP Plus)
Dual field of view system	Allows for fast target orientation and situational awareness, easily switch to the super long range zoom
Portable	Take Ranger II/III into the field and set up quickly for force protection or forward observation; an optional pan tilt with remote control is available
Flexible	A variety of standard control interfaces, video outputs, and power supply options make fielding easy
Advanced image processing	Provides sharp thermal imagery regardless of scene dynamics, even with hot targets in cold scenes
Simple mounting	Install on vehicles, tripods, or into fixed security networks
Simple operation	Automatic image optimization and intuitive controls speed proficiency
Rugged Mil STD 810F qualified	Allows deployment in severe climatic or battlefield conditions
Optional built-in heaters	Keeps the lens clear in cold climates
Built-in Test (BIT)	Intelligent self-test confirms optimum performance at start-up and offers on-screen help menus which reduce fielding and support issues
It's all FLIR inside	FLIR controls the entire supply chain for the critical technology inside ThermoVision systems ensuring fast service and long term support

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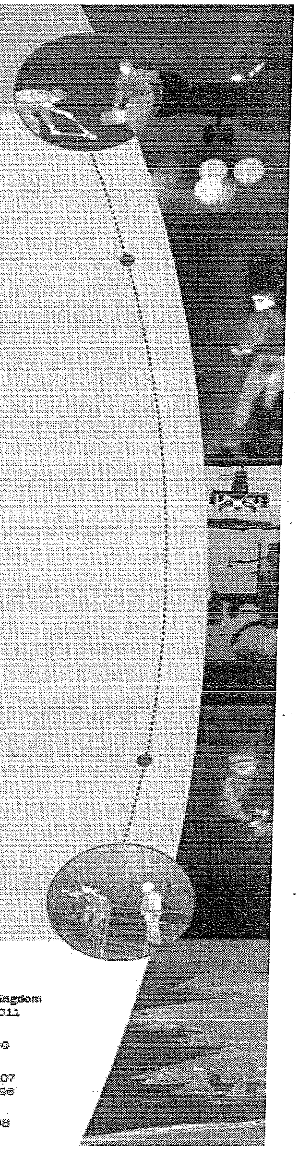
ThermoVision
Ranger® II/III



THERMAL IMAGING PERFORMANCE	
Sensor type	320 x 240 or 640 x 480 InSb
Number of fields of view	2
Wide FOV	11.0° x 8.2°
Narrow FOV	2.2° x 1.6°
Wide FOV (XR)	5.5° x 4.1°
Narrow FOV (XR)	1.1° x 0.8°
Wide FOV (XR Plus)	3.6° x 2.5°
Narrow FOV (XR Plus)	0.7° x 0.5°
E Zoom (all models)	2x, 4x
Spectral band	3-5 μm
SYSTEM FEATURES	
Advanced image management	Automatic image optimization, polarity, color palettes, image freeze
BIT	Intelligent internal diagnostic confirms optimum system performance at startup, and includes on-screen help files
OUTPUTS	
Video	NTSC or PAL video, S video
Connector types	BNC, S-Video
POWER REQUIREMENTS	
Power requirements	9-23 VDC
Power consumption	80 W at 12 VDC with optional heater
ENVIRONMENTAL	
Mil-spec	810 F
IP rating	IP 66, IEC 529
Operating temp	-32°C to 55°C (-26°F to 131°F)
DIMENSIONS, WEIGHTS AND MOUNTING	
Dimensions	56 cm L x 22.9 cm Dia (26" L x 9" Dia) including sun shield
Weight	9 kg (<20 lb depending on options)
Weight (XR Plus)	12.9 kg (28.5 lb)
Mounting	1/4"-20 threaded base plate
INTERFACES	
Command and control	RS 232, 422
STANDARD PACKAGE	
Included accessories	Hard shell lockable case with fitted foam insert, 110/220 VAC power supply, break out box, system controller, 7.6 m cable system cable, operator's manual
OPTIONS	
Optional accessories	Tripods, monitors, hard carbon coatings, extended cables, Nexus mini server, pan/tilt controller

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APPENDIX E – BOSCH MONOCHROME CAMERA TECHNICAL SPECIFICATIONS

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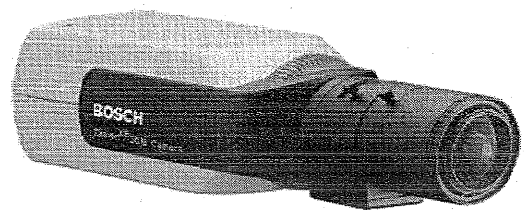
BOSCH
Invented for life

LTC 0510 Series DinionXF Monochrome Cameras



- 15-bit DSP technology
- XF-Dynamic
- Bilinx communication
- Default shutter
- Lens wizard
- Auto black
- Video motion detection
- Exceptional IR sensitivity

The LTC 0510 Series of High Performance 1/2-inch Digital CCD Monochrome Cameras create the best possible image, even under the most difficult light and scene conditions. Based on unique 15-bit digital video processing technology and employing XF-Dynamic, these cameras provide the ultimate sensitivity with extended dynamic range. By employing the best 1/2-inch CCD available, advanced front end processing, combined with the outstanding Dinion DSP, the cameras achieve an astonishing sensitivity, providing better images in low light situations and sharper daytime images.

