LUDLUM MEASUREMENTS, INC.

Ludlum Model 4525

Operator's Manual

July 2026

Software Version 3.9.9a

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Ludlum Measurements, INC.
ATTN: Radiation Security Division
404 W. 4th St.
Sweetwater, TX 79556

Contact Information

Phone: 1-800-622-0828 (US, CA)
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Free Gate Monitor Support

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Section 1 – Introduction

Introduction

The Model 4525 Radiation Portal Monitor (RPM) is a sophisticated system with very sensitive gamma and optional neutron detectors for detecting small amounts of radiation. The sophistication of the RPM provides the user with the best chance of avoiding radiation. The RPM performs these functions with minimal disruption to the normal processes of handling materials inbound and outbound. Model 4525 systems are normally operated in a pass-through (or drive-through) configuration with a scan occurring while the vehicle is passing through the portal.

Several configurations are available. The most common RPMs are listed below.

- Two-Detector Systems
  - Model 4525-5000
  - Model 4525-7000
- Three-Detector Systems
  - Model 4525-7500
  - Model 4525-10500
- Four-Detector Systems
  - Model 4525-10000
  - Model 4525-14000
- Five-Detector Systems
  - Model 4525-12500
  - Model 4525-17500
- Six-Detector Systems
  - Model 4525-15000
  - Model 4525-21000

The indoor wall-mounted Model 4525 computer uses software to display and store data from up to four Model 4525 RPMs via a 10Base-T Ethernet connection or 802.11g wireless connection.

The software is composed of the following components:

- **Supervisor Station** – Responsible for communication and controlling the RPMs. All installations must have one Supervisor station.

- **Echo Station** – Provides a remote view of the Supervisor display. There can be multiple Echo stations.

- **Data Viewer** – The Data Viewer application can be installed on multiple computers to provide the capability to view previous occupancies and to print profile and summary reports.

The software provides audible and visual indications of the current status of the RPMs. These include radiation alarms, background failures, power failures, low battery, and infrared failures.

The software supports a network-attached camera, which allows an image to be captured when a vehicle enters or exits the RPM. The image can be set to trigger from 0 to 9 seconds to provide some flexibility for various camera mounting schemes. These images are stored as standard JPEG files and may be captured for every occupancy or only for occupancies that alarm.

In addition to the software, an optional hardware remote may be included, which has status lights and a reset switch. The hardware remote can be used to reset alarms and view the current status when the Supervisor computer is not available or located in an area that is not near the RPM. When an alarm occurs, pressing the RESET button once will silence the audible alarm. Pressing the RESET button, a second time will clear the alarm. Holding the RESET button down for approximately 10 seconds will reboot the RPM.

Optional system accessories include a strobe/horn, an external video camera in weatherproof enclosure, and detector stand sets.

When a radiation alarm occurs, the Supervisor and any Echo stations will sound an audible alert. Once the vehicle has cleared the RPM, an alarm window will be displayed showing a profile graph of the occupancy, which detector panels in the RPM alarmed, and a camera image if available. The profile graph plots the background during the occupancy with the Y-Axis representing the gamma reading while the X-Axis represents the length of the vehicle. Vertical lines indicate the beginning and end of the occupancy.

If enabled, the system will determine if the alarm is a Naturally Occurring Radioactive Alarm (NORM). NORM consists of materials enriched with radioactive elements found in the environment, such as uranium, thorium, and potassium and any of their decay products such as radium and radon. These types of alarms are characterized as having a high background over the entire length of the occupancy rather than the "spike" of a typical gamma alarm.

A version of the Model 4525 offers new additional discrimination of gamma energies to reduce radiation alarms caused by NORM. Each gamma detector has been configured to have better resolution than the typical plastic scintillator detector. Additionally, the electronics features low-energy and high-energy discrimination, which allows the system to NOT alarm on common NORM. When combined with distributed NORM detection software (included in standard Model 4525 models), this version offers a dual approach towards the reduction of secondary screening of everyday NORM.

All data are stored into a Microsoft Access database. The following tables are used:

Alarms.MDB – Stores all occupancy data including readings and alarm status for alarming occupancies.

NoAlarms.MDB – Stores all occupancy data, including readings and alarm status for all occupancies.

Background.MDB – Stores background values for all active RPMs once every minute.

EventLog.MDB – Stores information about the current status of the software and RPMs.

The databases can be configured to be automatically archived at midnight to a user-specified drive. During the archive process the free space on the hard drive is checked. If the amount of free space drops below 20%, the archived databases and image files are automatically purged beginning with the oldest data first.

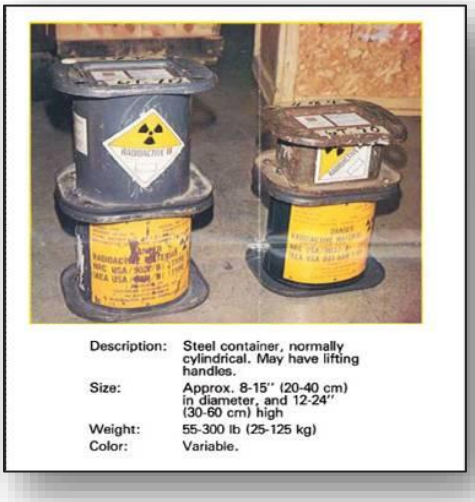
The ESP32 Ethernet board has an internal micro-SD card that will log data in the event that communication is lost with the supervisor computer. Once communication is restored, the logged data is automatically transferred to the Supervisor software's database.

Section 2 – Features

- Visual and audible indication for radiation alarms and RPM failures.
- Password protection for setting RPM parameters and software options.
- Counters for each lane display the number of vehicles, number of radiation alarms, and over-speeds that have occurred since the counters were reset.
- Network camera supports either streaming or static images.
- Ability to monitor lanes from remote Echo stations in addition to the Supervisor station.
- Data can be saved for each occupancy or only occupancies that alarm.
- Images can be saved for each occupancy or only occupancies that alarm.
- Custom site location can be printed on reports and saved to database.
- A serial number can be set up for each lane and saved to the database.
- Automatic daily backup of all database tables to a user-defined folder.
- Each lane can be setup to print a report on all vehicles or just vehicles that alarmed.
- User-defined upper and lower threshold value can be used to display three user-defined watermarks on the alarm report.
- Automatic purging of the oldest data if hard drive space falls below 20%.
- User-defined caption can be set up for each lane and is saved to the database.
- View, print, and search records in the live or archived databases using the Data Viewer software.
- A pop-up window with audible alarm indicates high or low background alarms or a problem with the sensors.
- System status messages recorded to event log database.

Section 3 – Radiation Basics

Radiation in recycled material has become a matter of growing concern. Whether the radiation is natural or artificial, the potential for injury and lost revenue in the workplace exists. For steel mills the threats of multimillion-dollar clean-ups, worker injuries, and lawsuits are staggering. For scrap metal suppliers the expense of rejected loads and potential for worker injury is becoming higher every day.



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.

Description:	Lunch-box appearance. Steel shell with integrated carrying handle and a round hose connector at each end.
Size:	Approx. 12" × 8" × 6" (30 cm × 20 cm × 15 cm)
Weight:	Approx. 45 lb (20 kg)
Color:	Variable, often orange.

Radiation is an energy given off by an unstable atom as it decays. Many radioactive materials, such as radium, uranium and others occur naturally and are found in the ground. These and other sources of naturally occurring radiation make up what is commonly referred to as background radiation. This is low level radiation that is always present. We are all exposed to background radiation every day with no ill effects.

The problem, therefore, is not in detecting radiation in scrap metal but detecting excessive radiation in scrap metal. Many factors have to be considered when attempting to do this. Background radiation is not constant. It is continuously changing due to cosmic events, weather, and other influences.

- The farther away from the source of radiation, the less you will be able to detect radiation from that source. The measurement of the radiation level varies as the inverse square of the distance from the source. For example, a source of a certain size will read a certain amount at a distance of one foot. If the distance is doubled (two feet from the source), the reading will only be 25% of that obtained at one foot.

- The more time the detectors have to look at the source, the better the reading. For this reason, the slower the vehicle passes through the Radiation Portal Monitor (RPM), the better the chance of seeing a potential source.

- The amount of scrap and its density play a large role in the detectors' ability to see a potential source. The more material there is between the source and the detectors, the harder it is for the detectors to see it. The higher the density, the harder it is for the detectors to see it as well.

- The larger the detector, the more sensitive it will be.

- A well shielded detector will be able to detect smaller changes in radiation levels than an otherwise equivalent unshielded detector. By shielding the sides and back of the detectors, we are able to block out a large part of the background radiation, thus increasing the sensitivity of the detector to the small changes in radiation levels caused by a source.

When taking all of the above circumstances into consideration it can be determined that the best way to monitor loads is to have large detectors as close to a lightly packed small load that is moving through the system as slowly as possible. Another factor to consider is that the system should be able to monitor background radiation at all times and make adjustments to the alarm to keep it as close to the background as possible without causing a false alarm.

Naturally Occurring Radioactive Material (NORM) is a big problem. Oilfield pipe, hot water heaters, and industrial piping will sometimes contain scale that is radioactive. Most alarms are the result of NORM. Medical tests that use a radioactive dye or tracer are yet another problem. Patients can be released from the hospital reading several thousand µR/hr or less than 100 µSv/h, and set off RPMs 30 m (100 ft) away. A third problem is that of radiographers and certified welders who use a powerful radiation source to check their material or welds for cracks. This radiation is powerful enough to set off RPMs 3 km (2 miles) away. When installing your RPM, check with your neighbors and ask them to point their source(s) in another direction.

NORM is the reason we developed the version of the Model 4525 that offers new additional discrimination of gamma energies to reduce radiation alarms caused by NORM.

When large sensitive plastic scintillator portal systems were first implemented, people began to realize how many items contain natural amounts of radioactive materials. The sensitivity required to detect a smuggled item also detects NORM. False alarms can be caused by the high potassium levels in bananas, radium in kitty litter, and even some ceramics. These alarms, also called nuisance alarms, can cost significant amounts of time to verify. These nuisance alarms can occur in approximately 1 of 1000 cargo vehicles that transit through the portal monitor.

The first portal systems used only a simple pulse height threshold to distinguish between noise and valid pulses caused by radiation. The first systems then just used statistical analysis to measure the number of pulses at normal background levels of radiation, and set an alarm point whenever the pulse rate increased by some sigma level above that background. This algorithm works very well in detecting any slight increase in radiation level, but is not discriminating in the type of radiation. A more sophisticated method uses multiple thresholds to differentiate between different energies of radiation. A low-energy ratio could be defined as the number of low-energy pulses divided by the total number of pulses, and a high-energy ratio defined as the number of high-energy pulses divided by the total number of pulses. Rather than the standard sigma alarm based on total number of pulses, alarms could be determined by the increase of either of these ratios.

Once this method was implemented, it was noticed that NORM tended to produce pulses of various heights from low to high energy. In other words, NORM could produce an increase of the total numbers of pulses produced by the detectors, but not change the ratios of low or high energy. In contrast, special nuclear materials, or SNM, emitted exclusively low-energy pulses. Some industrial sources tended to produce mostly high-energy pulses. Thus, we get the following tendencies:

INCREASES IN LOW ENERGY ONLY: possible SNM : LOW RATIO ALARM

INCREASES IN LOW AND HIGH ENERGY: possible NORM: no alarm unless sigma value exceeded

INCREASES IN HIGH ENERGY ONLY: possible industrial sources: HIGH RATIO ALARM

Note that these categories are not definitive, but are shown as generalizations. It is important to realize these limitations. One would want to investigate very high levels of radiation, regardless of the category shown. These categories are meant only to help guide the response to these kinds of alarms.

What to Do When the System Alarms

Note:

It is advisable to contact your state health authorities prior to an incident of radioactive materials so that the steps required by the pertinent authorities may be expedited in the event of such an incident. Additional information and suggestions may also be found on the internet at www.crcpd.org and www.isri.org.

The following is a suggested procedure; local procedures and regulations may take precedence.

1. If possible, have the vehicle pass through the RPM again after resetting the alarm. If the alarm is repeated, you will want to locate what is causing the alarm.

2. Secure a portable radiation detector, and turn the instrument on to the lowest range. Turn the instrument on in a known area, and make sure that the background radiation level is normal. Also, check the batteries to make sure they have a good charge.

3. Proceed toward the vehicle, increasing the range if necessary, to keep the meter needle from pegging full-scale.

4. Circle the load slowly, trying to get the front part of the radiation detector as close as possible to the load. Also, look for any radiation symbols, or anything that appears as though it may contain radiation. If possible, get a contact reading.

If you are able to identify the load as being a man-made source shielded with lead, call your RSO and isolate the load. More often than not, the offending material will be NORM (Naturally Occurring Radioactive Material). Your company will need to decide what to do with NORM: whether to reject it or hold it aside.

False Alarms in Radiation Portal Monitors

When one buys a radiation detector, it should seem reasonable that you will be able to use this detector to warn you of any "bad" radiation. Unfortunately, the radiation world is really about shades of gray, as you soon find out. Especially with very sensitive equipment, "false" alarms are generated and must be sorted from "real" alarms. This article, written by a design engineer, is meant to assist with that determination.

Knowing a little bit about how the portal system works is important. One of the first things to learn is that there is a certain level of background or ambient radiation that is present all around us. Cosmic radiation is one source of this radiation, but a bigger contribution is from the dirt and rocks around us. Single atoms of radium or uranium are scattered widely throughout the earth, and are measurable with sensitive detectors. And this background radiation level is different at different geographic locations AND changes all the time, mostly due to precipitation. So the background radiation level must be constantly monitored, and the portal system must dynamically set an alarm point above this background level.

The second thing to keep in mind is the relative amounts of change in the radiation level, as seen by the detector. For instance, consider the standard portal radiation detector: a big "slab" of plastic scintillator, well-shielded by one inch or so of steel shielding on five sides. A standard alarm point might be just a 15% increase of background. When a large vehicle drives through the system, the mass of the vehicle blocks some of the ambient background radiation, actually reducing the radiation level seen by the detector by up to 40%. Most sensitive systems then have to dynamically change the alarm point as the vehicle drives through, and look for anomalous "spikes" or "bumps" in the radiation level. For right now, the point is that the amount of radiation that we are looking for is roughly ONE-THIRD that of the change caused by the presence or absence of the vehicle itself. Also, note that the changes in background radiation due (especially) to precipitation can increase the radiation level seen by the detector by 300%. So relative to the alarm point, these changes in the radiation level due to vehicle shielding or environmental changes are quite big.

That being said, the following is a brief list of the causes that routinely cause "false" alarms in portal monitors:

1. **Environmental Changes**: Especially at the beginning of a rainstorm, the background radiation level can increase by 300%. Obviously, detection of a 15% increase during this same timeframe may result in some alarms. The best recommendation is to pass the vehicle through a second time, or base your decision on the best two of three passes. Other than multiple passes, keeping the portal system clear of vehicles and watching for a “stable” background reading from the detectors is most likely the only helpful suggestion to reduce this type of alarm.

2. **Vehicle in Buffer Zone**: If a vehicle is allowed to pull up and stay close to the radiation detectors, then that vehicle may reduce the background radiation level as seen by the detector. We have seen reductions of about 15%, or very nearly the same as the alarm point. Therefore, if this vehicle drives off at the same time that another vehicle is within the portal, the radiation detector sees the increase in background radiation, and alarms. Our recommendation is for vehicles to stay out of the 3 m (10 ft) immediately before, after, and behind the detectors. Vehicles should only enter the buffer zone while driving through at a constant, slow speed.

NOTE:

Either of these first two alarms may be verified by looking at the radiation profile of the vehicle. The first and last samples should be very similar if the background radiation has not changed while the vehicle was present.

3. **Voids**: If the scrap metal has been loaded unevenly on the trailer, especially when dense bales are set on the axles with empty space between axles, an alarm may occur when the radiation detector sees the drop in radiation level as caused by the dense bale, and then sees the increase in radiation level as the empty space is encountered. Inspection of the scrap loading or screening with a portable detector may allow this determination to be made. Our portal system can avoid this problem if the bales are stacked on a flat-bed trailer, but not if the bales are inside a roll-off trailer.

4. **Driver with Medical Tests:** If the radiation profile shows a large increase at the very beginning of the vehicle, the driver should be screened with a portable radiation detector to determine if he is “hot.” This will not happen with X-rays, but with stress tests, colonoscopies, and other tests involving radioactive “dyes.” These radiation levels can be very big. A reading with a hand-held radiation detector may be 1000 times the background reading. Such an individual may be "hot" for weeks, with the radiation reading declining a little each day.

5. **Drive-By Medical:** Many sites are located very close to a major road, and the alarm may be triggered by drive-by vehicles with people who have had medical tests. Again, because they are so "hot" they only need to be within 46 m (50 yd) or so to set off the alarm. Alternatively, a worker on-site will have a test of this nature, and the alarm will be triggered intermittently until that worker is identified. This kind of alarm may be very aggravating and difficult to diagnose.

6. **Welds**: Some welding rods are “thoriated,” usually containing about 2% thorium. Thorium has an isotope that is radioactive, and the weld can thus be “hot.” This is also difficult to diagnose, but can be done if the vehicle is surveyed with a portable detector once the load has been removed from the trailer.

7. **Dirt and Scale:** Some dirt and scale buildup has natural (NORM) radiation, and can set off the radiation alarm if enough is accumulated in the bottom of the trailer. Again, like above, the cause will only be revealed if the "empty" trailer is surveyed.

