



Ludlum Measurements, Inc.

Radiation Detection Systems for the Recycling Industries

Richard Smola
Director of Engineering
Ludlum Measurements, Inc.



Ludlum Measurements, Inc.



Don Ludlum



THE COMPANY

- 45 years in the radiation detection business
- Located in Sweetwater, Texas
- Over 200 products in current production
- Over 400 employees
- Highly Integrated Company
 - Engineering
 - Manufacturing
 - Expanded Capabilities
 - PMT Design/Mfg
 - Scintillation Design/Mfg
 - PC Board Design/Mfg
 - Plastic Injection Molding Design/Mfg
- Legendary Support
 - Technical support
 - Repairs
 - Calibration
 - Training



Ludlum Measurements, Inc.

Product Lines

- Portables
- Sample Counters
- Air Monitoring
- Area Monitors
- Contamination Monitors
- Waste Monitors
- Gate Monitoring Systems
- Test Equipment



Markets

- Research
- Medicine
- Industry
- Nuclear Power
- Security
- Waste Management





Ludlum Measurements, Inc.

Ludlum's Philosophy

Provide a quality product that meets the customer's needs at a competitive price





Ludlum Measurements, Inc.



Description: Lunch-box appearance. Steel shell with integrated carrying handle and a round hose connector at each end.

Size: Approx. 12" x 8" x 6"
(30 cm x 20 cm x 15 cm)

Weight: Approx. 45 lb (20 kg)

Color: Variable, often orange.



Description: Steel container, normally cylindrical. May have lifting handles.

Size: Approx. 8-15" (20-40 cm) in diameter, and 12-24" (30-60 cm) high

Weight: 55-300 lb (25-125 kg)

Color: Variable.

Will Your Site Detect These?
And Will You React Appropriately?



Ludlum Measurements, Inc.

Radiation Instrumentation for the Metals Industry

- Gate or Portal Monitors
- Conveyor and Scale Monitors
- Charge Bucket Monitors
 - Area Monitors
- Slug/Sample Monitors
- Handheld μ R meters
- Isotope Identifiers



Ludlum Measurements, Inc.

And We Can Network Them!

Why?

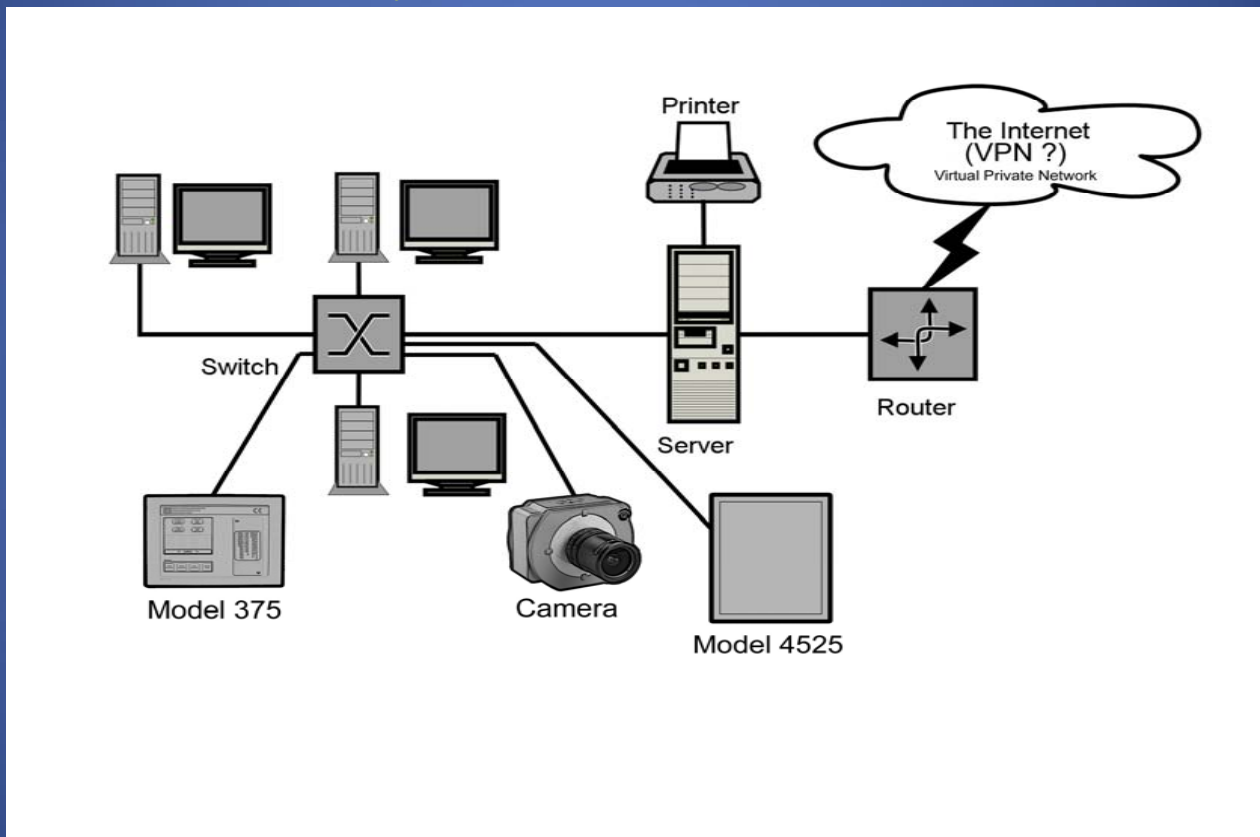
- Increased Visibility
- Correlate Multiple Incidents
- Summarize Incidents
- Historical Records

While Taking Advantage of Off-The-Shelf Networking Products

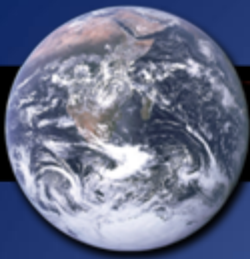


Ludlum Measurements, Inc.