All Dinion cameras are supplied ready to operate. Simply attach and focus the lens, and connect power to provide optimal pictures under virtually all scene conditions. No tools are required for back focus and power connection. For extra challenging situations where fine tuning or special settings are required, the camera parameters can be individually set using the control buttons on the side of the camera and On-screen Display (OSD). Also, to aid installation, the camera automatically detects the lens type, and using the Lens Wizard ensures accurate (back) focusing for perfectly sharp pictures at all times.

Functions

XF-Dynamic

Extended dynamic range is brought to a new level on the LTC 0510 Series Camera by XF-Dynamic technology. XF-Dynamic automatically processes the highly accurate 15-bit digital signal to optimally capture the detail in both the highlight and lowlight areas of the scene simultaneously, to maximize the information visible in the picture.

Bilinx Technology

The LTC 0510 series cameras incorporate Bilinx. Bilinx is a bidirectional communication capability embedded in the video signal of all Bosch Dinion cameras. With Bilinx technicians can check status, change camera settings and even update firmware from virtually anywhere along the video cable. Bilinx reduces service and installation time, provides for more accurate setup and adjustment, and improves overall performance. In addition, Bilinx uses the standard video cable to transmit alarm and status messages, providing superior performance without additional installation steps.

Video Motion Detection

The built-in video motion detector allows you to select up to four fully programmable areas with individual thresholds. The global scene change detector minimizes false alarms

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caused by sudden lighting condition changes, such as switching on or off the indoor or security lighting. When motion is detected alarms may be displayed in the video signal, the output relay can be closed in addition to alarm message transmission on Bilinx.

Auto Black

The automatic black level feature, enhances contrast by removing veiling glare from the picture or when contrast is reduced by fog or mist.

Default Shutter

When viewing moving objects a fast shutter speed is required. When using a fast shutter speed the lens opening or gain control needs to be increased to maintain the video signal. The camera sensitivity is limited by the fast shutter speed. The default shutter setting of the LTC 0510 offers the best of all worlds, fast shutter speed as long as there is sufficient light, however as the light level falls, when other adjustments have been exhausted, the shutter reverts to the standard setting maintaining the cameras excellent sensitivity.

Back Light Compensation (BLC)

Offering a fully programmable BLC area of interest, and a variable BLC level, the camera can be easily set up for even the most challenging entrance applications.

Lens Wizard

The LTC 0510 series automatically detects the type of lens installed. The Lens Wizard will focus the lens at the maximum lens opening, to ensure that focus is maintained throughout the entire 24-hour day/night cycle. No special tools or filters are required.

Programmable Modes

The camera supports 3 independent operating modes. The 3 modes are preprogrammed for typical applications, but are fully programmable for individual situations. Switching between modes is easy via Bilinx or the external alarm input.

SensUp

By increasing the integration time on the CCD up to 10 times, the effective sensitivity is dramatically enhanced, especially useful where there is no artificial lighting and you rely on the moon, stars and scattered radiation.

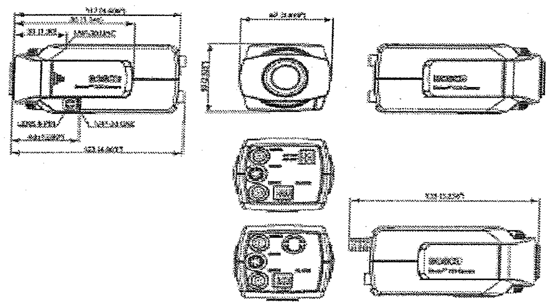
Certifications and Approvals

Electromagnetic Compatibility	
Emission	EN55022 class B, FCC class B part 15
Immunity	EN50130-4 Alarm Systems, Part 4

Electromagnetic Compatibility	
Vibration	Camera with 500 gr (1.1 lbs) lens according to IEC60068-2-27

Safety
EN60065 (/10 and /50 models)
UL6500, cUL CAN/CSA E60065-00 (/20 and /60 models)

Installation/Configuration Notes



Dimensions in mm

Parts Included

Quantity	Component
1	LTC 0510 Series Dinion[XF] Monochrome Camera
1	Spare male 4-pin lens connector
	Lens not included