8. **“Spike” or radiographic alarms:** A spike alarm, where only a single 0.1 second sample is much higher than normal, is indicative of either a software malfunction or possibly an alarm caused by radiography. Radiography is used to inspect pipe or thick steel structures for cracks, and thus requires high levels of radiation. Such radiography can set off these sensitive portal systems from a mile away. Some radiography is done in fixed locations, which is unfortunate if in close proximity to your portal system. But it is even harder to diagnose when temporary radiography work sites are set up, and are gone before they can be located. The best diagnostic tool is an independent radiation detector, maybe a handheld type that can be referred to whenever the alarm is detected.

With all these possible reasons for radiation alarms, many users do have a two-of-three passes procedure, and/or use portable radiation detectors to assist in determining the location or type of alarm.

Section 4 – Network Communication Information

The software uses TCP (Transmission Control Protocol) to communicate with the Model 4525 RPMs and the computers configured as Echo stations. The Echo station communicates only with the Supervisor station, and the Supervisor station communicates with the Model 4525 RPMs.

For communication between the Supervisor computer and the Model 4525, port 23 (TCP) and port 20034 (UDP) are used. The Device Finder and ip setup and the Supervisor application use UDP to search for available RPMs on the network.

The Echo station(s) connect to the Supervisor station at TCP Port 64500. Multiple Echo stations can be connected to a single Supervisor station.

Supervisor to RPM (RPM Network)

TCP Port 23

UDP Port 20034 (Find RPMs)

Echo Station to Supervisor Station

TCP Port 64500

Section 5 - Software Installation and Setup

Hardware and Software Requirements

The software is preinstalled on computers purchased from LMI. The software can also be installed on Windows™ based PCs.

Minimum Computer Requirements

- Windows 11 Professional (32-bit or 64-bit) or higher
- 1.6 GHz processor or greater
- 2 GB of memory (4 GB recommended)
- 64 GB hard drive for storing database and images
- SVGA monitor capable of a resolution of 1280 x 800 or greater
- Sound card with speakers for audible voice alarms

IP Addresses and Ports

Each device on a network has a unique address. This number is called the Internet Protocol (IP) Address. This number can either be dynamically or statically assigned. A static IP Address is assigned to the device manually. A dynamic IP Address is automatically assigned by a Dynamic Host Configuration Protocol (DHCP) server. The format is a 32-bit numeric address written as four numbers separated by periods (dots). Each of the four numbers ranges from 0 to 255.

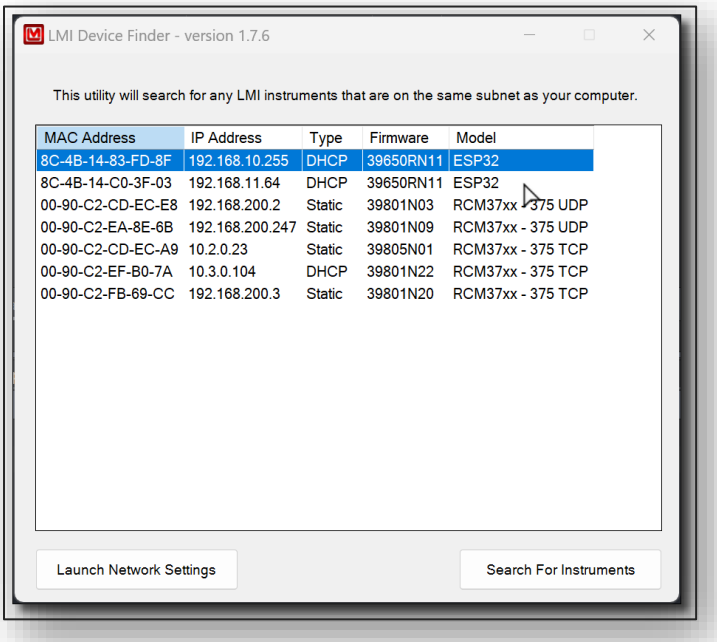
The port number is a number from 1 to 65535 that is typically used to map data to a particular process running on a computer. The default port for the RPM is 23 (TELNET).

IP Address Setup

The RPM network is set up using a Class C address range, which limits the total number of addresses from 192.168.200.1 to 192.168.200.254. The IP Default addresses are assigned as follows:

Supervisor	192.168.200.2
Echo Station #1	192.168.200.6
Echo Station #2	192.168.200.7
RPM #1	192.168.200.1
RPM #2	192.168.200.3
RPM #3	192.168.200.4
RPM #4	192.168.200.5
Camera #1	192.168.200.20
Camera #2	192.168.200.21
Camera #3	192.168.200.22
Camera #4	192.168.200.23

This is just an example of how to number the IP Addresses. Because of the many ways a network can be configured, consult the Network Administrator before connecting any devices to the network.



RPM NIC Configuration

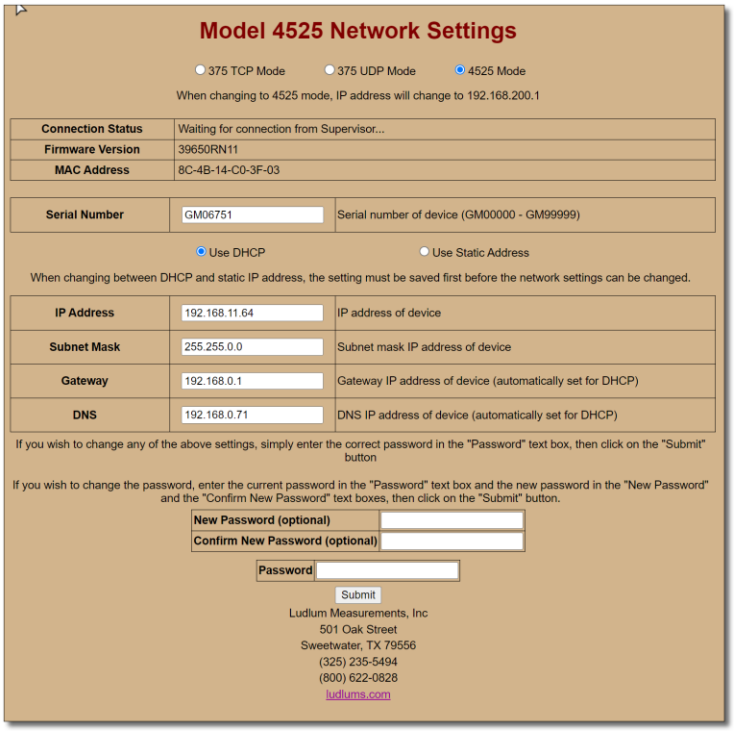
Note:

The network settings are stored in the RPM's network interface card. If this card is replaced it will need to be reconfigured to the correct settings.

When configuring a site for the first time, it is usually best to start with all lanes off and configure each lane one at a time.

The Device Finder program is used to find the devices on the network. Configuration is done via the Network Settings web page that is running on the Ethernet board.

Device Finder uses UDP communication to find the RPMs on the network. It displays the MAC address, IP address, DHCP or static IP assignment, firmware version, and model. The model shows which type of Ethernet board it finds. The older Ethernet boards are RCM37xx boards while the newer boards are ESP32. The RCM37xx boards use the included ipsetup program to change network settings. To change the network settings on the ESP32 board, select it from the list and click Launch Network Settings. This will open a web page with the IP address of the ESP32 board. If you know the IP address of the Ethernet board, you can open a web browser and type in the IP address into the address bar.



Ethernet Board Network Settings Page

From here, the following parameters can be changed for the 4525 Ethernet board.

- Serial Number
- DHCP or Static IP address
- IP Address
- Subnet Mask
- Default Gateway
- DNS Server

Note:

When switching from any mode to Model 4525, the IP address will automatically be set to 192.168.200.1.

The change the Ethernet board to work with the model 4525, select the **Model 4525** radio button at the top, type in the password in the password field at the bottom and click **Submit**.

After the change is made, the web page will report success and provide a Home link to return back to the network settings page.

For the 4525, the serial number must be in the following format: GM00000 – GM99999.

To change the default password, enter a new password in both **New Password** and **Confirm New Password** fields and enter the current password. The password will be changed once the **Submit** button is clicked.

Test Network

An RPM that is not visible through Device Finder or is experiencing timeouts might indicate a network problem. First check to make sure there are no firewalls running on the computer and that there are no devices between the computer and RPMs that might interfere with communication. Examples would be optical converters, wireless access points, or routers. Windows XP includes a firewall application that will need to be either disabled or modified to allow communication between the RPM and computer.

To test the network connection to any other device on the network, use the "ping" command. This command will transmit data to the specified IP address and display the time it takes to reach the remote address. If the destination is unreachable or the request timed out, the remote address may not be on the network, or the workstation may not be connected to the network properly. The ping command is a command-line based utility. To access the Windows command line, click on the Start button, select Run… and type "cmd," and click OK.

Example of good network communication

C:\>ping 192.168.200.2

Pinging 192.168.200.2 with 32 bytes of data:

Reply from 192.168.200.2: bytes=32 time<1ms TTL=128

Reply from 192.168.200.2: bytes=32 time<1ms TTL=128

Reply from 192.168.200.2: bytes=32 time<1ms TTL=128

Reply from 192.168.200.2: bytes=32 time<1ms TTL=128

Ping statistics for 192.168.200.2:

Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),

Approximate round trip times in milliseconds:

Minimum = 0ms, Maximum = 0ms, Average = 0ms

Example of bad network communication

U:\>ping 192.168.200.2

Pinging 192.168.200.2 with 32 bytes of data:

Request timed out.

Request timed out.

Request timed out.

Request timed out.

Ping statistics for 192.168.200.:

Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),

Approximate round trip times in milliseconds:

Minimum = 0ms, Maximum = 0ms, Average = 0ms

Software Installation

The software is available on the Ludlum website for download. The default install location for the software will be “C:\Program Files\Ludlum Measurements, Inc.\Model 4525 Gate Monitor”.

Note:

The 64 bit version of Windows changes the default install location to: “C:\Program Files (x86)\Ludlum Measurements, Inc.\Model 4525 Gate Monitor”.

Note:

The user must agree to the terms and conditions of the Software License Agreement before installing the software.

The Supervisor software is installed in: C:\Program Files\Ludlum Measurements, Inc.\Model 4525 Gate Monitor\Supervisor.

The Data Viewer software is installed in: C:\Program Files\Ludlum Measurements, Inc.\Model 4525 Gate Monitor\Data Viewer.

The Device Finder utility is installed in: C:\Program Files\Ludlum Measurements, Inc.\Model 4525 Gate Monitor\Supervisor.

The ipsetup utility is installed in: C:\Program Files\Ludlum Measurements, Inc.\Model 4525 Gate Monitor\Supervisor.

A shortcut is created on the desktop for the Supervisor, Data Viewer, and Device Finder applications.

Data Location

Data, configuration files, and camera images are stored in C:\ProgramData\Ludlum Measurements, Inc\Model 4525 Gate Monitor. By default, Windows does not show hidden files and folders. In order to see the ProgramData folder the Windows Explorer will need to be changed to show hidden files and folders.

Sharing the Supervisor Folder

The computers configured as Echo stations must have access to the data folder on the Supervisor station to view camera images. They can access the data either through a mapped network drive or a UNC path.

To share the Supervisor folder:

1. Double Click on ”My Computer.”
2. Double Click on “Drive C.”
3. Double Click on “ProgramData”
4. Double Click on “Ludlum Measurements, Inc.”
5. Right click on the “Model 4525 Gate Monitor” folder and select “Sharing and Security...”
6. Check “Share this folder on the network.”
7. Make the share name “SupervisorShare.”

Note:

The share name can be any name; it does not have to be what is specified here.

8. Check “Allow network users to change my files.”
9. Click “OK.”

To Map the folder on the other computers (Not necessary if using a UNC path in the software):

1. Double Click on “My Computer.”
2. Double Click on “My Network Places.”
3. Double Click on “Entire Network.”
4. Double Click on “Microsoft Windows Network.”
5. Double-click on “supervisor” or the name of the Supervisor computer.
6. Right click on “SupervisorShare” and select “Map Network Drive…”
7. Set the drive letter to “Z:” and check “Reconnect at logon.”
8. Click “Finish.”

On the Options screen of the Supervisor and Data Viewer enter the location to the Supervisor share. Examples:

X:\
Z:\
\\supervisor\SupervisorShare\
\\computer-name\share-name\

Station Configuration - Supervisor

1. Start the Supervisor application. If this is the first time, the station will be set to "Unknown."
2. Click on the Tools menu and select Options.
3. Click on the Station Configuration tab.
4. Set the station ID to "Supervisor." There can only be one computer designated as the Supervisor station. All other computers must be Echo stations.
5. Click on the Save button. The Supervisor application must be restarted for the station ID change to take effect.

Station Configuration - Echo

1. Start the Supervisor application. If this is the first time, the station will be set to "Unknown."
2. Click on the tools menu and select Options.
3. Click on the Station Configuration tab.
4. Set the station ID to Echo.
5. Enter the path to the Supervisor share. This can either be a mapped drive (z:\) or a UNC path (\\Supervisor\SupervisorShare).
6. Enter the Supervisor's name or IP address. The IP address can be found by looking at the Supervisor application's title bar on the computer configured as the Supervisor Station.
7. Click on the Save button. The Supervisor application must be restarted for the station ID change to take effect.
8. Repeat these steps for each computer serving as an Echo station.

NOTE:

The Echo station now supports multiple sites, which can be accessed from the drop-down list box on the main screen.

The status bar will display “Supervisor Connected” when it is able to successfully connect to the Supervisor station. The status bar on the Supervisor station will indicate how many Echo stations are connected.

Station Configuration - Data Viewer

1. Start the Data Viewer.
2. Click on the Tools menu and select Options.
3. If the station is configured as the Supervisor, enter the path to the Supervisor folder. This should be: “C:\ProgramData\Ludlum Measurements, Inc.\Model 4525 Gate Monitor”.
4. If the station is configured as an Echo, enter the path to the Supervisor share. This can either be a mapped drive (z:\) or a UNC path (\\Supervisor\SupervisorShare).
5. Click on the Save button.

Supervisor RPM Setup

1. Run the Supervisor software.
2. Click on the Tools menu and select Search Network.
3. Click on the Search button. The software will begin searching the network for available RPMs. As each RPM is found, its Unit ID is displayed.
4. Once all available RPMs are found, click the Save button.
5. Click on the Tools menu and select Assign RPMs.
6. Select a lane and click on the Add New button.
7. Select the RPM to add and click OK
8. Repeat steps 6 through 7 until all RPMs have been assigned a lane.
9. Click the Save button.

The Main screen should now try to connect to the RPMs. After a few moments, all the RPMs should have a status of “Connected.”

If any RPMs show timeout errors, double check all communication parameters.

Standard Computer Setup Checklist

- ☐ Terminate network cables.
- ☐ Unpack computer equipment and install at location.
- ☐ Connect RPMs and computers to Ethernet switch.
- ☐ Set up computer IP Address.
- ☐ Set up computer names and work group.
- ☐ Install software on computers.
- ☐ Set RPM network configuration.
- ☐ Share Supervisor folder.
- ☐ Map Supervisor folder on Echo/Data Viewer computers (optional).
- ☐ Setup Echo and Data Viewer software to use mapped drive letter or UNC path.
- ☐ Set up Supervisor to connect to RPMs.

Power-Down Procedure

1. Close all running programs, including the Supervisor and Data Viewer applications on each station.
2. Shut down the computer. Do not power off computer without first shutting down Windows, or data loss may result!
3. Turn off each RPM using the power switch inside the control box, or primary detector if the system does not have an external control box.

Section 6 – System Checks

Initial Instrument Check

Once the Model 4525 has been properly installed, it should be ready for normal operation upon checkout. The following procedures will take you through the initial checkout of the instrument and its operation.

Note:

Installation instructions with drawings and diagrams can be found in the Model 4525 Installation Manual.

1. Ensure that detectors, vehicle sensors, and any optional accessories are properly connected to the main electronics (i.e. printer, computer, strobes, horns, etc).
2. Confirm that the main electronics are connected to 110 Vac (220 Vac if applicable).
3. Flip the power switch on the connector plate inside the control box or primary detector panel to the on position. When this is done, all of the relays (that control the external horns or lights) will be activated for approximately five seconds. The relays then turn off, with the exception of the power ok light that stays on, and the checking light that will flash for 30 seconds.
4. At the end of 30 seconds, confirm that there are no instrument failure indications on the remote display, if used, or computer screen. The software should indicate the background level of radiation, and the absence of any vehicle within the system. The remote display, if used, should indicate power ok status only. Proceed with the operational check.

Operational Check

The operational check is an important assurance that the vehicle detection sensors and radiation detectors are working correctly. It is suggested that the operational check be performed on a weekly basis. This test, when coupled with the automatic system diagnostics, will ensure proper system operation.

For the operational check, it is necessary to use the radiation check source (sold as an option) to ensure proper alarm function. When the check source is not being used, store the check source in a secure area.

Note:

LMI check sources present minimal risks and are therefore unlicensed (Exempt Quantity Sources reference: 10 CFR 30.71 Schedule B). The radioactive element is sealed (permanently bonded or fixed inside a capsule). Consequently, cleansing of the user's skin after contact is not deemed necessary. Radiation exposure while handling this source is minimal with no identified long or short-term risks. Although the amount of radiation given off by exempt sources is so low that it presents no significant hazard, they should be handled with care and respect. Time, distance, and shielding are the best ways to control exposure.