Typical Ethernet Network



Virtual Private Network or VPN allows access/transparency to outside authorized users.



Model 192 & 193-6 μ R Meters



Model 192 μ R Meter

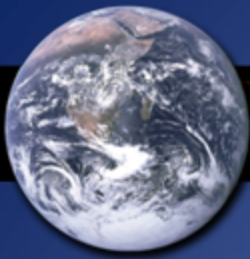
- Internal 2" x 1" NaI (TI) detector
- 700 cpm per μ R/hr (Cs-137)
- 0-5000 μ R/hr dynamic range
- Analog Meter Dial
- Audio Output
- Dual Alarms
 - Fixed alarm point
 - Deviation from background
- 600 hour battery life

**FIND
IT!**



Model 193-6 μ R Meter

- 6" diameter x 1" thick plastic scintillator detector
- 2000 cpm per μ R/hr (Cs-137)
- 0-5000 μ R/hr dynamic range
- Analog Meter Dial
- Audio Output
- Dual Alarms
 - Fixed alarm point
 - Deviation from background
- 600 hour battery life
- 51" (129 cm) overall length

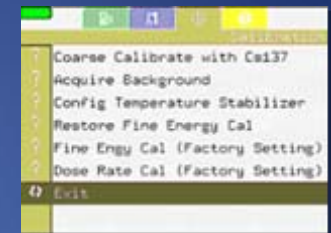
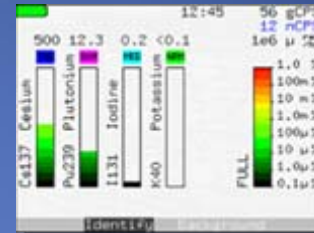


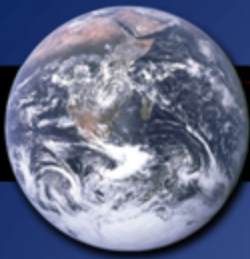
Model 703 Isotopic Identifier

IDENTIFY IT!

FEATURES

- Quick isotope identification
- Single-handed operation
- User and Administrator operating modes
- User-friendly operation
- Sunlight readable color LCD
- Compact Flash Card spectrum storage
- Ethernet connectivity
- 8 hour rechargeable battery operation
- Audible warning and voice alerts
- 3" x 3" NaI(Tl) detector
 - 7% resolution
 - 2300 cpm per $\mu\text{R/hr}$





Model 375 Slug/Sample Monitor System

Model 44-10 Detector

2" x 2" NaI(Tl) Scintillator
1200 cpm/ μ R/hr sensitivity



and

and



or

and

and



Model 44-2 Detector

1" x 1" NaI(Tl) Scintillator
200 cpm/ μ R/hr sensitivity

Model 180-9 Shielded Sampler

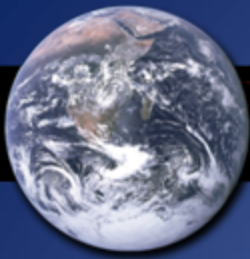
1.5" (3.8cm) thick lead shield
~ 410 cpm background
260 lbs. (159 kg)



Model 180-1L Sample Holder

$\frac{1}{4}$ " (.64 cm) lead shielding
4.7 cm (max) sample size
Selectable spacing





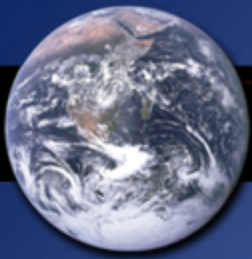
Model 375 Controller

Features

- Compact, Affordable Digital Controller
- Thousands Sold – many applications
- Adapts to many different types of detectors
- Time-tested-over 10 years on the market
- High Visibility Digital LED display
- Audible & Visual Alarms
- Status Indicators
- Overload & Over-range Protection
- Relay Outputs
- Battery Backup – 48 hours
- Networkable

- Options:
 - Remote Indicators/Annunciators
 - Weatherproof Enclosures
 - Industrial Camera support
 - Ethernet Network Software with Email Notification
 - Webpage & Service Software for Transparency





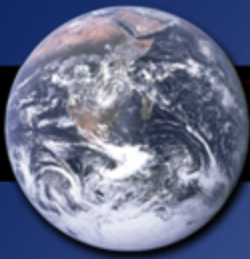
Model 375-10 Area Monitoring System

Features

- Model 375 Controller with integral 2" x 2" NaI(Tl) detector
- 100 $\mu\text{R/hr}$ – 2,000 $\mu\text{R/hr}$ range
- Removable detector shield
- Ethernet interface standard

General Purpose/Bag House
Detection!





Model 375P-3500 Conveyor Monitor

Features

- Excellent Secondary Measurement Process
 - Added assurance nothing enters the furnace
- Improved Sensitivity
 - Shorter distance between detector and materials
 - Longer detector facilitates longer count cycles
- Automatic Background Compensation
- Built-in Mains Relay for:
 - Remote alarms
 - Automatic conveyor shutoff
- Networkable

Can Also Be Used As A Charge Bucket Monitor!