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Technical Specifications

Electrical

Model No.	Voltage Range		System
LTC 0510/10	12 – 28 VAC 11 – 39 VDC	45 – 65 Hz	CCIR
LTC 0510/20	12 – 28 VAC 11 – 39 VDC	45 – 65 Hz	EIA
LTC 0510/50	85 – 265 VAC	45 – 65 Hz	CCIR
LTC 0510/60	85 – 265 VAC	45 - 65 Hz	EIA

Power Consumption	4 W
Imager	Interline transfer CCD 1/2-inch image format
Active Pixels	
CCIR Models:	752 H x 582 V
EIA Models:	768 H x 492 V
Sensitivity (3200 k)	
Sensitivity (Full video)[1]	0.16 lux (0.016 fc)
Sensitivity 50 IRE[1]	0.032 lux (0.0032 fc)
Minimum Illumination[1]	0.021 lux (0.0021 fc)
Minimum Illumination with Sense Up	0.0021 lux (0.00021 fc)
Horizontal Resolution	570 TVL
Signal-to-Noise-Ratio	> 50 dB
Video Output	1 Vpp, 75 ohm
Synchronization	Internal, line lock or genlock selectable
Electronic Shutter	Auto (1/60 (1/50) to 1/500000), fixed, flickerless, default
Sensitivity Up	Off, automatic continuous up to 10x
Auto Black	On, off selectable
Range	32x dynamic range enhancement
Dynamic Noise Reduction	Auto, off selectable
Contour	Sharpness enhancement level selectable
BLC	Off, area and level selectable
Gain	Auto (maximum level selectable to 28 dB) or fixed level selectable
VMD	4 area, sensitivity selectable
Alarm Output	VMD or Bilinx
Alarm Input(TTL)	Profile switching, +5 V nominal, +40 VDC max
Alarm Output Relay	max. 30 VAC or +40 VDC, max. 0,5 A continuous, 10 VA
External Synchronal Input	75 ohm or High impedance selectable
Cable Compensation	Up to 1000 m (3000 ft) coax without external amplifiers (automatic set-up in combination with coaxial communication)
Camera ID	16 character editable string, position selectable

Model No.	Voltage Range	System
Lens Types	Manual, DC- and Video-Iris auto-detect with override. DC-iris drive: max 50 mA continuous Video-iris: 11.5 ± 0.5 VDC, max. 50 mA continuous	
Remote Control	Bi-directional coaxial communication	

1) F/1.2, 89% reflection, SensUp off

Mechanical

Dimensions (H x W x L)	59 x 67 x 122 mm (2.28 x 2.6 x 4.8 inch) without lens
Weight	450 g (0.99 lbs) without lens
Tripod Mount	Bottom (isolated) and top 1/4-inch 20 UNC
Lens Mount	C and CS
Controls	OSD with softkey operation

Environmental

Operating Temperature	-20°C to +50°C (-4°F to +122°F)
Storage Temperature	-25°C to +70°C (-13°F to +158°F)
Operating Humidity	20% to 93% RH
Storage Humidity	up to 98% RH

Ordering Information

LTC 0510/10 DinionXF Monochrome Camera 1/2-inch B/W high performance CCIR, 570 TVL, 12-28 VAC/11-39 VDC, 50 Hz	LTC0510/10
LTC 0510/20 DinionXF Monochrome Camera 1/2-inch B/W high performance EIA, 570 TVL, 12-28 VAC/11-39 VDC, 60 Hz	LTC051020
LTC 0510/50 DinionXF Monochrome Camera 1/2-inch B/W high performance CCIR, 570 TVL, 85-265 VAC, 50 Hz	LTC0510/50
LTC 0510/60 DinionXF Monochrome Camera 1/2-inch B/W high performance EIA, 570 TVL, 85-265 VAC, 60 Hz	LTC0510/60
Accessories	
LTC 3264/30 Varifocal Lens 1/2-inch, 4.5 – 10 mm, DC-iris, CS-mount F1.6-360, 4-pin	LTC3264/30
LTC 3274/41 Varifocal Lens 1/2-inch, 7.5 – 75 mm, DC-iris, C-mount, F1.7-360, 4-pin	LTC3274/41
LTC 3283/20 Zoom Lens 1/2-inch, 8.0 – 48 mm, Video-iris, CS-mount F1.4-360, 4-pin	LTC3283/20
TC 120PS Power Supply Unit 110-120 VAC/15 VDC, 50/60 Hz, 300mA	TC120PS
TC 220PS Power Supply Unit 230 VAC/12 VDC, 50 Hz, 10 VA	TC220PS
TC 220PSX-24 Power Supply Unit 230 VAC/20 VAC, 50 Hz, 20 VA	TC220PSX-24

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