1. While placing one hand in front of the infrared sensor, position the check source over the "Ludlum Measurements, Inc." sticker on the detector.
    a. The checking light on the remote display, if used, should now be lit, and the Supervisor software should show that the lane is occupied.
    b. After three to four seconds, remove the source from the detector and your hand from in front of the sensor.
2. Verify that the alarm circuit is activated by checking to see if the alarm light(s) is on. Any other remote alarm indicators should also be activated (i.e. strobe or horn if applicable) and the Supervisor software should display an alarm "popup" message.
3. Press the alarm reset button on the remote (if used), or if the alarm hold time is set to a non-zero number, wait until the alarm automatically clears.
    a. All alarm indicators should go off, including any remote strobe or horn (if applicable).
    b. The "popup" alarm window must be cleared manually, by clicking on the "X" in the upper right-hand corner.

4. Repeat the procedure for any other active radiation detector and each infrared vehicle sensor pair. Once completed successfully, the system is ready for normal operation.

Note:

This procedure should be performed periodically. A complete recalibration is unnecessary as long as the system passes the alarm check with no other indications of failure.

NORM Operational Check

The version of the Model 4525 that reduces NORM alarms needs to be checked on a periodic bases to ensure that the additional NORM features are working correctly. This NORM Operational Check may be done as an additional test at the same frequency level as the standard Operational Check give prior to this.

REQUIRED SOURCES NEEDED

A high-energy radiation source, typically ^{137}Cs, is needed for this test. A low-energy radiation source, typically ^{57}Cobalt of approximately 20 µCi or 740 kBq, will be needed to perform this test, as well as a source of NORM. At Ludlum Measurements, a piece of salvaged NORM pipe approximately 2 meters long and measuring about 75 µR/hr or 0.75 µSv/h on contact was used for the following test.

The following test is general and will need to be modified to allow for the particular alarm point settings used and the radiation sources that are available. The objectives of this NORM Operational Check are:

1. To demonstrate that the system alarms and identifies low-energy ratio alarms
2. To demonstrate that the system alarms and identifies high-energy ratio alarms
3. To demonstrate that a certain level of NORM radiation can show an increase in the overall radiation level on the vehicle profile, but not trigger the alarm (because of increases in both low AND high energy levels)
4. To demonstrate that certain levels of NORM, if distributed throughout a load, may trigger an alarm but be identified as POSSIBLE NORM alarm.

It is assumed that the user has already taken care to set alarm points appropriately. Doing so means that the user has determined levels of low and high-energy radiation to trigger an alarm, and also determined levels of NORM that will or will not trigger an alarm. These tests were performed at Ludlum Measurements with the following (arbitrary) alarm points:

- All Sigma Set points were set to 200.0 sigma
- All Low Ratio alarms were set at 5%
- All High Ratio alarms were set at 5%
- The Distributed NORM percentage was set at 70%, with the maximum sigma at 400.
- The Distributed NORM alarm was enabled, the Ratio alarms were enabled, and the Gamma Percentage was disabled.

Note:

Results of the test depend on the chosen alarm points, the available source sizes or strengths, and the distance between the source and detector during the test. As with the Operational Check, it is important to determine a repeatable test so that instrument malfunction can be detected.

The following test can be used to fulfill the four objectives listed above:

1. Ensure that the system has a valid background by clearing any vehicles that are within the portal and pressing the RESET button on the Model 4525 Remote for 5 seconds, which will restart the system.
2. Wait until the system READY status indicator shows that the initial background process is finished.
3. Have someone block the infrared beams at the detectors to simulate a vehicle driving through the system. Wait for 5 seconds.
4. Carry the low-energy radiation source (^{57}Co or equivalent) through the portal near to one side of the portal, close to the detector(s). Remove the source from the vicinity of the portal.
5. Wait a few seconds and unblock the infrared beams.

6. The low-energy radiation source (if strong enough and close enough to the detector) should trigger the low-energy ratio alarm. Confirm and reset the alarm. If desired, the user may repeat steps 3-6 for the other detector(s).

7. Repeat steps 3-6 using the high-energy radiation source (^{137}Cs). Confirm that the high-energy ratio alarm is triggered with this source.

8. Repeat steps 3-6 using the NORM source. Confirm that the source profile shows the increase in radiation level from the radiation source, but that the Ratio Graph shows no substantial change. When performed with the "right" source size, alarm point, and distance between source and detector, the test should NOT trigger an alarm.

9. Repeat steps 3-6 using the NORM source, but instead getting the NORM source closer to the detector to exceed the sigma alarm point (but not the Max Sigma set point) for a duration of time greater than the percentage set point, e.g. if the percentage is set to 70%, ensure that the source is at the detector for at least 42 seconds during a 60-second simulated vehicle occupancy. This procedure should trigger the alarm, but the red "Possible NORM Alarm" status bar should also be triggered.

Annual Checks

Annual checks should be performed by trained personnel in order to detect and correct problems or potential problems within the system. Yearly checks should include:

- ☐ Check backup battery voltage status.
- ☐ Check for loose wires, etc.
- ☐ Check for water leakage or metal corrosion.
- ☐ Check system parameters.
- ☐ Check occupancy sensors' alignment.
- ☐ Run computer diagnostic routines and check memory storage.
- ☐ Replace the internal gel-cell backup battery every four years to provide assurance of backup power during power outages.

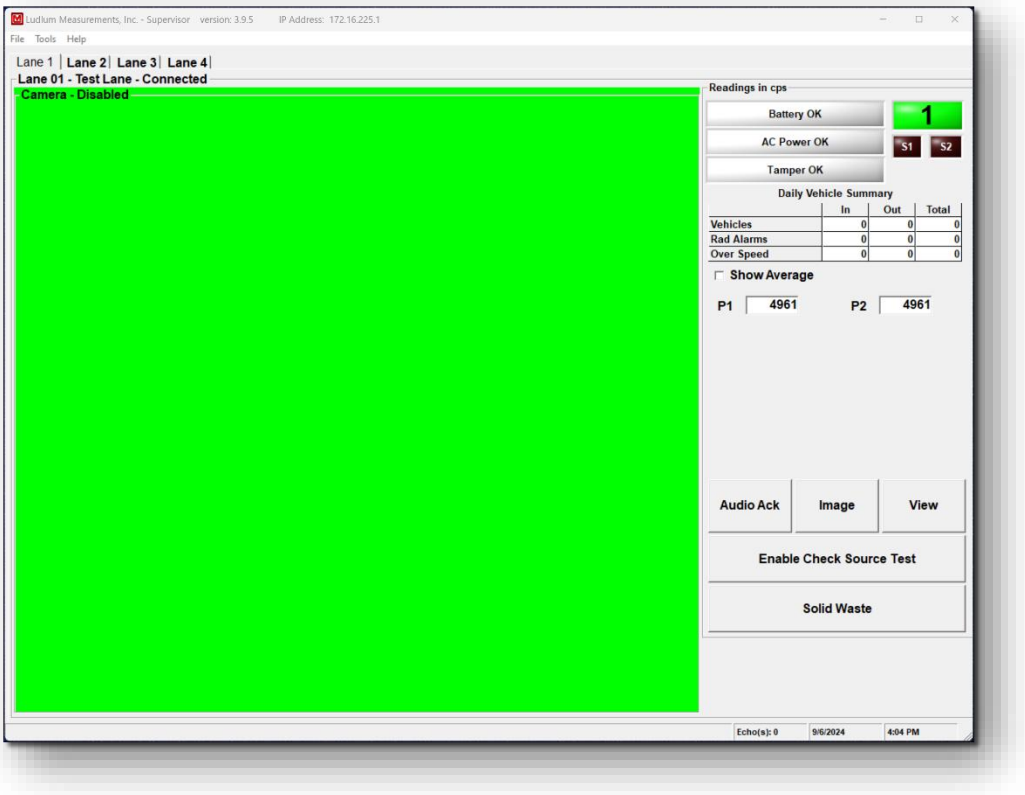
Maintenance

The only routine maintenance required is to clean the infrared occupancy sensors. It is recommended to periodically clean the front lenses of the sensors using a soft cloth and water only.

Section 7 – Supervisor Software Overview

Main Display Window

The Supervisor software can be configured as a Supervisor station or as an Echo station. When configured as a Supervisor, the user has full access to all configuration options including RPM setup, RPM parameters, software options, and archive functions. Echo stations are allowed to only change options that relate directly to the Echo station's functions.



The main screen displays four tabs with each tab displaying the data for one lane. Each tab displays a camera image, battery and AC power status, infrared sensor indicators, and vehicle counts including number of radiation alarms and over-speed alarms, and the current background readings for each panel. There

are buttons to acknowledge the audio, to display the camera image in a larger window, and a button to view the current occupancy in the Data Viewer application. The vehicle counters are grouped into inbound and outbound values. The background readings may be displayed as individual panels or as a single average of all enabled panels.

If the station is configured as an Echo, then an indicator at the top right of the screen indicates if the Echo has successfully made a connection to the Supervisor station. A list box next to the indicator allows the user to change between different Supervisor stations.

If the camera is enabled, then either a live image is displayed in the image area or a static image will be displayed. Live images are currently only supported using IQeye cameras and when the camera streaming option is enabled. When the camera streaming option is not available or disabled, the main window will update with a new camera image when a vehicle enters or exits the portal. The camera image may be triggered when a vehicle enters or exits the RPM. A user-definable time can be set to allow the image to be triggered up to 9.9 seconds after the vehicle enters or exits the RPM. If a camera is not enabled, then the image area displays an animated truck or train image that moves to the left or right to represent a vehicle in the RPM.

Two indicators are used to represent the infrared sensors and are labeled “S1” and “S2.” The infrared sensors are used to detect when a vehicle enters the RPM and to calculate the speed. The indicators will turn red when the infrared sensors are blocked by an object.

The main screen displays the lane number, user-defined lane caption, and RPM status in the frame that borders the image area. The following status message may be displayed:

- **Connected**: The Supervisor is connected to the RPM and communicating normally.
- **Timeout**: The Supervisor has received no data from the RPM in the last 10 seconds.
- **Retrying**: The Supervisor is attempting to reconnect to the RPM.
- **Missing:** The Supervisor was unable to reconnect to the RPM and will continue trying to connect every 10 seconds.
- **Rebooting:** The RPM is rebooting.
- **Initializing**: The RPM is taking an initial 30-second background count and is not ready for vehicles.
- **Radiation Event**: One or more channels have a Low or High background failure.
- **Sensor Blocked**: The infrared sensor has been blocked longer than the specified limit.

- **Alarm**: A radiation alarm has occurred.
- **Only One Infrared**: Only one infrared was blocked during the vehicle occupancy. This will automatically clear once a vehicle as blocked both infrared sensors.

Failures

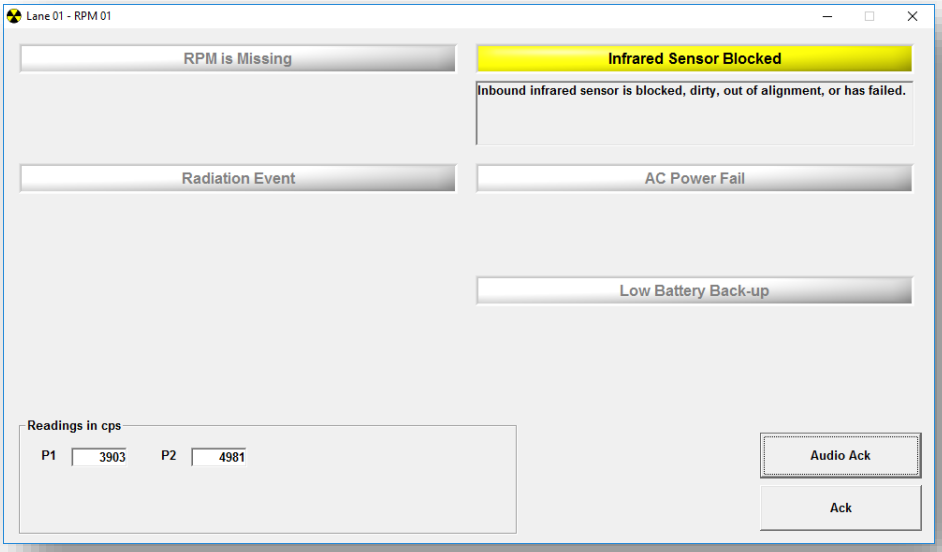
Failures can be caused by several conditions including low or high backgrounds and infrared sensor problems. If there is a radiation event, the background readings on the main screen will turn red on the main screen, the status will change from “Connected” to “Radiation Event,” indicating there is a problem with one or more detector panels. A fail window will pop up indicating which channel and what type of background alarm occurred.

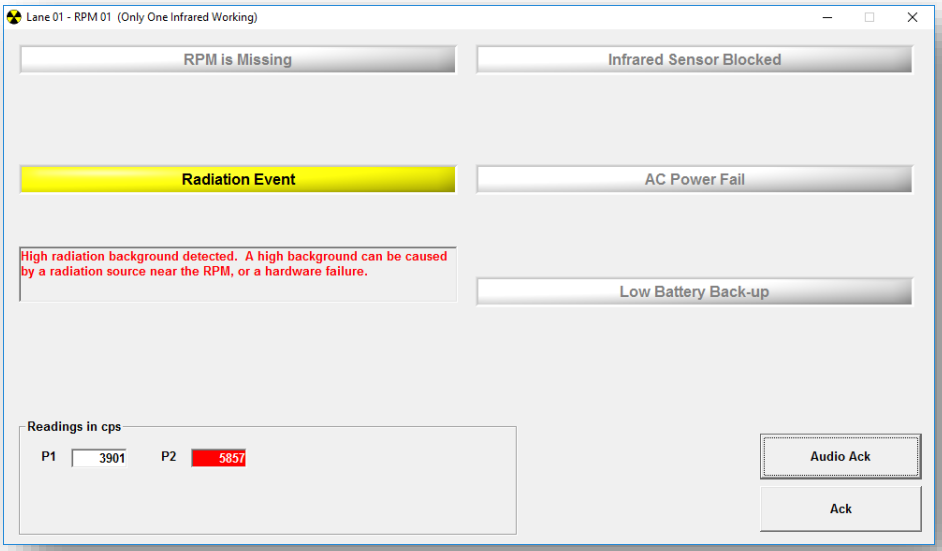
Low-background alarms are displayed in purple, and high-background alarms are displayed in red. If the sensors are misaligned or blocked long enough to trigger the sensor fail timeout, the sensor fail window will pop up and the status will change from “Connected” to “Sensor Fail.” These windows must be closed manually and will reappear if closed before the failure is corrected. Clicking on the "Audio Ack" button will silence the audio. A report is also printed when each event occurs. If the Supervisor Location option is set to Local, then the Audio Ack button will also silence the audio on the RPM.

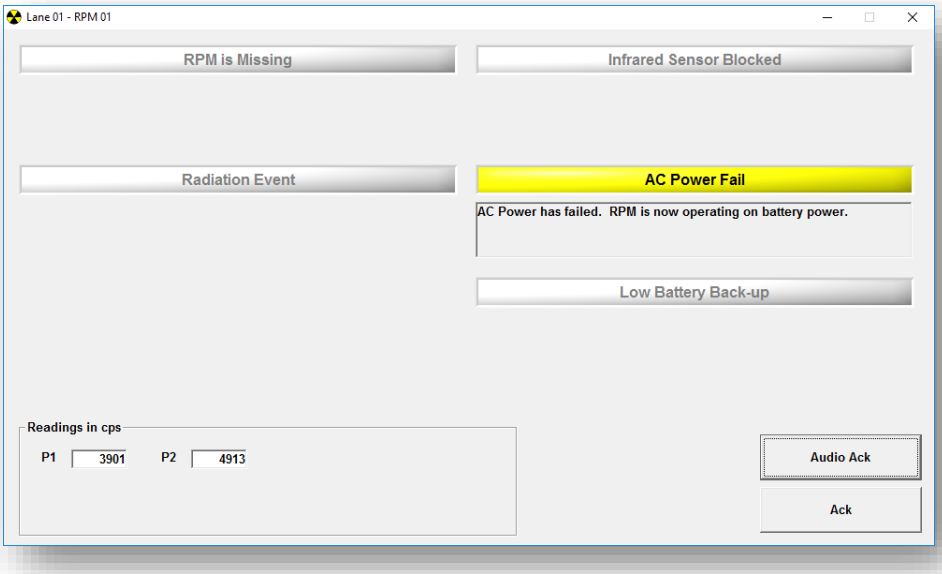
When the AC power fails or if a low battery is detected, the fail window will pop up to alert the user. During an AC fail condition, the AC indicator on the main screen will turn yellow. During a low battery condition, the battery indicator on the main screen will turn red. The fail window may be closed during these events, and will not pop up as long as any other type of failure does not occur. The failure window will also stay open after the failure goes away in order to inform the user of failures that could have occurred during the night.