Model 375 Controller & Model 3500 Detector



Model 375-600 Area Monitoring System

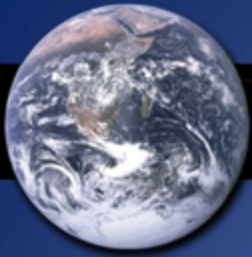
Applications

- Bag House
- Scale Monitor

Features

- Integrated system
 - 630 in³ plastic scintillator detector with 1/8" lead shielding on 5 sides
 - Model 375 Controller
 - Alarm strobe
 - Environmental enclosure
- 30 kcpm per $\mu\text{R/hr}$ sensitivity (*Cs-137*)
- 2' H x 3' W x 1' D (61 x 91.5 x 30.5 cm)
- 125 lbs (57 kg)





Model 375 Webpage and Service

Service

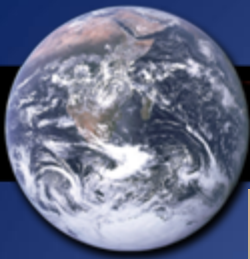
- 24/7 Service-runs anytime computer is on-no need to log in
- Continuously logs data from up to fifty networked Model 375 units
- Sends out Email on incident to multiple addresses, multiple shifts
- Interfaces with Ethernet Cameras

Webpage

Webpage serves up:

- ❖ Current Status
- ❖ Incident Summary
- ❖ Timeline Data

To any networked user
with a browser!



Model 375 Networking

Model 375 Webpage - Current Status

ver 1.4.0

Last Updated: 1/31/2008 8:25:29 AM

[Go To Incident Summary](#)

[Go To Timeline Data](#)

All Items

Query:

Site:

Building:

Area:

Location:

Turn Sound Off

Serial Number	Reading	Units	Site	Building	Area	Location	Status
173641	1.10	µR/hr	ADIT	Main	Front	Lobby	OK
 237025	5.30	µR/hr	LMI	Main	Front	Lobby	OK
239431	0.05	mrem/hr	LMI	Main	Repair	Neutron range	OK



Ludlum Measurements, Inc.

501 Oak Street

Sweetwater, TX 79556

(325) 235-5494

www.ludlums.com



Model 375 Networking

Model 375 Webpage - Timeline Data

ver 1.4.0

Last Updated: 1/31/2008 8:27:13 AM

[Go To Current Status](#)

[Go To Incident Summary](#)

Serial Number: 237025: LMI, Main, Front, Lobby

- Today
- Yesterday
- This Week
- Last Week
- Choose Interval

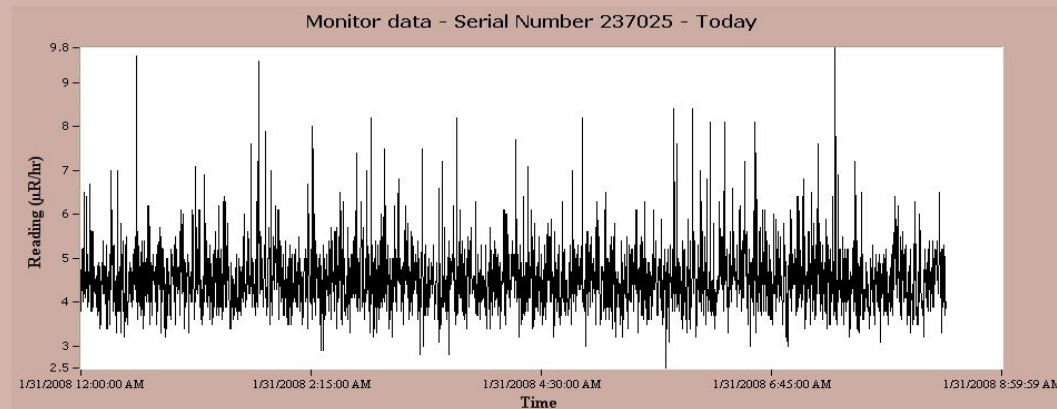
Date Time
Start Data: 01/31/2008 12:00 AM
Stop Data: 01/31/2008 11:59 PM

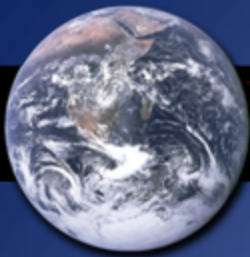
Graph Refresh: On Save Data To File (CSV) Save Data To File (Excel)

Click On A Point To View Data

Smoothing Factor: 1

Date:	No Zoom	Minimum Reading: 2.5
Time:	12-hour zoom 6-hour zoom	Maximum Reading: 9.8
Reading:	2-hour zoom 1-hour zoom	Average Reading: 4.6





Model 375 Networking

Model 375 Webpage - Incident Summary

ver 1.4.0

Last Updated: 1/31/2008 8:29:04 AM

[Go To Current Status](#)

[Go To Timeline Data](#)

- Today
- Yesterday
- This Week
- Last Week
- Choose Interval

	Date	Time
Start Data:	01/31/2008	12:00 AM
Stop Data:	01/31/2008	11:59 PM

Site:

Building:

Area:

Location:

Incident Refresh: On Save Data To File (CSV) Save Data To File (Excel)

Incident Summary

Site	Number of Incidents
LMI	1 Incident
ADIT	2 Incidents

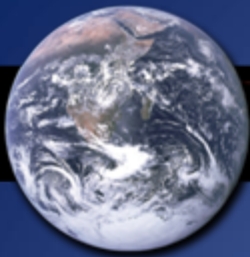
Incident Date Range

FROM:	TO:
1/31/2008 12:00:00 AM	1/31/2008 11:59:59 PM

Incident List

Serial Number	Reading	Units	Start Time	End Time	Site	Building	Area	Location	Type
173641	3.0	µR/hr	1/31/2008 8:14:20 AM	1/31/2008 8:23:22 AM	ADIT	Main	Front	Lobby	ALARM
173641	0.0	µR/hr	1/31/2008 8:12:23 AM	1/31/2008 8:14:20 AM	ADIT	Main	Front	Lobby	MISSING
239431	0.0	µR/hr	1/31/2008 8:04:36 AM	1/31/2008 8:07:34 AM	LMI	Main	Repair	Neutron range	MISSING