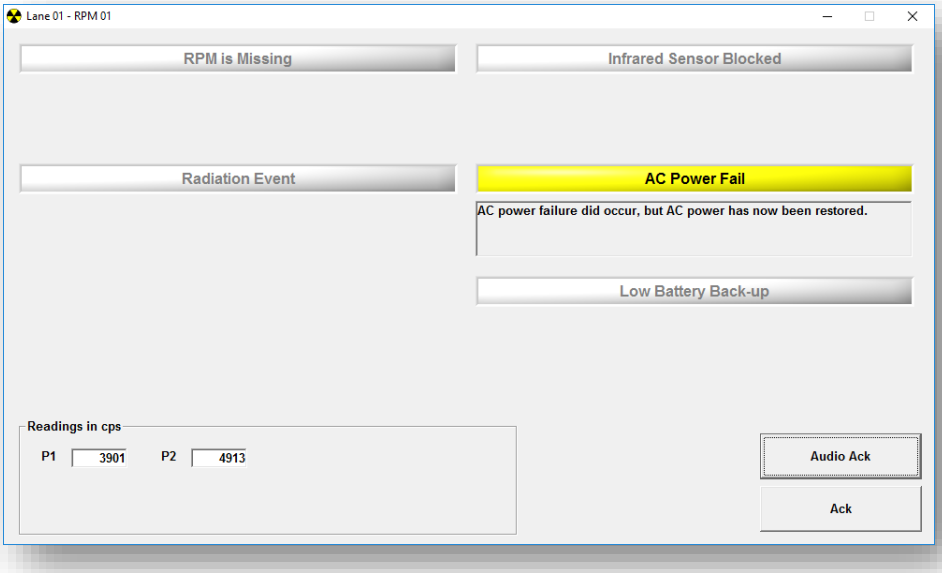
The fail window can display multiple failures in the same window.

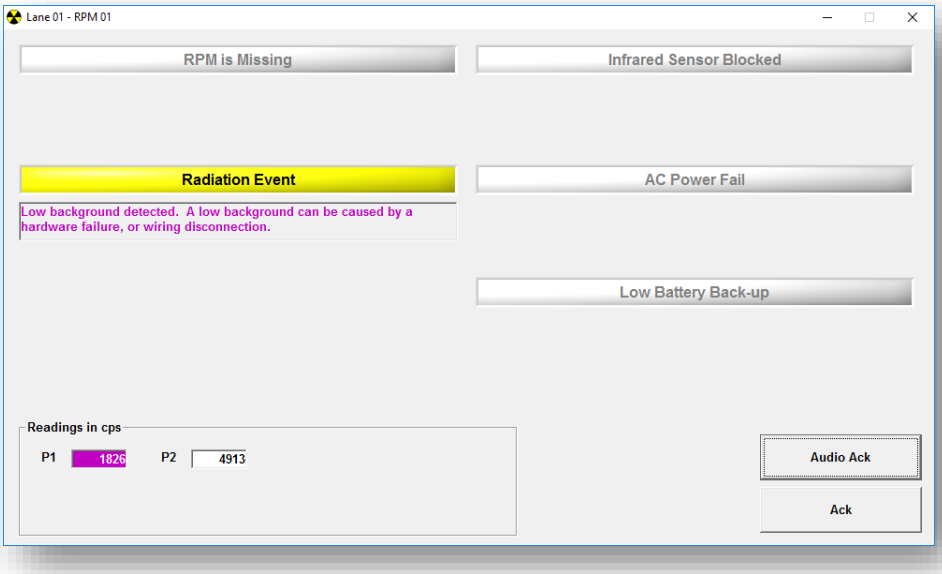
Examples of various fail windows

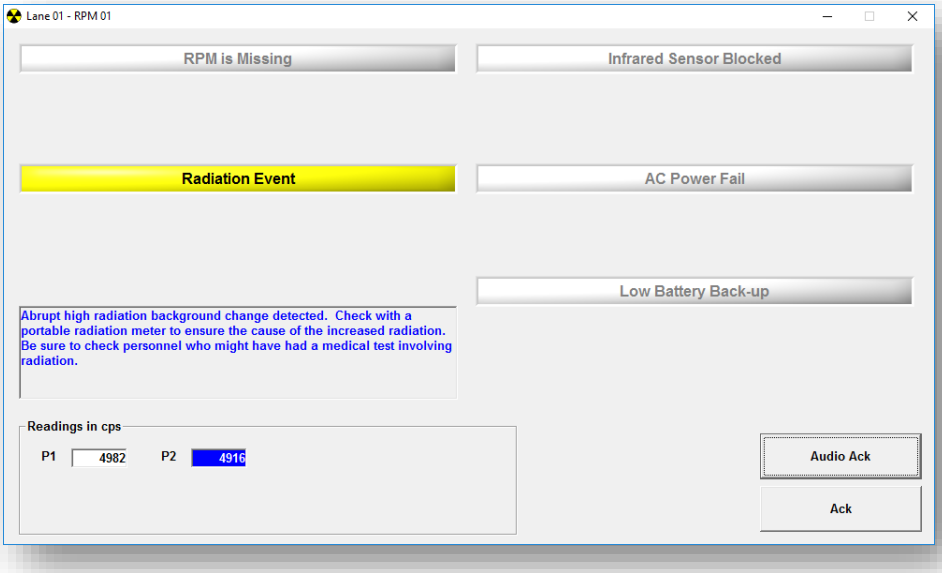


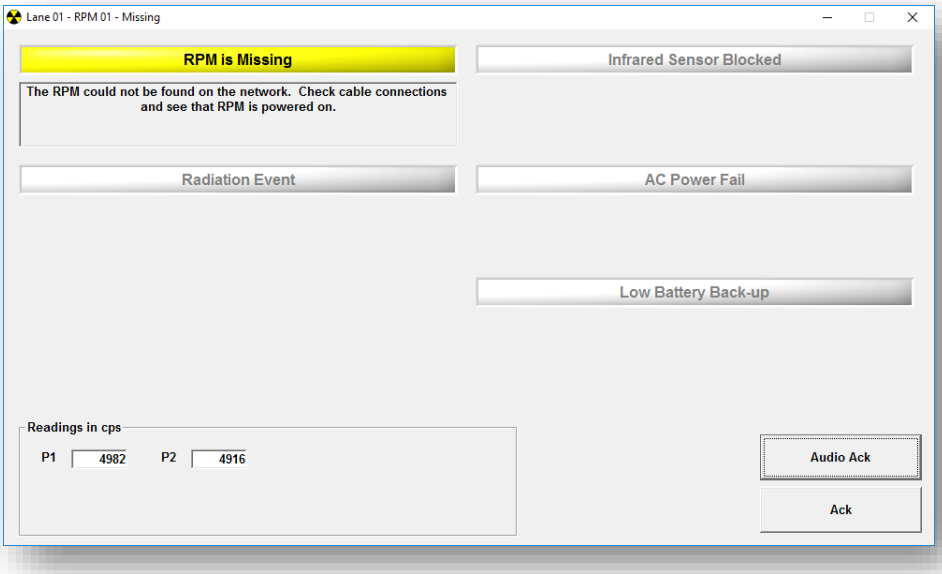


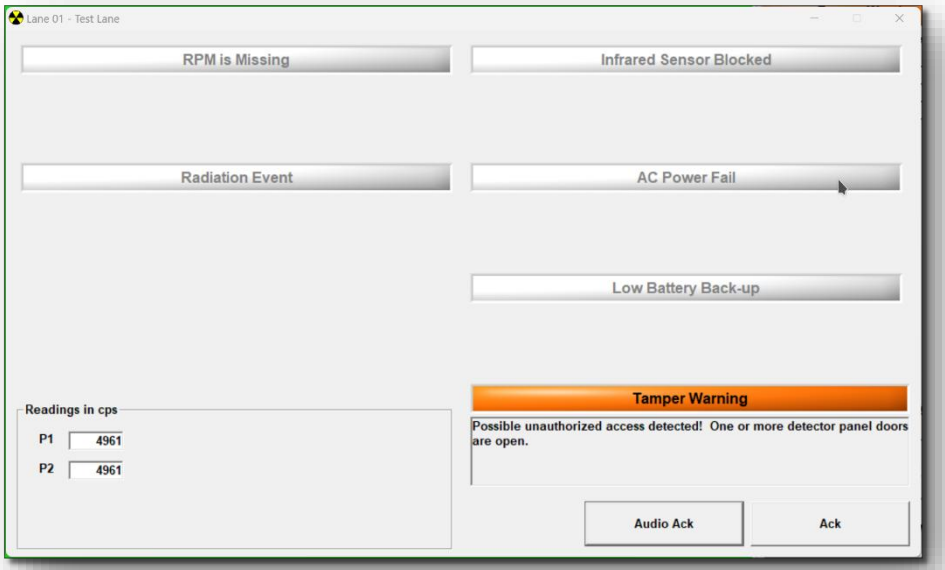

Lane 01 - RPM 01
RPM is Missing
Infrared Sensor Blocked
Radiation Event
AC Power Fail
AC Power has failed. RPM is now operating on battery power.
Low Battery Back-up
Readings in cps
P1
3901
P2
4913
Audio Ack
Ack


Lane 01 - RPM 01
RPM is Missing
Infrared Sensor Blocked
Radiation Event
AC Power Fail
AC power failure did occur, but AC power has now been restored.
Low Battery Back-up
Readings in cps
P1
3901
P2
4913
Audio Ack
Ack

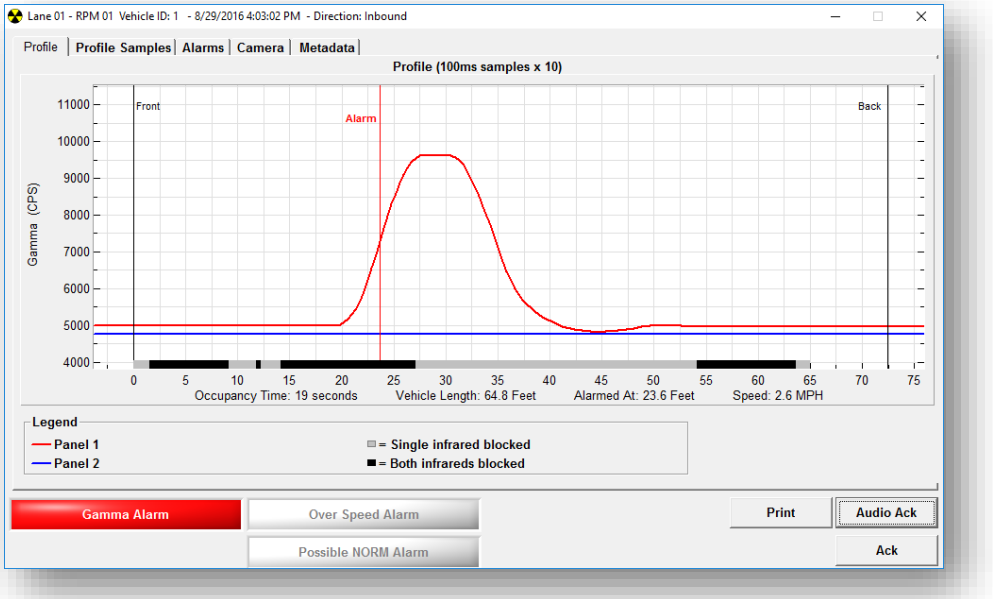

Lane 01 - RPM 01
RPM is Missing
Infrared Sensor Blocked
Radiation Event
AC Power Fail
Low background detected. A low background can be caused by a hardware failure, or wiring disconnection.
Low Battery Back-up
Readings in cps
P1
1826
P2
4913
Audio Ack
Ack


Lane 01 - RPM 01
RPM is Missing
Infrared Sensor Blocked
Radiation Event
AC Power Fail
Low Battery Back-up
Abrupt high radiation background change detected. Check with a portable radiation meter to ensure the cause of the increased radiation. Be sure to check personnel who might have had a medical test involving radiation.
Readings in cps
P1
4982
P2
4916
Audio Ack
Ack


Lane 01 - RPM 01 - Missing
RPM is Missing
Infrared Sensor Blocked
The RPM could not be found on the network. Check cable connections and see that RPM is powered on.
Radiation Event
AC Power Fail
Low Battery Back-up
Readings in cps
P1
4982
P2
4916
Audio Ack
Ack


Lane 01 - Test Lane
RPM is Missing
Infrared Sensor Blocked
Radiation Event
AC Power Fail
Low Battery Back-up
Tamper Warning
Possible unauthorized access detected! One or more detector panel doors are open.
Readings in cps
P1
4961
P2
4961
Audio Ack
Ack

Alarm Window

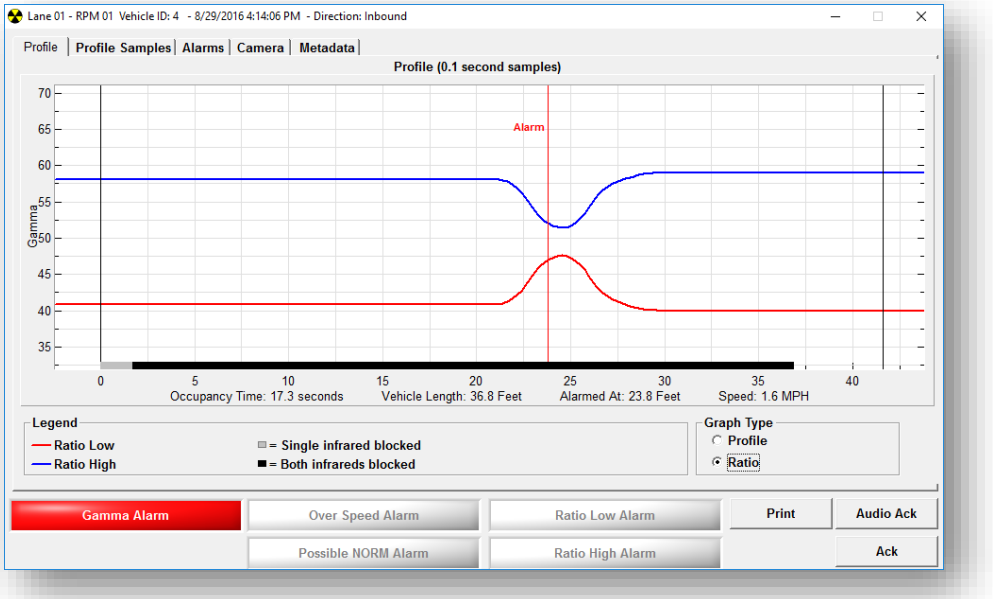


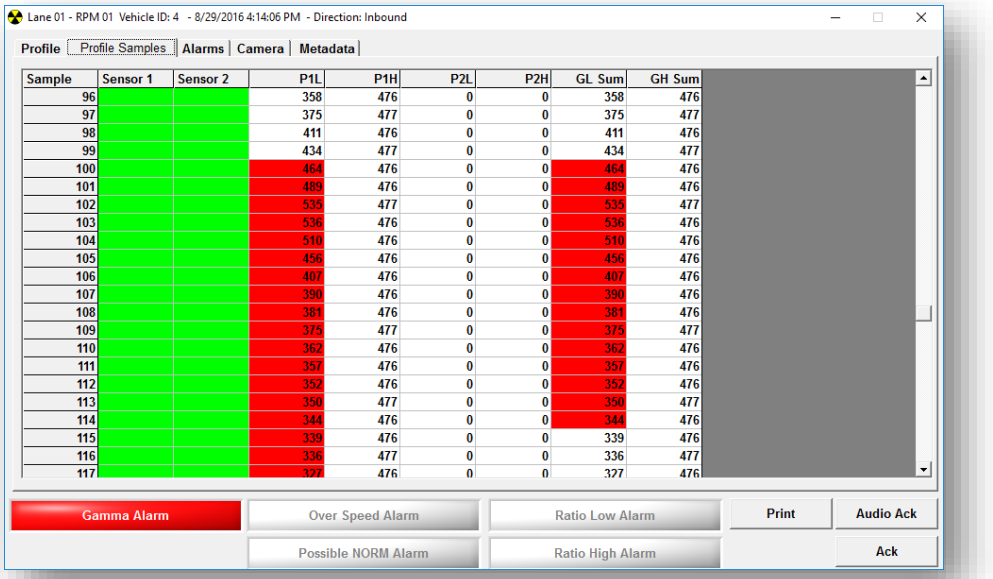
The Alarm window is automatically displayed and an alarm report is printed when a gamma alarm or over-speed alarm occurs. The alarm window is grouped into five tabs, each representing a different aspect of the alarm. The bottom of the alarm popup displays the gamma alarm status, over-speed alarm status, and the direction, date, and time of the occupancy. A Print button allows

another copy of the alarm report to be printed. The Audio Ack button will silence the audible alert, and the Ack button will acknowledge the alarm and close the alarm window. The alarm window will also indicate if the gamma or over-speed alarm is being ignored because of the direction. The alarm window can be configured to require a password before the alarm can be acknowledged.