Photo of Alarm Available Camera Error/Missing



Model 375 Networking

Model 375 Setup Utility ver. 1.4.0

Model 375 Settings | Email Settings | Database/FTP Settings

Model 375 Unit List

Add, by serial number, offline or different subnet Model 375

Serial Number Unit Code Firmware Number:

Network Settings:

IP Address 0 to 255

Subnet Mask 0 to 255

Gateway 0 to 255

DNS 0 to 255

TCP/IP Port 0 to 65535

Supervisor Primary Address Max 25 characters

Supervisor Secondary Address Max 25 characters

Camera Settings:

Camera Enabled

IP Address

Password

Settings:

Site	Building	Area	Location
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

Normal Log Interval sec X-Coordinate Save To CSV Channel Enabled

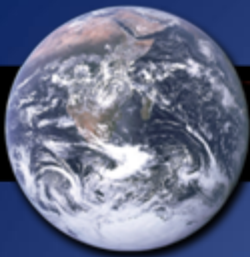
Alarm Log Interval sec Y-Coordinate Save To Database Average Readings

Caption Comment

Refresh Model 375 List | Add Unit By Serial Number | Save Settings | Delete Unit From Config File | Back Up Config File

Setup Utility:

- enables camera support
- defines IP address
- defines location fields
- selects options



Model 375 Networking

Model 375 Setup Utility ver. 1.4.0

Model 375 Settings | **Email Settings** | Database/FTP Settings

Allows email notification to be sent to multiple individuals in the event of an alarm or failure. Different shifts may be defined to allow notification to be sent to different people at different times of day.

Alarm Notification

Addresses - Alarm Shift 1	Addresses - Alarm Shift 2	Addresses - Alarm Shift 3
<input type="text"/>	<input type="text"/>	<input type="text"/>
<input type="text"/>	<input type="text"/>	<input type="text"/>
<input type="button" value="Add"/> <input type="button" value="Delete"/>	<input type="button" value="Add"/> <input type="button" value="Delete"/>	<input type="button" value="Add"/> <input type="button" value="Delete"/>

Failure Notification

Addresses - Fail Shift 1	Addresses - Fail Shift 2	Addresses - Fail Shift 3
<input type="text"/>	<input type="text"/>	<input type="text"/>
<input type="text"/>	<input type="text"/>	<input type="text"/>
<input type="button" value="Add"/> <input type="button" value="Delete"/>	<input type="button" value="Add"/> <input type="button" value="Delete"/>	<input type="button" value="Add"/> <input type="button" value="Delete"/>

Shift 1 Start Time:
 12:00:00 AM

Shift 2 Start Time:
 12:00:00 AM

Shift 3 Start Time:
 12:00:00 AM

From Address:

Alarm Message:

Fail Message:

SMTP Address:

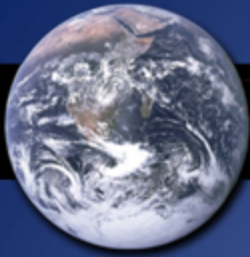
SMTP Port:

Alarm Subject:

Fail Subject:

Email Settings:

- defines up to 3 shifts
- customizes messages
- allows input of multiple email addresses



Model 375 Networking

Example E-Mail message

Subject: [Model 375 Alarm] Area monitor has Alarmed
Reading: 1000 μ R/hr
Attention! Alarm!

S/N: 400000
Hospital 1
Building 2
Floor 3
Room 4

This E-Mail was generated by:
Model 375 Supervisor Service



Ludlum Measurements, Inc.

Gate Monitoring Experience

- over 1000 Systems Sold
 - 158 Customers
 - 20 Countries

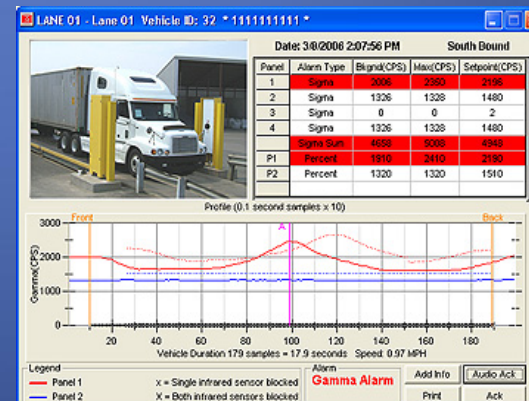


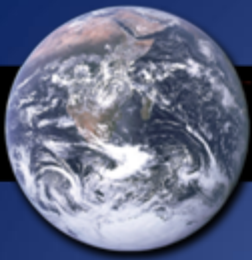
Networking Experience-Model 375

- over 230 Sites
- 49 Customers
- 4 Countries

20 COUNTRIES

- AZERBAIJAN
- BULGARIA
- CANADA
- FRANCE
- JAPAN
- LATVIA
- LITHUANIA
- MOLDOVA
- ROMANIA
- SWITZERLAND
- REPUBLIC OF GEORGIA
- USA
- AUSTRALIA
- CHINA
- GERMANY
- ITALY
- PHILIPPINES
- SOUTH AFRICA
- SPAIN
- TAIWAN

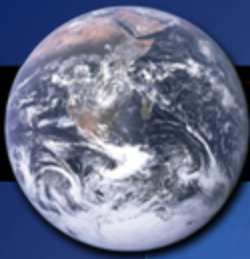




Model 4525-Series Gate Monitoring Systems

- Over 1000 systems sold throughout the world
- Largest Size Detectors on the Market
- Configurable to Accommodate Site Criteria
- Networkable
- Simple User-Interface
- Field Proven Design
- Well Supported