The Profile tab displays a graph representing the background readings during the occupancy. Up to three plots are displayed, with each plot representing the sum of the left, right, and top (if available) panels. The readings are displayed in counts per second (CPS) or in µR/hr. If a valid speed was calculated for the occupancy, the X-Axis will display the profile samples in either feet or meters. If no speed was calculated, the X-Axis will display as 100 ms sample intervals. The front and back of the occupancy is denoted by two black vertical lines. A vertical red line will indicate the location of the gamma alarm. The status of the infrared sensors is plotted at the bottom of the graph as either dark red squares (one infrared sensor blocked) or bright red (both infrared sensors blocked). If enabled, the graph will also show the background averages used for the percent alarm

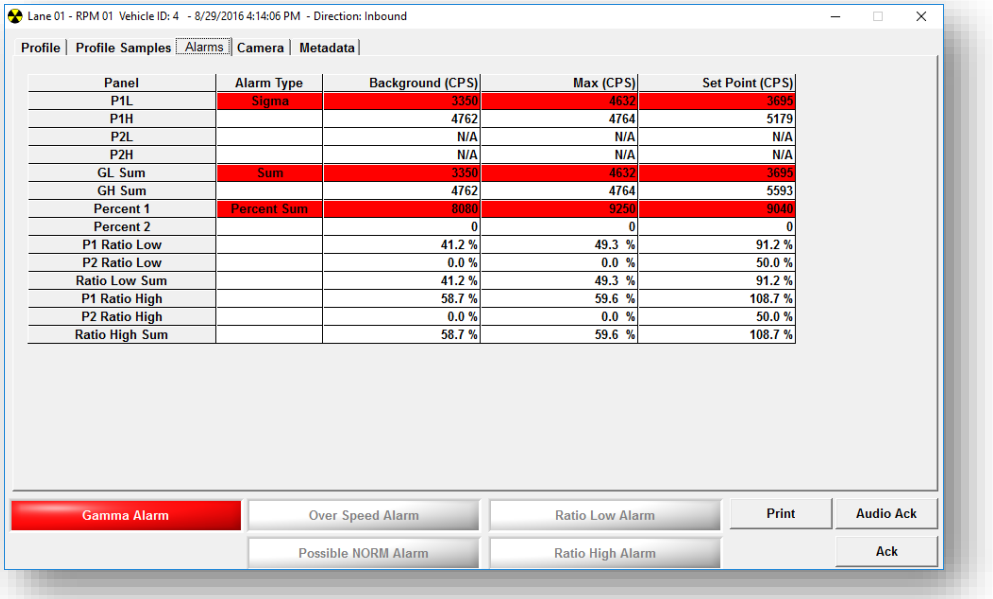
calculation. These are only plotted when both infrared sensors are blocked and appear as dotted lines.





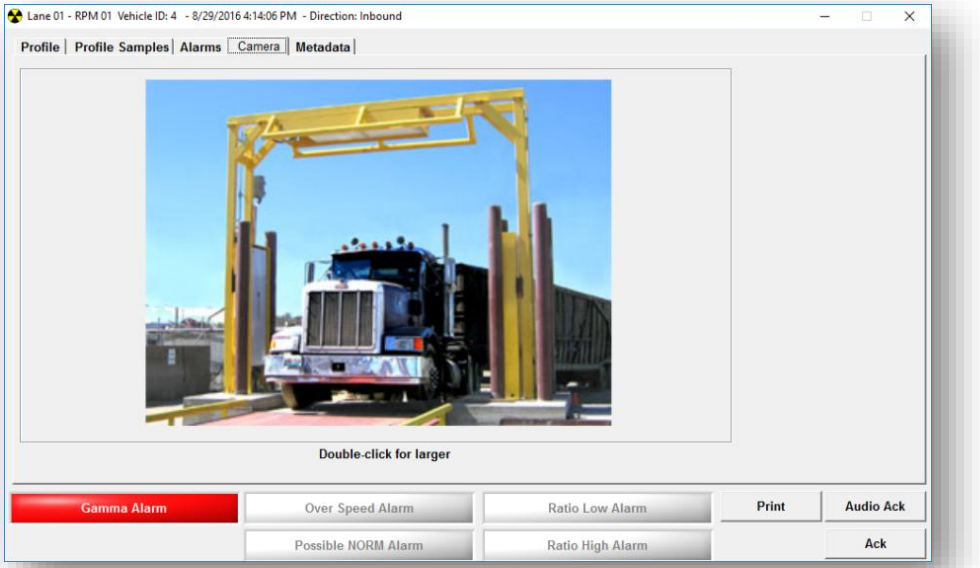
Sample	Sensor 1	Sensor 2	P1L	P1H	P2L	P2H	GL Sum	GH Sum
96			358	476	0	0	358	476
97			375	477	0	0	375	477
98			411	476	0	0	411	476
99			434	477	0	0	434	477
100			464	476	0	0	464	476
101			489	476	0	0	489	476
102			535	477	0	0	535	477
103			536	476	0	0	536	476
104			510	476	0	0	510	476
105			456	476	0	0	456	476
106			407	476	0	0	407	476
107			390	476	0	0	390	476
108			381	476	0	0	381	476
109			375	477	0	0	375	477
110			362	476	0	0	362	476
111			357	476	0	0	357	476
112			352	476	0	0	352	476
113			350	477	0	0	350	477
114			344	476	0	0	344	476
115			339	476	0	0	339	476
116			336	477	0	0	336	477
117			327	476	0	0	327	476

The Profile Samples tab shows the raw samples that were captured during the occupancy. The grid shows the sample number, infrared sensor 1 and 2 status, detector panel readings, and the sum. The readings are the counts received in 100 ms intervals and include the pre-samples (values before the RPM is occupied), occupied samples, and the post-samples (readings after the occupancy). The background color for the infrared fields is green when a sensor is blocked. The background color for the panel readings are red to indicate where the background occurred.



Panel	Alarm Type	Background (CPS)	Max (CPS)	Set Point (CPS)
P1L	Sigma	3350	4632	3695
P1H		4762	4764	5179
P2L		N/A	N/A	N/A
P2H		N/A	N/A	N/A
GL Sum	Sum	3350	4632	3695
GH Sum		4762	4764	5593
Percent 1	Percent Sum	8080	9250	9040
Percent 2		0	0	0
P1 Ratio Low		41.2 %	49.3 %	91.2 %
P2 Ratio Low		0.0 %	0.0 %	50.0 %
Ratio Low Sum		41.2 %	49.3 %	91.2 %
P1 Ratio High		58.7 %	59.6 %	108.7 %
P2 Ratio High		0.0 %	0.0 %	50.0 %
Ratio High Sum		58.7 %	59.6 %	108.7 %

The Alarms tab displays which panel has alarmed and includes the alarm type, background reading, max reading, and if the alarm set point has been enabled. The Alarm Type indicates if the alarm was a Sigma, Sum, or Percent Sum alarm.



The Camera tab displays the image taken during the occupancy or a representation of the type of vehicle. If a camera is enabled, then the image captured during the occupancy will be displayed. The image may not be displayed immediately depending on the camera's trigger time. If the camera is disabled, then either a picture of a truck or train car will be displayed. A radiation symbol will be displayed to indicate the approximate location of the alarm. Double-clicking on the image will display it in a larger window.

For the system that offers more discrimination of NORM background, the screenshot shows the different alarms that are possible (see below).

The Gamma Alarm (shown in red) indicates the presence of gamma radiation in excess of the sigma level set points. This alarm does not indicate the energy level or discriminate on the type of gamma radiation, just that the level is high and should be investigated further.

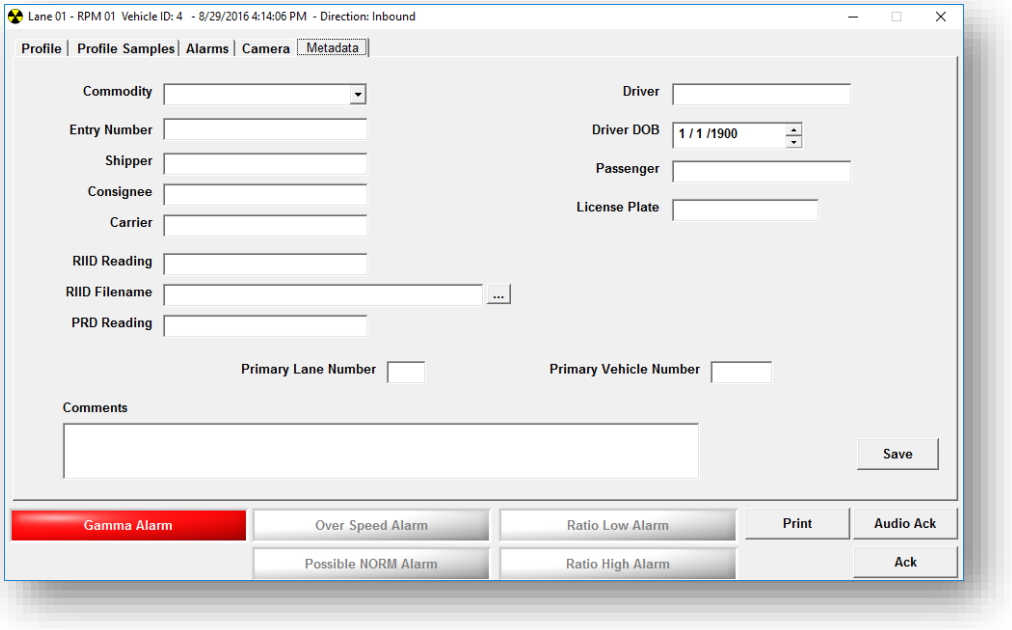
The Neutron Alarm will be activated in the “N” –suffix systems whenever the neutron sigma set points are exceeded. Generally, neutron alarms are regarded as “high threat” alarms since neutrons are fairly specialized particles and common in nuclear weapons. Still, there are some common industrial sources utilizing neutrons, and neutrons are also widely used in moisture-density gauges in highway departments. The Over Speed Alarm simply indicates that the vehicle has driven faster than the speed limit parameter. Driving too fast through the system reduces the radiation sensitivity of the system. If this alarm is activated, it may be possible for the system to miss some amounts of radiation in the vehicle. Procedures should be followed to correct this problem.

The Possible NORM Alarm is activated by low levels of radiation distributed throughout the vehicle load. This feature typically is used to warn of the carrying of low-level NORM, such as is found in minerals, kitty litter, or ceramics. This alarm will NOT be activated if the gamma radiation level is too high, or if the radiation profile indicates a single "spot" of excess radiation.

The RATIO LOW ALARM will be activated if the system detects an excess of low energy radiation from the vehicle. While such alarms may indicate the presence of Special Nuclear Material (SNM), which is a high threat condition, the RATIO LOW ALARM may also indicate the presence of medical isotopes located in the driver.

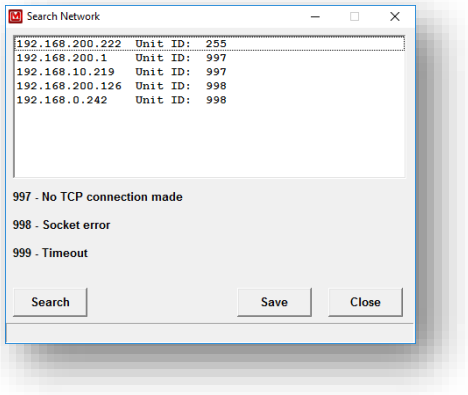
The RATIO HIGH ALARM will be activated if the system detects an excess of high energy radiation from the vehicle. Such alarms are typically activated by higher energy industrial sources.

The Metadata tab (below) displays information that may be entered for the alarm. This information includes the commodity, shipper, consignee, license plate, and comments. This information can also be entered through the Data Viewer.



Searching for RPMs

Use the Tools/Search Network... menu option to search the network for new RPMs.

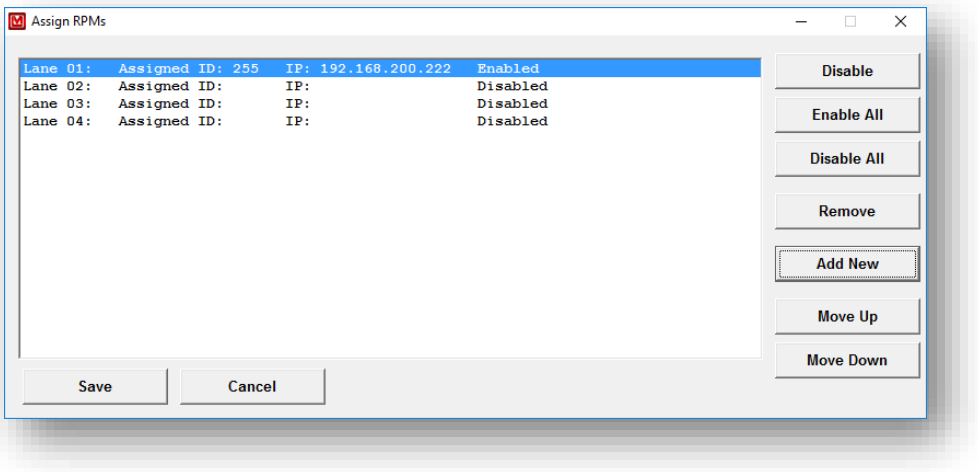


Click the Search button to begin searching for RPMs. When all available RPMs have been found, click the Save button. As each RPM is found, the Supervisor software retrieves its unit ID and displays it next to the IP Address. The Supervisor software displays several codes when retrieving the unit ID if a problem occurs. They are:

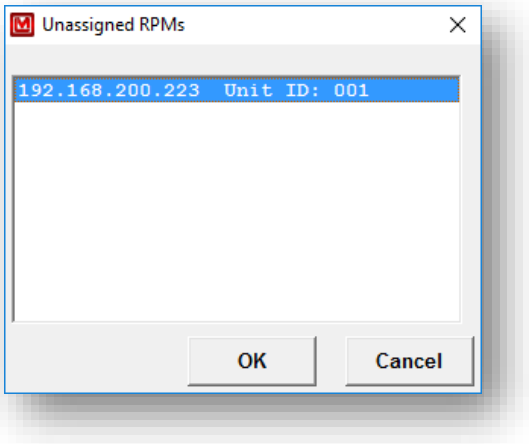
- 997 – Supervisor is unable to make a TCP connection.
- 998 – Network socket error.
- 999 – Supervisor timed out waiting for response to unit ID command.

Assigning RPMs to a Lane

Use the Tools/Assign RPMs… menu option to assign RPMs to a lane. This screen also allows an RPM to be enabled or disabled and to move an RPM assignment from one lane to another.



To assign an RPM to a lane, select a lane and click on the Add New button. A list of all unassigned RPMs that were found in the Search screen will be displayed. Highlight an RPM and click on the OK button.



Disable: To disable a lane, highlight it and click on the Disable button.

Enable: To enable a lane, highlight it and click on the Enable button.

Enable All: Clicking on the Enable All button will set all lanes with an assigned RPM to enabled.

Disable All: Clicking the Disable All button will set all lanes with an assigned RPM to disabled.

Move Up: Click the Move Up button to move a lane to the next lower lane number.

Move Down: Click the Move Down button to move a lane to the next higher lane number.

Save: Click the Save button to save the current lane assignments.

Cancel: Click the Cancel button to restore the previous lane assignments.

Setting Parameters

Use the Tools/Set RPM Parameters… menu option to set the operational parameters for each RPM. This screen also provides the ability to reboot the RPM and to manually reset the occupancy counters. The parameters screen is divided into seven tabs that group related parameters together. An RPM can be selected by clicking on the Select Lane list box and selecting a lane. To change a parameter, click the Set button next to the parameter or the button for the current tab.

Reset Counters: Reset all occupancy counters to 0.

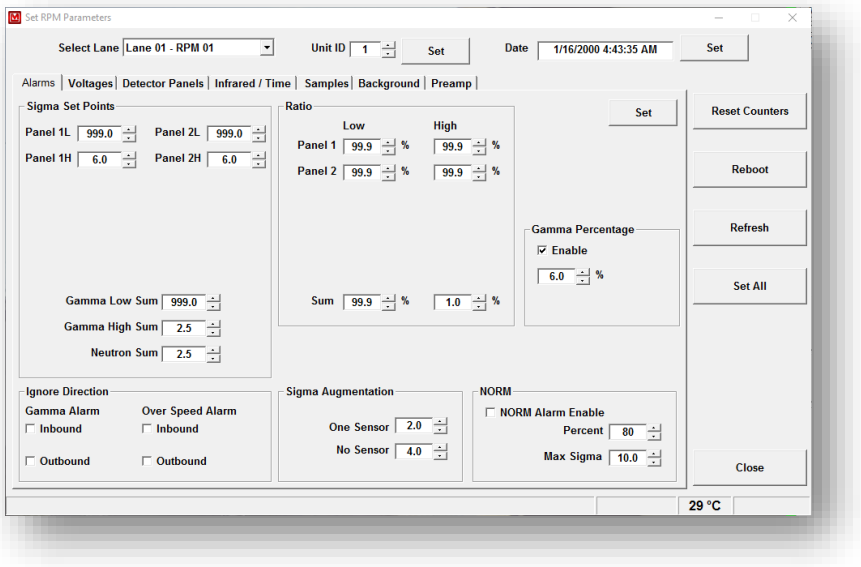
Reboot: Reboot the RPM. After rebooting, it will take approximately 30 seconds for the RPM to be ready for operation.

Refresh: Reloads all parameters from the RPM.

Set All: Sets all parameters on all tabs.

Unit ID: An identification number that can be assigned to each Model 4525. Valid values are from 1 to 255.

Date: The current date and time when the parameters were downloaded. The computer's current date and time is used when any parameter is set. This date and time must be set correctly for proper operation with the SD card upgrade.



The Alarms tab is used to set the radiation alarm set points and if a gamma or over speed alarm is ignored for a particular direction.

Sigma Set Points: These parameters set the number of standard deviations above background that it takes to set off a radiation alarm. There are individual set points for each detector panel and a set point for the sum of all detector panels. If neutron detectors are enabled, then there is a neutron sigma sum alarm parameter. There are no individual neutron detector alarms. A standard deviation is assumed to be equal to the square root of the background count. As a simple example, a 3-sigma alarm of a detector with a background count rate of 1000 counts is calculated as 3.0 times the square root of 1000, which equals 95. In this simple example, a sudden count of 1095 counts would cause an alarm. As a correction for Poisson statistics, which deviate from normal Gaussian statistics, a constant of 2.7 is added to the alarm calculation. The addition of this constant is negligible at higher backgrounds, but is especially important with the low backgrounds. The sigma alarm is adjustable from 2.5 to 999.9.