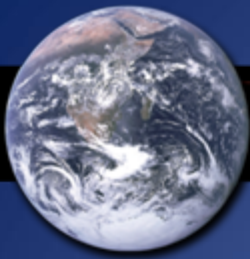


Model 4525-Series Gate Monitoring Systems



DETECTORS

- Maximized detectors
- High sensitivity
 - 3500 in³ plastic scintillator
 - Dual PMT's
 - Low density door
- Industrial duty
 - Stainless steel enclosures
 - NEMA 4X weather resistant
 - Thermal & shock protection
- Reliable operation
- Very low false positives
- Flexible detector configurations
 - 2 – 6 detectors per cluster
- Optional detector stands



Model 4525-Series Gate Monitoring Systems

CENTRAL COMPUTER SYSTEM

- Real-time data logging
- Displays vehicle radiation profile
- Alarm email notification
- Bidirectional entry
- Up to 4 lanes
- Optional cameras to capture and log vehicle images
- Rail car mode
- User-friendly operation

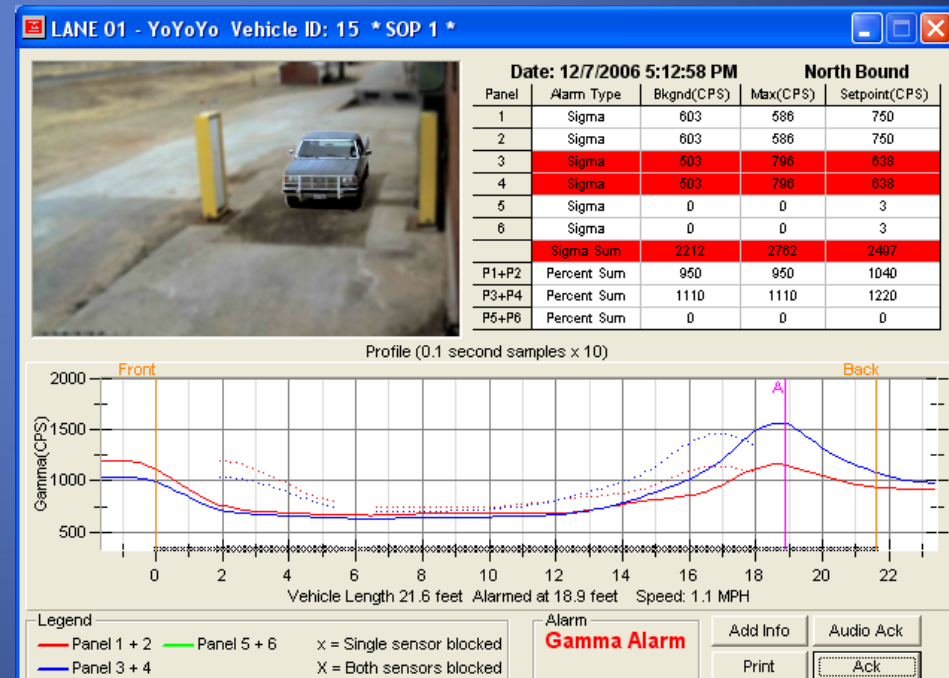


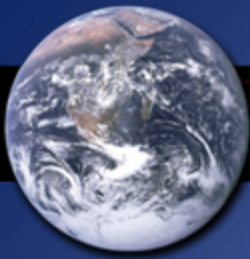
Three Software Packages:

Supervisor-main display, control

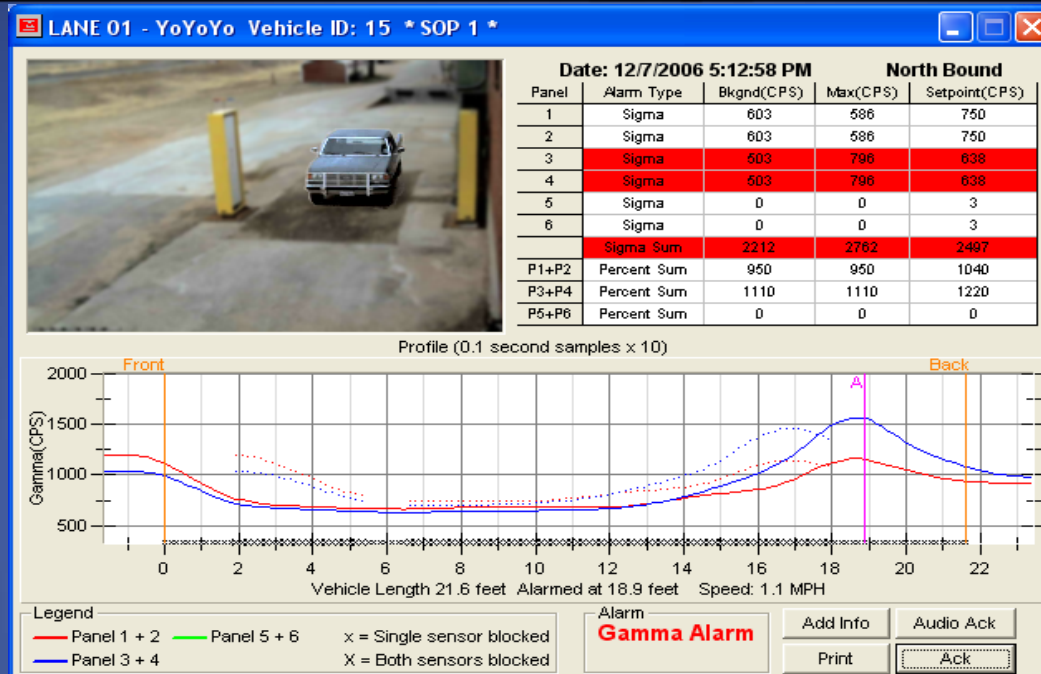
Monitor-remote viewing

Dataviewer-historical data



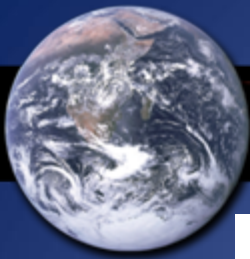


Model 4525-Series Gate Monitoring Systems



Alarm Algorithm

- Sigma alarm based on background radiation before vehicle enters-typically 6 sigma
- “truck background” computed at every point-typically 30-40% below background
- Percentage alarm then based on “truck background”-typically 15% above
- Gaps that can be seen by infrared sensors are compensated for
- Sum alarms can enhance sensitivity if radiation is not collimated

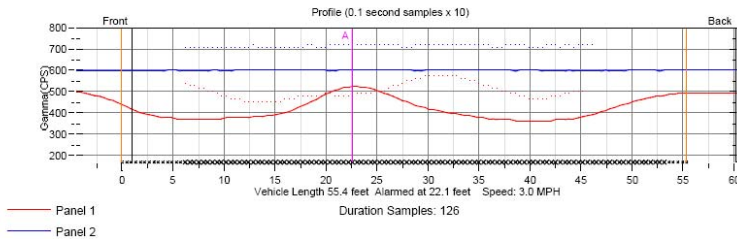


Model 4525-Series Gate Monitoring Systems

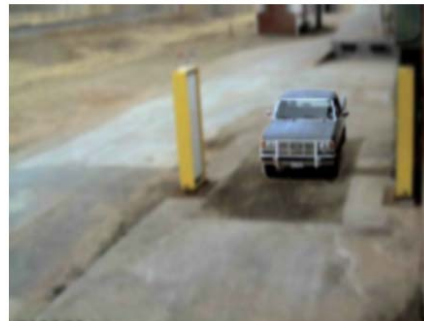
Vehicle ID: 2
 Date: 1/15/2007
 Time: 12:43:38 AM
 Shipper: _____
 License Plate: _____

jays office
LANE 01 - YoYoYo - ALARM - North Bound
 Gamma Alarm

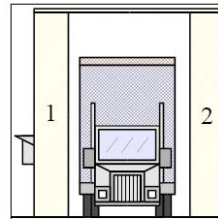
SOP 1



Picture



Panel	Alarm Type	Alarm	Bkgnd(cps)	Max(cps)	Setpoint(cps)
1	Sigma	None	503	528	638
2	Sigma	None	600	601	747
3	Sigma	N/A	N/A	N/A	N/A
4	Sigma	N/A	N/A	N/A	N/A
5	Sigma	N/A	N/A	N/A	N/A
6	Sigma	N/A	N/A	N/A	N/A
	Sigma Sum	None	1103	1128	1304
P1	Percent	ALARM	400	500	480
P2	Percent	None	600	600	720

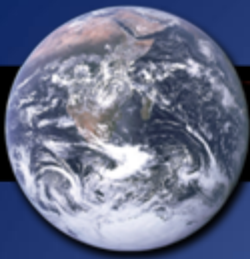


Comments: _____

VER: 260S

Alarm Report:

- Shows date/time, location
- Shows radiation profile to help locate radiation source
- Shows camera picture if available
- Shows status of each detector
- Gives space for operator to add Shipper, License plate, or other comments
- Can show watermark (see "SOP1") for different radiation levels



Model 4525-Series Gate Monitoring Systems

Model 4525 Supervisor version 2.8.1 IP Address: 192.168.10.174

File Prefs Help

Lane 1 | Lane 2 | Lane 3 | Lane 4

LANE 01 - Office - Connected

Camera



Battery OK

A/C Power Fail

1

Daily Vehicle Summary

	In Bound	Out Bound	Total
Vehicles	0	0	0
Rad Alarms	0	0	0
Spd Alarms	0	0	0

Show Gamma Average

P 1 5007 2 5007 CPS

A 3 0 4 5007

N

E

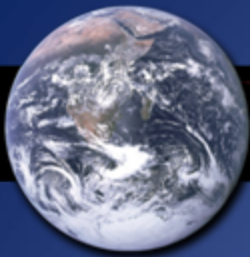
L

Audio Ack Image View

2/23/2008 10:28 AM

Main Screen:

- shows daily vehicle summary
- shows detector status
- shows camera image if available
- shows power and sensor status