Net Gamma Ratio Alarm Set points: Sets the value used in the ratio alarm calculation in terms of a percentage. There is a high and a low ratio set point for each panel. RatioLo is calculated as GammaLo / (GammaLo + GammaHi). RatioHi is calculated as GammaHi / (GammaLo + GammaHi). The ratio alarms are adjustable from 0.1 to 99.9 %. The Net Ratio is calculated as Measured Ratio - Background Ratio. The Ratio alarms can be used in addition to the Sigma or Absolute alarms and are not affected by speed.

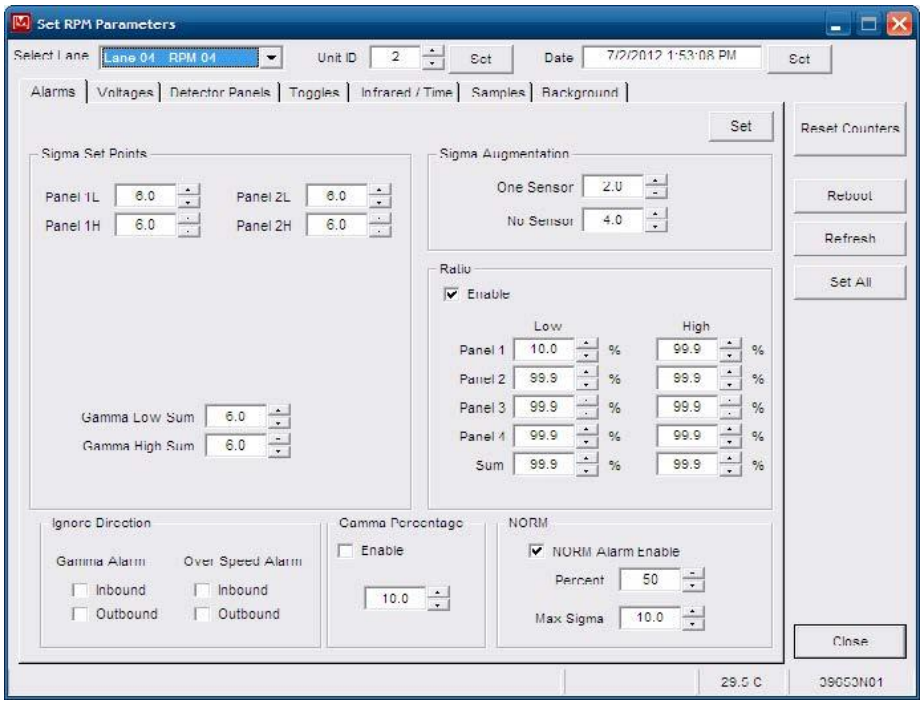
Sigma Augmentation: Augmentation increases the sigma set points when one infrared sensor is blocked and when no infrared sensors are blocked. The sigma augmentation may be adjusted from 0.0 to 25.5.

Gamma Percentage Alarm: The Gamma Percentage Alarm is different from the Sigma alarm in that it takes into account the background while the RPM is occupied. This parameter sets the percentage above background that the maximum counts per second must be greater than to set off an alarm. See the related Gamma Percentage Sample parameters for more information. This parameter is adjustable from 0 to 99.9 percent and can also be disabled.

NORM: These parameters control the NORM alarm function. When enabled, a check for NORM occurs at the end of the occupancy. Set the percent to define the percentage of the occupancy that the background must exceed the alarm set point to be considered a NORM alarm. If the background exceeds the Max Sigma parameter, then a gamma alarm is triggered instead of a NORM alarm.

Ignore Direction: This parameter allows the RPM to ignore gamma and over-speed alarms from a particular direction. For instance, this allows the system to ignore outbound over-speed alarms while still maintaining an over-speed check for inbound vehicles. When the gamma alarm direction is ignored, the max readings on the alarm window and printouts are zero.

The Alarms tab (shown below) for the dual channel option features a few changes in the software setup screen to allow for both the gamma discrimination parameters and the possible neutron alarm points (“N” –suffix versions only). The screenshot below shows the Alarms tab with the Set RPM Parameters screen.



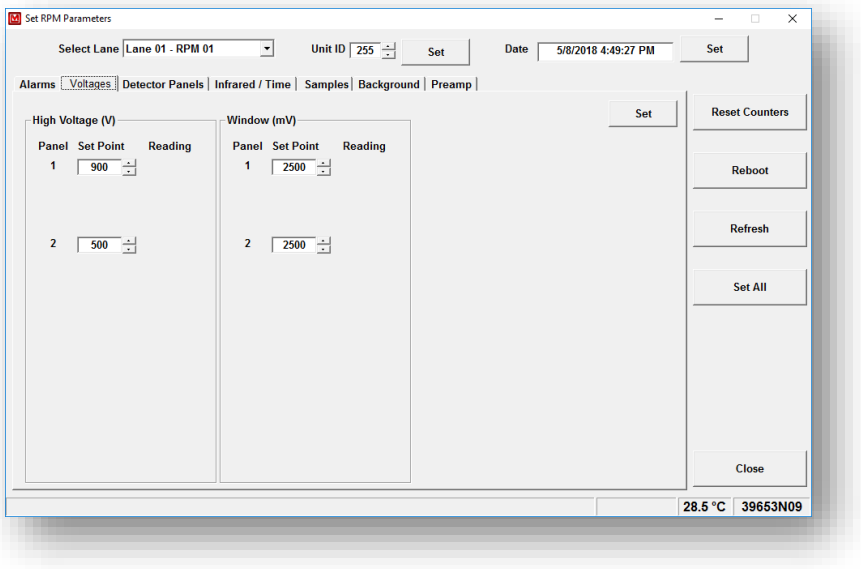
Sigma Set Points: This area in this screen is similar to the typical Model 4525, and is explained in the manual. The only change is that separate sigma alarms can be set for low energy and high energy, distinguished by "L" and "H" respectively. Some amount of discrimination can be achieved by proper selection of these alarm points. Note, however, that effective NORM discrimination requires relatively high levels of sigma alarms, in order to NOT alarm based on some small increases in sigma levels. The sigma alarm points in this situation become a secondary, higher threshold alarm.

Ratio: This section of the screen above is where NORM nuisance alarms can be effectively reduced. These percentages reflect the change in the relative energy level of the pulses coming from the detector. If the energy ratios do not change when a vehicle drives through the detectors, then neither the RATIO LOW ALARM nor the RATIO HIGH ALARM are triggered. Since these alarms are only triggered on the change in ratios, it doesn't matter if the total number of pulses from the detectors increases. Thus, a typical NORM source increases both the low and high-energy pulses, and so does NOT trigger an alarm.

Note that the ratio set points shown on this screen above reflect a CHANGE in the ratio levels. Background ratios are thus effectively subtracted. For an example, if the LOW RATIO and HIGH RATIO are 85% and 15% at background levels, and both alarms are set at 10%, the LOW RATIO alarm will be triggered when the LOW RATIO exceeds 95% or the HIGH RATIO exceeds 25%.

NORM: This section of the screen is a standard feature now on all Ludlum Model 4525s, and contains the parameters for the NORM identification of distributed NORM. This feature

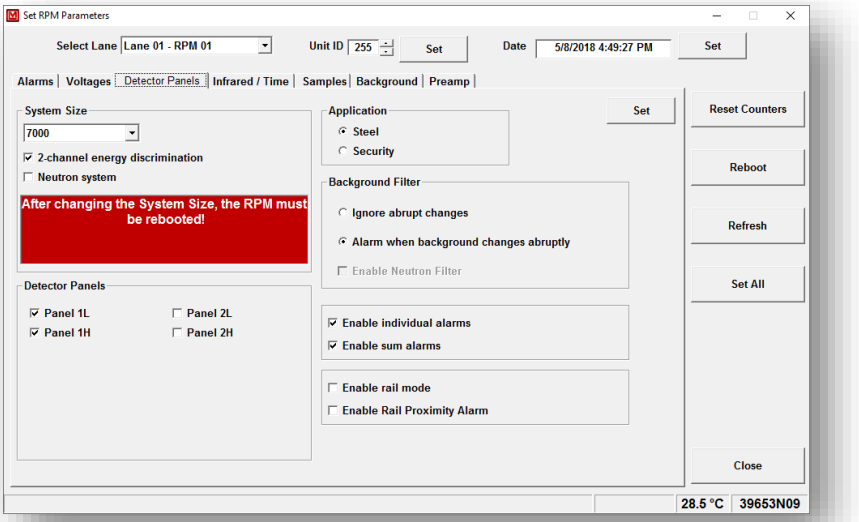
does NOT rely on energy information (whether LOW or HIGH) but instead just looks at the duration of the alarm in terms of percentage of all the samples. This feature will produce an ALARM, but describe it as “Possible NORM Alarm.” This feature allows for more rapid identification of materials, which are distributed throughout the load and that don't exceed some maximum level. This feature can be used to detect low levels of NORM radiation coming from truckloads of minerals or ceramics.



High Voltage: Sets the high voltage set point for each panel. Refer to the RPM calibration procedure for information on how to set these values properly. After changing the high voltage, the RPM should be rebooted.

Threshold: Sets the lower threshold set point for each panel. Refer to the RPM calibration procedure for information on how to set these values properly. After changing the lower threshold, the RPM should be rebooted.

Window: Sets the upper threshold set point for each panel. Refer to the RPM calibration procedure for information on how to set these values properly. After changing the upper threshold, the RPM should be rebooted.



System Size: Sets the detector configuration. Typically, this parameter will never have to be changed. The system size is determined by the total cubic inches of the detector panels. Refer to the RPM calibration procedure for information on how to set these values properly. After changing the high voltage, the RPM should be rebooted.

2-Channel Energy Discrimination: Enables the configuration of a gamma high and gamma low-channel and allows alarms to be set based on a net ratio independent of the sigma alarm. This feature divides the gamma energy spectrum into two regions of interest, enhancing the radiation detection sensitivity.

> ***Example:*** *Isotopes with energy level below the discriminator, like ^{241}Am, ^{57}Co, ^{99m}Tc, and ^{133}Ba, will alarm the low-energy sigma, ratio, or both. Isotopes with energy levels above the discriminator, like ^{60}Co and ^{40}K, will alarm the high-energy sigma, ratio, or both.*
>
> ***Note:*** *Isotopes with medium energy, like ^{137}Cs, could alarm as low, high, or both, as the energy level spans both regions of interest.*

Enable Neutron: When checked, detectors 3, 6, 9, and 12 are designated as neutron detectors.

Detector Panels: Sets which detector panels are enabled. A failed detector panel can be disabled, allowing the RPM to continue functioning until the panel can be repaired. After changing the number of enabled detector panels, the RPM should be rebooted.

Application: When set to security, the percent alarm is disabled automatically.

Background Filter: The background filter is used to prevent the background from rising too fast due to a sudden increase caused by a possible source nearby. There are two options for the background filter: ignore or alarm.

When set to ignore abrupt changes, the background will only be updated if the new one second count is less than twice background. If it is larger, then the background is not updated. From a user perspective, this will appear as if the background is "stuck" and not updating.

If set to alarm when the background changes abruptly, the RPM will alarm if the new one second background count is three time larger than the current background. When set to this option, the background filter is still in effect.

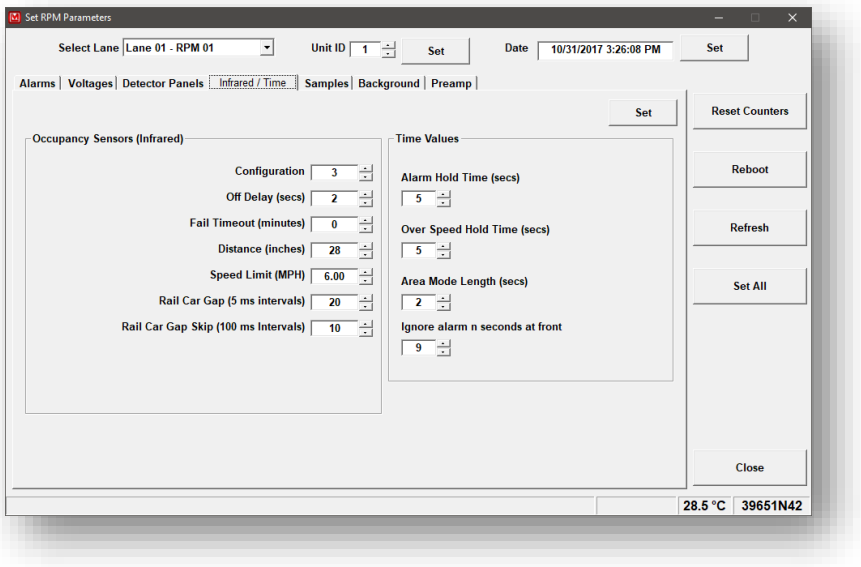
Enable Neutron Filter: Takes the number of samples + 2 and discards the two highest neutron samples to eliminate false neutron alarms caused by spurious events.

Enable Individual Alarms: When individual alarms are enabled, each detector panel is checked for a radiation alarm.

Enable Sum Alarms: When sum alarms are enabled, the sum of all detector panels are checked for a radiation alarm.

Enable Rail System: When an RPM is configured as a rail system, occupancies are treated as a single train with multiple cars. This parameter should be disabled for trucks.

Enable Rail Proximity Alarm: A proximity alarm occurs when the last or only rail car in a train system causes a gamma or over-speed alarm. This will only cause the alarm from being reported as a proximity alarm. It will not stop the alarm from occurring.



Occupancy Sensor Configuration: Sets the number of active infrared sensors. A setting of 1 enables only infrared sensor 1, a setting of 2 enables only infrared sensor 2, and a setting of 3 enables both infrared sensors. This allows the RPM to continue functioning if an infrared sensor has failed.

Infrared Sensor Off Delay: Sets the number of seconds the RPM will continue checking after both infrared sensors are cleared. This prevents infrared sensor flickers from causing a single occupancy to appear as multiple occupancies due to gaps in the shape of a vehicle.

Infrared Sensor Fail Timeout: Sets the number of minutes an infrared sensor must be blocked before an infrared sensor failure will occur. Setting this to zero will disable the infrared fail. If firmware 39651N46 or higher is installed, after five minutes with an infrared sensor blocked the portal will enter sleep mode. Sleep mode is identical to the normal background mode except that it is not possible to trigger a background failure. After both infrared sensors are cleared, the portal will reboot and be ready for operation.

Infrared Sensor Distance: Sets the distance between the infrared sensors. This parameter must be set accurately, or the calculated length and speed of the occupancy will be incorrect.

Speed Limit: Sets the limit on how fast a vehicle can enter the RPM before an over-speed alarm occurs.

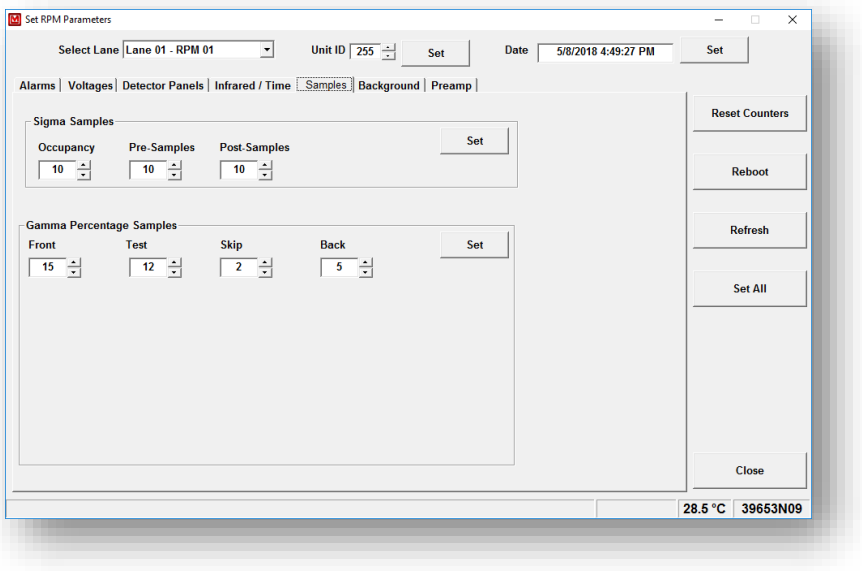
Rail Car Gap: The rail car gap is used to determine how long a sensor must be cleared to signal the end of one rail car and the start of another. This value is specified in 5-millisecond increments.

Rail Car Gap Skip: The rail car gap skip allows the percent alarm to skip over the gap between rail cars. The background between two rail cars will typically rise, which might cause a percent alarm. This parameter sets the number of 100-millisecond samples where both infrareds must be blocked before a percent alarm is checked. In between the gap, each infrared sensor is blocked by the beginning of the next car and the end of the last car. The percent alarm is only checked when both infrareds are blocked.

Alarm Hold Time: Sets the number of seconds a radiation alarm is latched until automatically reset. Setting this parameter to 0 will hold the alarm until manually reset either through the reset button on the hardware remote or through the Supervisor.

Over-Speed Hold Time: Sets the number of seconds an over-speed alarm is latched until automatically reset. Setting this parameter to 0 will hold the alarm until manually reset either through the reset button on the hardware remote or through the Supervisor. If both a radiation alarm and over-speed alarm occur at the same time, then the alarm hold time takes precedence.