Model 4525-Series Gate Monitoring Systems

Model 4525 Supervisor version 2.8.1 IP Address: 192.168.10.174

File Prefs Help

Lane 1 | Lane 2 | Lane 3 | Lane 4

LANE 01 - Office - Connected
Camera - Disabled



Battery OK

A/C Power OK

Daily Vehicle Summary

	In Bound	Out Bound	Total
Vehicles	0	0	0
Rad Alarms	0	0	0
Spd Alarms	0	0	0

Show Gamma Average

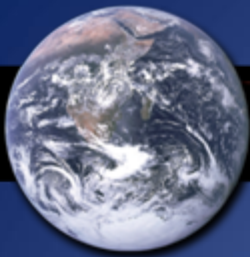
p 1 5033 2 5033 CPS
A 3 0 4 5033
N
E
L

Audio Ack Image View

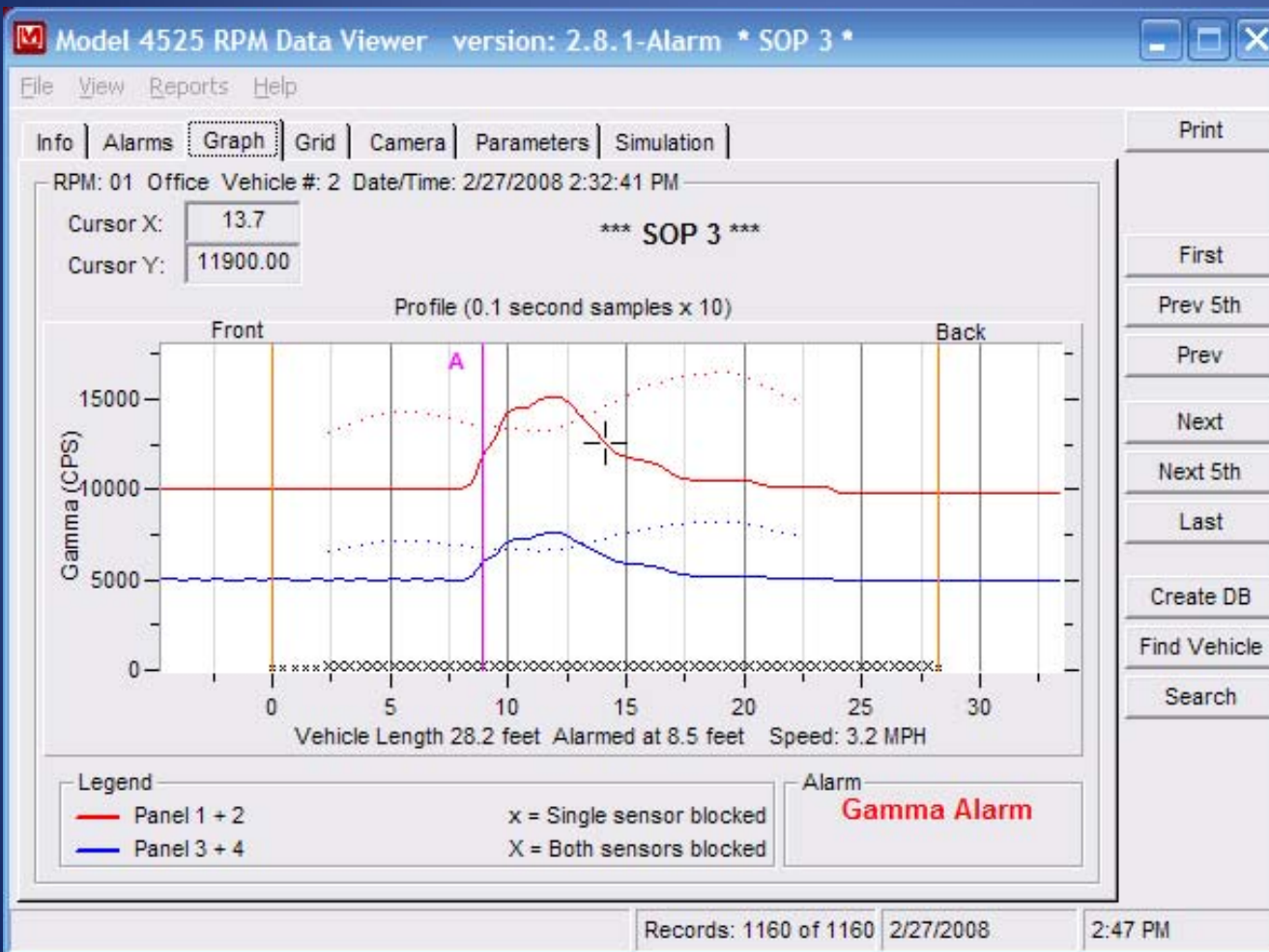
2/27/2008 1:06 PM

Monitor Software:

- shows same screen as Supervisor
- doesn't allow changes or affect operation
- shows line drawing of vehicle if camera image isn't available
- shows power and sensor status

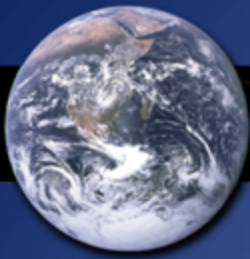


Model 4525-Series Gate Monitoring Systems



Data Viewer:

- shows radiation profile
- shows detector status
- shows instrument parameters
- shows camera images if available
- can print alarm summaries over time



Model 4525-Series Gate Monitoring Systems

Model 4525 RPM Data Viewer version: 2.8.1-Alarm * SOP 3 *

File View Reports Help

Info | Alarms | Graph | Grid | Camera | Parameters | Simulation |

RPM: 01 Office Vehicle #: 2 Date/Time: 2/27/2008 2:32:41 PM

Front Back

Double-Click image to display full size

Records: 1160 of 1160 2/27/2008 3:23 PM

Data Viewer:

- can show approximate location of radiation source
- uses line drawing if camera is not available



Model 4525-Series Gate Monitoring Systems

On-site Training:

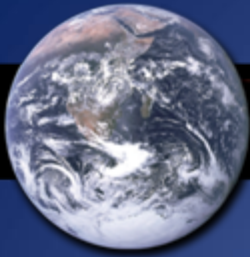
- done immediately after installation
- manuals supplied in electronic and paper format
- Training/Discussion for:
 - Operator use, display, printouts, possible procedures
 - Maintenance, hardware options, and parts guide
 - Parameter setting, software options



Model 4525-Series Gate Monitoring Systems

Software Support:

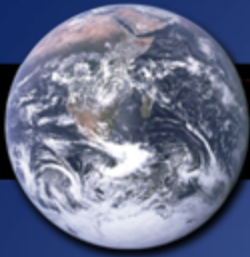
- software is maintained using in-house programmers
- welcome to suggestions for improvements
- upgrades are FREE (or maybe \$25 to cover chip/DVD cost)
- upgrades are announced periodically (about once/year)
- customers can choose to upgrade or not



Model 4525-Series Gate Monitoring Systems

Technical Support:

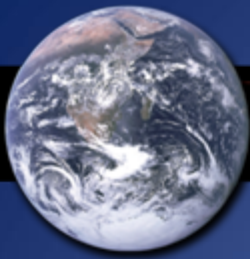
- toll-free 24/7 support
- phone answered by knowledgeable technicians, NOT a helpdesk
- spare part kits are available
- Field technicians available to travel on-site for repair
- parts are stocked (and set aside for repair) at the factory
- orders by 3:00 pm CST can be sent out that day
- lifetime support, as much as possible (we still support portables that are 30-40 years old)



Model 4525-Series Gate Monitoring Systems

Customer List (partial):

D&L Foundry Allied Alloys Steel Dynamics Beijing Jiamaijua Sci Mid America GSD Trading PSC Metals
Algoma Steel US Military DRMS Behr Iron & Steel Portland General Electric Longview Scrap & Metal
Wrights Scrap Metal Emert Recycling Fenster Metals KC Recycling Ltd Matlow Company Sotraval
Pratt & Whitney OmniSource OmniSource Galamba Group Australian Radiation Services PSC Metals
LeTourneau Inc Maine Metal Recycling NE Metal Processors Skagit River Recycling CMC Columbus Recycling
US Military DRMS Clark Iron & Metal Adams Steel Tri-State Metals M Blose & Sons OmniSource
Australian Radiation Services Oscar Winski Smorgen Steel Scrap All Revere Copper
Arkla Recycling Adams Steel Metal Management Metal Management Lincoln Metal Wm F Sullivan
Meadville Metals M Lipsitz Company CMC Metals CMC Metals Trenton Iron & Metal Prince George's Scrap
WMG Inc H & H Iron & Metal Beijing Jiamaihua QMR Inc CMC Recycling Golden State Metals
Smorgen Steel Recycling Nucor Allied Recycling Barr Iron & Metal Metro Metals Beaumont Iron & Metals
Erath Recycling Youngstown Iron & Metal Louisiana Scrap & Metal Aluminum Commercial Alloys
L & K Metals Texas Port Recycling Camden Iron & Metal Reserve Marine Terminal Behr
Auburn Metal Processing CMC Recycling TVR LLC Decatur Div Southern Metals Recycling
Ocala Recycling Monroe Recycling Allied Waste Acme Iron & Metal W Industries Alma Iron & Metal
Louisiana Scrap Metal CMC Newell Recycling of S.A. Seneca Landfill Joseph Smith & Sons
Longhorn Recycling Carolina Recycling Group Louisiana Scrap Metal Kantner Iron & Steel Garrett Recycling
PSC Metals Audubon Metals Galamet M Lipsitz OmniSource OmniSource Onyx Environmental
OmniSource Allied Alloy Ocala Recycling Fulton Supply & Recycling Southern Scrap Williston Elin



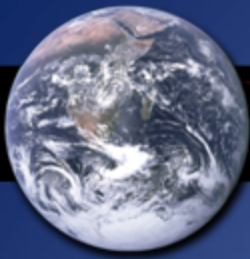
Reported Incidents

Model 4525 Success Story (Remote Software + VPN) March 2008

I was in the area calling on customers and had been to the Anaheim facility in the morning. The former manager had been assigned to a new job and was not there. At 3 p.m. he calls me to say while he was in meetings in Las Vegas with his laptop running the Model 4525 Remote software, he saw a truck alarm and from the profile he thought it was a source. I was able to arrive about 30 minutes later with a Ludlum Model 192, while they had a Ludlum Model 3 with 44-2. They were just dumping the load for inspection of bailed scrap. The two of us with instruments had walked about and through the piles about 3 times until I got a "hit". After searching for the source for over 15 minutes, I was thinking that maybe it could have been a false alarm. It would have been really easy to quit looking if you did not have confidence in the Model 4525 data. On the underside of one of the bales there was activity. When I first located the source, it was just a few flashes on the Model 192. They opened it up to find lots of small pieces of hot scrap.

The best part of this-the truck came from a customer that scans their loads with RadComm.

The Model 4525 Remote software for these systems is one of the best selling features and many of our customers do not even know it is available or how valuable it can be.



Reported Incidents

Model 4525 Success Story (DataViewer Software) April 2007

We were visiting the yard in Tallahassee where the manager was complaining of a lack of sensitivity with their current Ludlum Model 4525 system. We looked at the system parameters and detector status and could find nothing wrong. We even called an engineer back at Ludlums to see if he could think what might be the problem. In the middle of our discussion with the increasingly skeptical manager, one of the office ladies came in reporting another rejected load. You can imagine that we wished we were someplace else. But then we used the DataViewer to locate the record of that truck went it passed through the Model 4525 on its way out-and there was a radiation alarm! When we showed this to the scale operator, he said he had been told to just ignore that kind of alarm. The misinformation was then tracked back to a yard manager that hadn't even attended the post-installation Ludlum training.

Without the DataViewer software, our visit could have ended badly.



Ludlum Measurements, Inc.

Conclusion

- Reliable, Consistent Performance
- Long Term Experience
- Local/Factory Support
- Excellent Company Reputation
- Lowest Prices

= Superior Value
Secure Investment
Peace of Mind