Ignore Alarm n Seconds After Front: Sets the number of seconds that are ignored at the front of the vehicle for determining if an alarm occurred. Used to prevent false alarms from occurring off of the vehicle's radiator.



Occupancy Samples: Sets the number of 100-millisecond samples that must occur before checking for an alarm. The RPM should be rebooted after changing this parameter.

Pre-Samples: Sets the number of 100-millisecond samples that are added to the beginning of the occupancy profile. The RPM should be rebooted after changing this parameter.

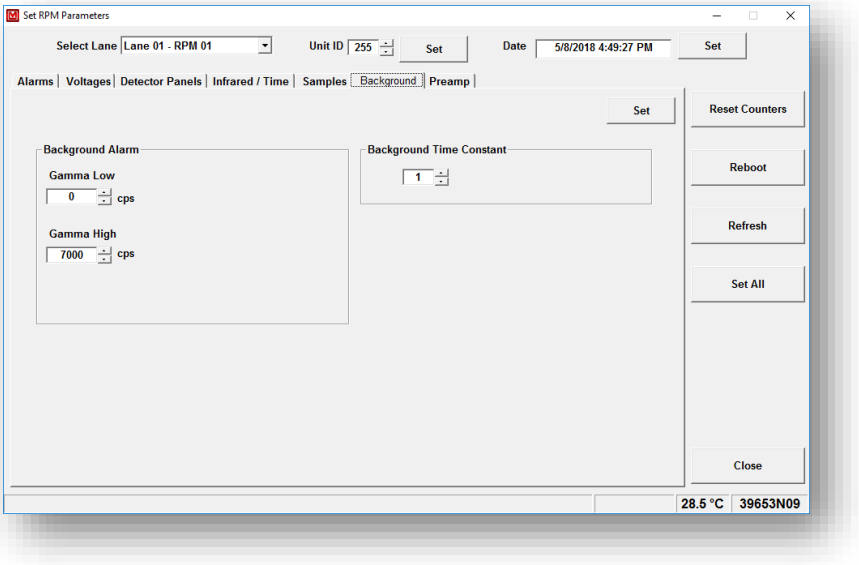
Post-Samples: Sets the number of 100-millisecond samples that are added to the end of the occupancy profile. The RPM should be rebooted after changing this parameter.

Front Samples: Sets the number of 100-millisecond samples before time (in time) to the test the samples.

Test Samples: Sets the number of 100-millisecond samples that are averaged together to be compared against the background average.

Skip Samples: Sets the number of 100-millisecond samples that are before and after the test samples that are ignored by the percentage alarm.

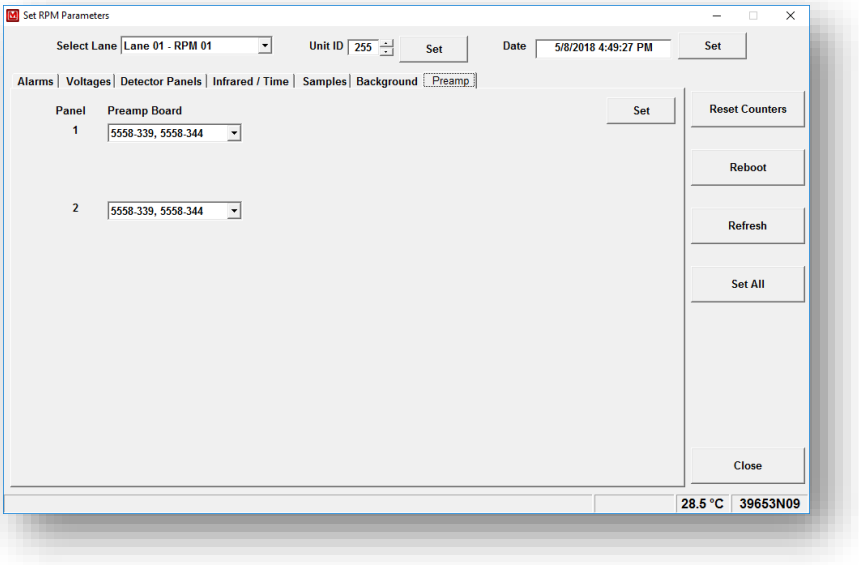
Back Samples: Sets the number of 100-millisecond samples after (in time) time to the test the samples.



Gamma/Neutron Low Set Point: Sets the low background set point for all detector panels. If any panel's background reading drops below this value, a low background failure will occur. This can indicate a problem with a detector panel

Gamma/Neutron High Set Point: Sets the high background set point for all detector panels. If any panel's background reading goes above this value, a high background failure will occur. This can indicate a problem with the detector panel or that a radiation source is nearby.

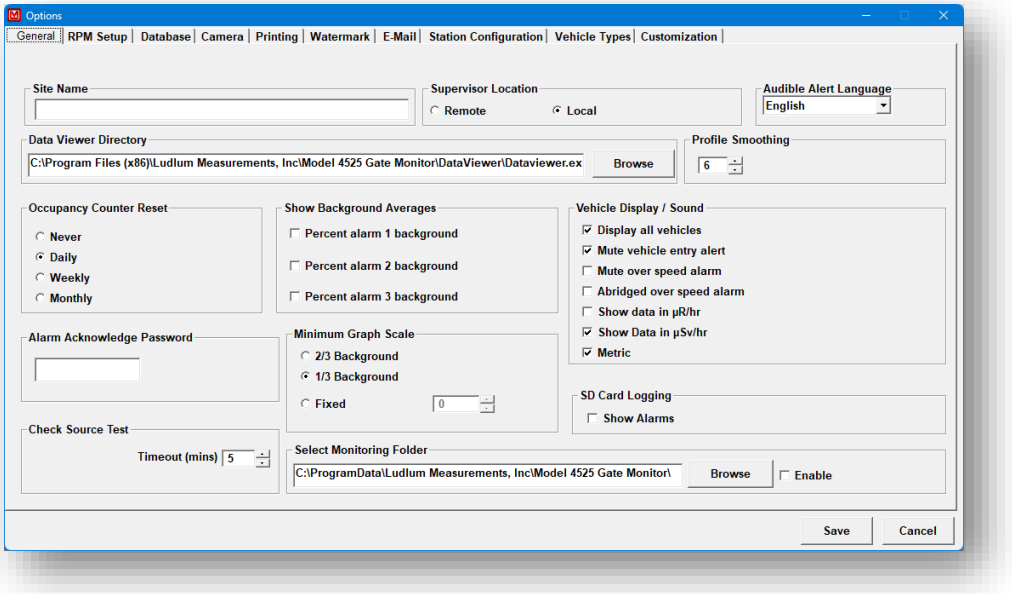
Background Time Constant: Sets how fast the background is updated while the RPM is not occupied. This is used to update the background after the initial background is taken. This parameter can be adjusted from 1 to 9. A value of 1 provides the fastest response time and a value of 9 provides the slowest. With a value of 1, it will take approximately 45 seconds to go from 0% to 90% of the final value. A setting of 2 will take 90 seconds.



The Preamp tab is used to set the type of detector preamp that is installed. This should only be changed under the supervisor of an LMI technician.

Options - General Tab

Use the Tools/Options... menu option to set the operational parameters for the Supervisor application. The options screen is divided into eight separate tabs.



Site Name: A Descriptive name given to this site. This name will be saved to the database and also printed on the alarm reports.

Supervisor Location: Set the location to "Remote," and all alarms will have to be reset from the RPM itself. Set the location to "Local," and the Supervisor will be able to acknowledge alarms. This feature is useful if the Supervisor computer is not located near the RPM. A setting or "Remote" allows the operators near the RPM to clear alarms.

Audible Alert Language: Sets the language for the audible alerts played on the Supervisor computer. The .WAV files for the audible alerts are stored in the \WAV folder under the Supervisor folder

Data Viewer Director: Specifies the path where the Data Viewer application is installed. This is necessary for the View button on the main screen to function correctly.

Profile Smoothing: Sets the number of samples that are averaged together to smooth out the plots on the profile graph.

Occupancy Counter Reset: Specifies when the occupancy counters are reset. If enabled, the counters are reset at midnight.

Show Background Averages: Specifies if the backgrounds used for the percentage alarm are plotted on the profile graph.

Alarm Acknowledge Password: Specifies if a password is required to acknowledge alarms. Leave this field blank to not require a password.

Minimum Graph Scale: Specifies the minimum graph scale for the Y-Axis on the profile graphs.

Display All Vehicles: When checked, the alarm popup window will be displayed for all occupancies. The window will automatically close after 30, seconds as long as the user does not change between different tabs.

Mute Vehicle Entry Alert: Silences the audible alert sounded by the Supervisor computer when checked.

Mute Over-Speed Alarm: When checked, mutes the over-speed audible alert. This does not affect the alarm popup from displaying.

Abridged Over-Speed Alarm: Uses three beeps for an over-speed alarm, instead of the normal audible alert.

Show Data in µR/hr: When checked, displays all readings in µR/hr instead of counts per second (cps). Calibration constant must be set correctly for the type of detector.

Show Data in µSv/hr: When checked, displays all readings in µSv/hr instead of counts per second (cps). Calibration constant must be set correctly for the type of detector.

Metric: When checked, the speed and vehicle length are displayed using metric units.

Check Source Test: This adjust the timeout for the Check Source Test feature. When the Check Source Test button is clicked on the main screen, every occupancy will be tagged in the commodity field as a "Check Source Test". The system returns to normal operation either once the button is clicked again or the specified time elapses.

Select CeMoSys Folder: Select the shared folder for saving CeMoSys status and results files. The status file is saved every one minute or if the instrument status changes. The results file is saved after every occupancy.

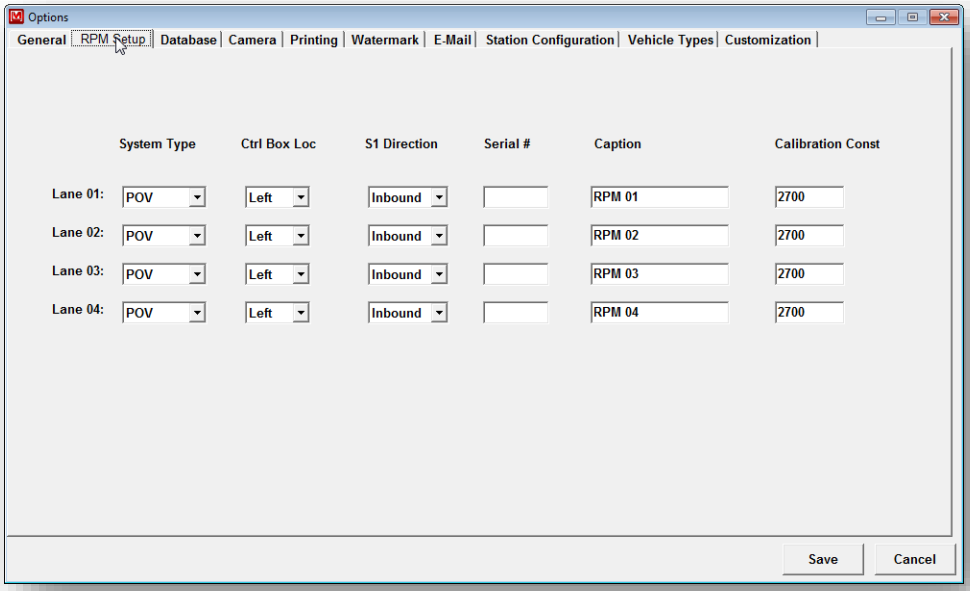
SD Card Logging

The RPM can log data in the event that communication is lost with the Supervisor computer. Once the connection is reestablished, the logged data will be sent to the Supervisor. The logged data is sent and processed as normal messages from the RPM. To show an alarm window for the logged vehicles that caused an alarm, check Show Alarms otherwise they will be silently logged to the database.

The logged file has a maximum file size of 100MB. The file size for the log file with 1000 occupancies of 10 seconds in length is approximately 15MB.

After the file has been transferred, it is automatically deleted from the SD card.

Options – RPM Setup Tab



RPM System Type: Set the type of occupancies the lane will have. The choices are car, truck, or rail.

RPM Control Box Location: The control box location determines which panel is designated as Panel 1 and is defined by looking at the vehicle head-on as it passes through the RPM. The choices are left or right.

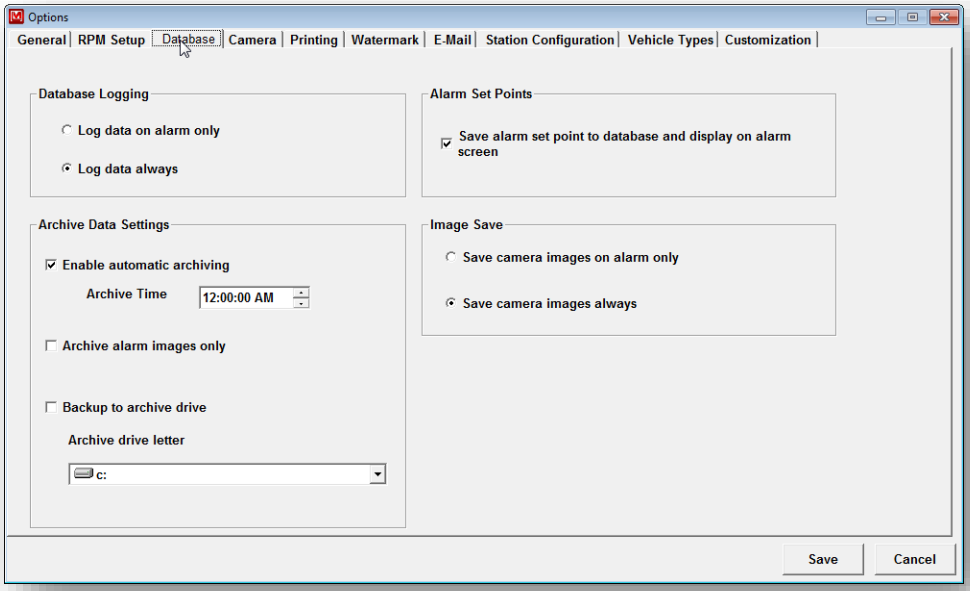
RPM S1 Direction: Set the direction of the occupancy when infrared sensor 1 is blocked first. The choices are inbound or outbound.

RPM Serial Number: Sets the serial number for the RPM. The serial number is saved to the database for future reference.

RPM Caption: The caption is a user-defined 10 character field that can be used to help differentiate one RPM from another. The caption appears on the main screen and is printed on all reports.

RPM Calibration Constant: Sets the calibration constant used when converting the counts per second value to µR/hr. The default is 1350.

Options - Database Tab



Database Logging: Sets how the occupancies are logged to the database. The occupancy data can be logged for every vehicle that passes through the RPM or only for vehicles that alarm. Alarms include both radiation and over-speed.

Alarm Set Points: When enabled, the alarm set points are displayed on the alarm popup and saved to the database.

Enable Automatic Archiving: When checked, the databases are archived automatically to the archive folder, and new database files are created. The archive time can be set to any time but is typically midnight.

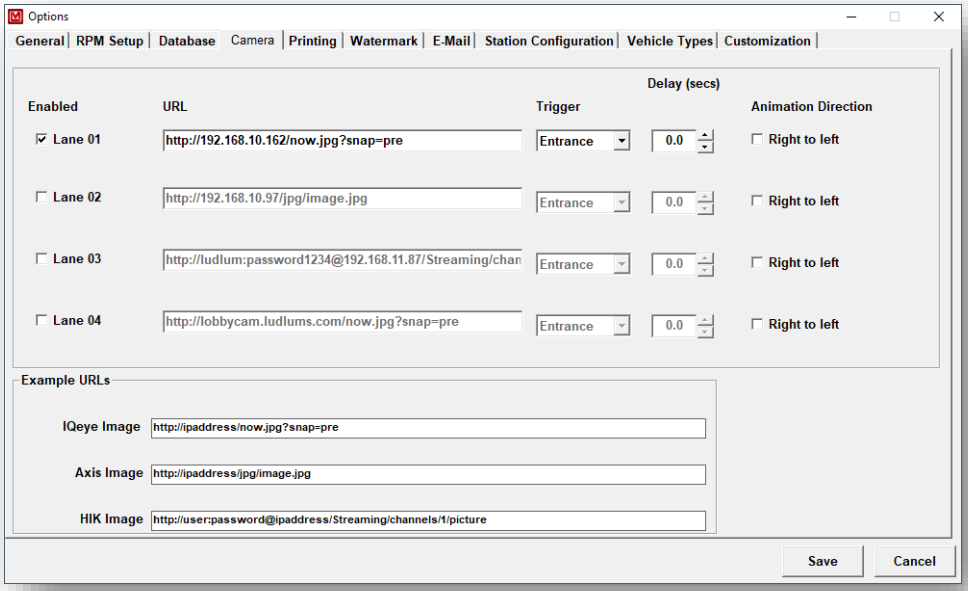
Archive Alarm Images Only: This option determines if all images are copied to the archive drive or only images that were taken for alarming vehicles.

Backup to Archive Drive: When enabled, the files created during the archive are also copied to this drive for backup purposes.

Archive Drive Letter: The drive letter specifies where the archive data is backed up. This can be any device that can be mapped to a driver letter and can include mapped network drives, etc.

Image Save: Camera images can be stored for all vehicles or alarming vehicles.

Options - Camera Tab



The Camera tab is used to configure an Ethernet camera to be used to capture an image during the occupancy and to display on the main screen. For each camera, a URL is specified that is used to retrieve an image from the camera. The main screen will update approximately every 1 second with a new image. When a vehicle breaks an infrared beam, an image will be captured and will be saved in the event of an alarm. It is also possible to save an image for every occupancy.

The URL can be broken down into 4 parts:

1. The URL must begin with either http or https followed by a colon ":" and two forward slashes "//".
2. If the camera does not allow anonymous access, the user name and password must be specified as "username:password@". If the camera allows anonymous access, this can be skipped.
3. The IP address or host name of the computer.
4. Manufacturer specific value to retrieve a JPEG image.

Example manufacturer specific values:

- Axis cameras use: **/jpg/image.jpg**

- Iqeye cameras use: **/now.jpg?snap=pre**
- HikVision cameras use: **/Streaming/channels/1/picture**

Camera Enabled: Enable or disable the camera for this lane.

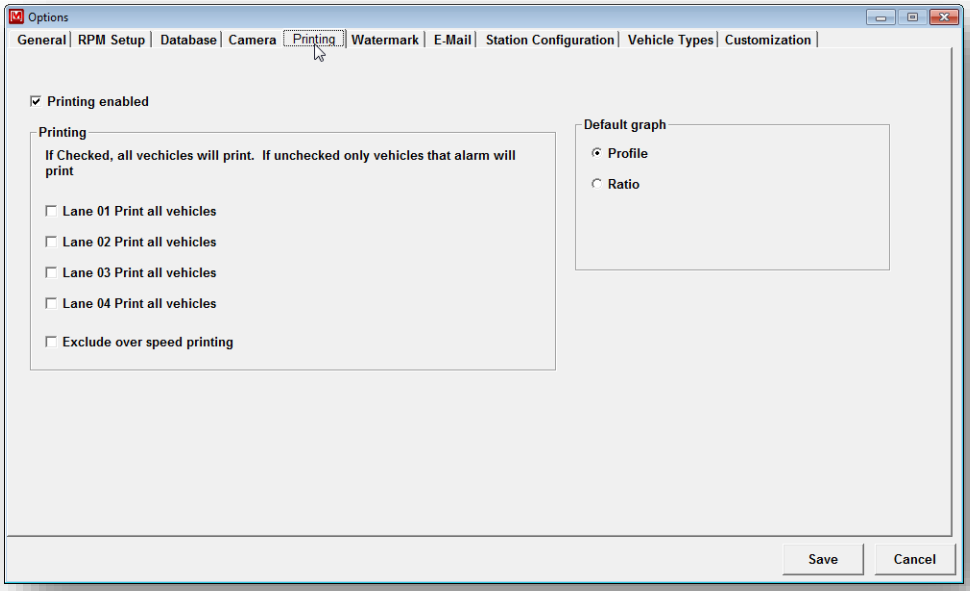
URL: Specifies the URL used to retrieve camera images displayed on the main screen and when an alarm occurs.

Trigger: Sets when the camera is triggered to get an image. The choices are entrance or exit.

Delay: The Supervisor can delay getting the camera image up to 9.9 seconds from the entrance or exit of the vehicle. This allows flexibility to account for camera placement.

Animation Direction: When a lane has no camera enabled, a image representing a truck or a rail car is displayed. This option controls the direction the image scrolls across the screen.

Options - Printing Tab

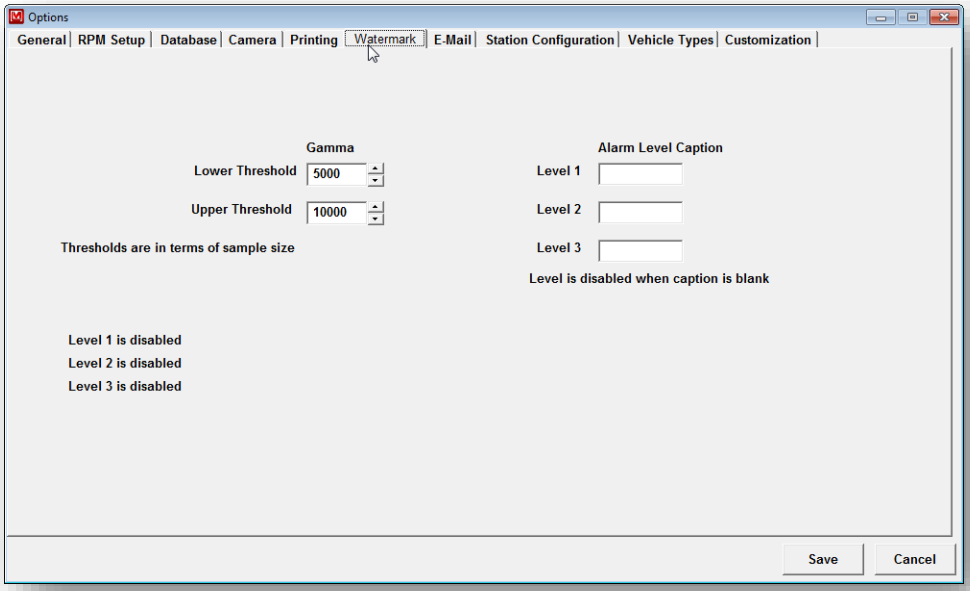


Printing Enabled: When unchecked, all automatic report printing is disabled.

Print All Vehicles: When checked, all occupancies will print a profile report regardless of if it causes an alarm.

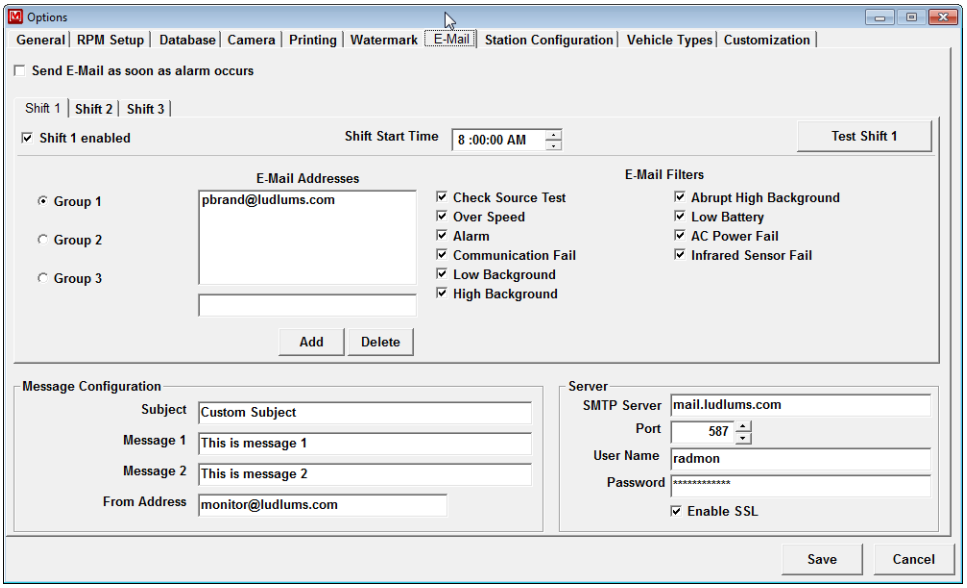
Exclude Over-Speed Printing: When checked, over speed alarms do not print a profile report.

Options - Watermark Tab



Watermark: The lower and upper thresholds define three alarm levels that will print on the alarm window and report. The levels are based on the sum of the gamma channels on each panel. Level 1 is less than the lower threshold. Level 2 is greater than or equal to the lower threshold and less than the upper threshold. Level 3 is greater than or equal to the upper threshold. This feature provides the ability to categorize alarm levels to provide information to the user. This could indicate specific procedures that may need to be performed when an alarm level is reached.

Options – E-Mail Tab



The E-Mail tab configures the Supervisor to send e-mail alerts when an RPM is alarming. There are three shifts that can be defined, each with their own set of six e-mail addresses. If a camera is enabled, then the image will be attached to the email. The image must be captured before the end of the occupancy to be included in the email. This means that triggering the camera on the exit of the occupancy with a delay time greater than 0 will not have the camera image attached.

Shift Enabled: When checked, the shift is enabled. Shift 1 must be enabled before shift 2 can be enabled. Shifts 1 and 2 must be enabled before shift 3 can be enabled.

E-Mail Addresses: E-Mail addresses can be set up for three groups. Each group can be configured to send messages if the event matches the filters set with the check boxes. This allows specific E-Mails to go to specific groups instead of sending to all addresses. So there can be one group that gets the alarms notifications, one group that gets the failure notifications, and one group that gets all notifications. Each group supports 20 E-Mail addresses.

Shift Start Time: Sets the start time for the shift.

Custom Subject: Sets a custom subject line for the e-mail.

Custom Message: Two user-defined messages can be set that will appear at the beginning of the e-mail.

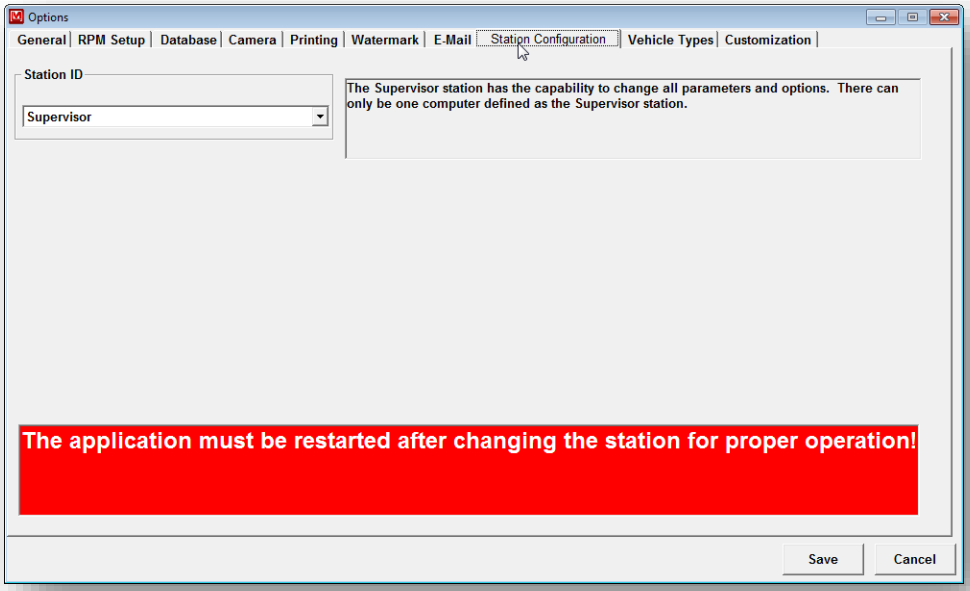
From Address: This sets the address that e-mails sent from the Supervisor will appear to be from. This should be a valid e-mail address.

Exclude: This option provides the ability to **not** send e-mails for specific types of events.

Server: The SMTP server name or IP address, port number, username, and password are set here. The port number is typically either 25, 465, or 587. Authentication is required.

Send E-Mail as soon as alarm occurs: This option provides the ability to send an e-mail as soon as an alarm occurs without waiting for the end of the occupancy. This e-mail is for notification purposes only. The standard e-mail sent at the end of the occupancy is also sent when this option is enabled and provides the final detector readings.

Options – Station Configuration Tab

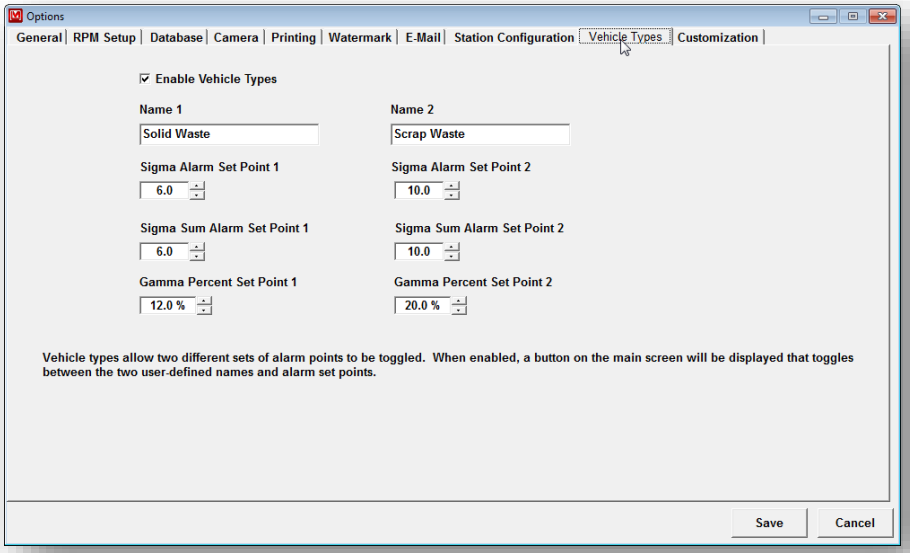


The Supervisor can be configured as either the Supervisor station or as an Echo station. There can only be one computer configured as the Supervisor station. There can be multiple computers configured as Echo stations. The Supervisor station is the only station that can set the RPM parameters. Echo stations can be used to remotely monitor the RPMs. Echo stations display the same information as the Supervisor station, including alarm and fail windows and printouts. When the software is installed, the station defaults to undefined. This should be changed when the software if first run to the appropriate value. After changing a station ID, the software must be restarted.

Echo stations now support a list of multiple sites that can be accessed from the drop-down list on the main screen.

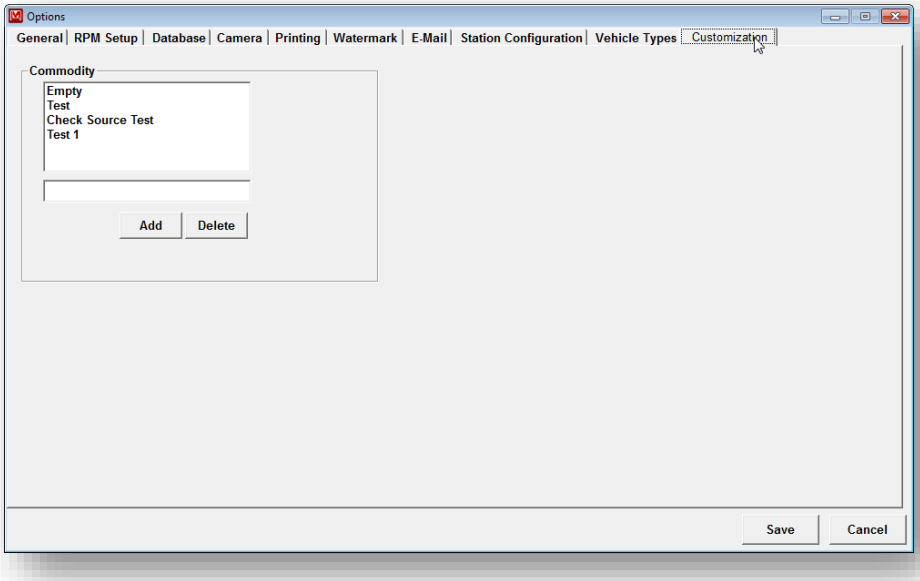
Stations configured as Echoes require two additional parameters. First is the path to the Supervisor. This path can either be a mapped drive letter or a UNC path, which points to the folder shared on the Supervisor station that contains the Supervisor EXE file. The second parameter is either the IP address or name of the Supervisor station computer. Stations that are configured as Echos have limited capability to change options. Basically, only options that effect the local station can be changed, such as printing, etc.

Options – Vehicle Types Tab



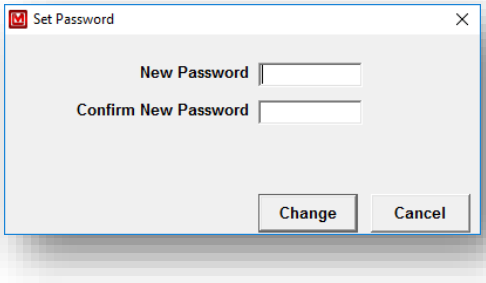
When enabled, this option allows two different alarm set points to be used depending on the type of vehicle. A button on the main screen toggles between the two sets of alarm parameters. The sigma set point applies to all detectors.

Options – Customization Tab



The Customization tab allows certain options to be modified with user-defined values. The default list of commodities can be set here allowing the user to pick from a list on the alarm and Data Viewer screens. Up to 20 user-defined commodities can be entered here.

Changing the Password



Note: The default password is "4525." After running the program for the first time, be sure to change the password.

Once a password has been entered, it will not have to be typed in again for five minutes. The password must be at least four characters in length and can contain only the characters: !"#$%^'()*+,-./ 0-9 A-Z a-z.

Event Log

The Event Log database stores information regarding system health and status. Any error messages that occur are also logged to this database. The Event Log has fields for Lane number, Date/Time, Firmware Number, Software Number, Event/Error message, and the Background readings for the detector panels. Lane Number 0 is used for messages/errors relating to the Supervisor computer. The following items are logged to the database:

Supervisor Started: Logged when Supervisor is initially run.

Supervisor Terminated: Logged before Supervisor is closed down.

Archive Started: Logged when an archive process is started.

Archive Completed: Logged when archive process is completed.

Connected (including current background readings): Logged when Supervisor connects to lane.

Connected: Logged when a lane that was missing is reconnected.

Missing: Logged after Supervisor has not received any data from RPM.

Gamma Alarm: Logged when an alarm occurs.

Alarm Reset: Logged when the alarm is reset.

Command Sent: Logged whenever a command to change a parameter is sent.

Error Sending Parameter: Logged when there is a problem sending a parameter.

Reboot: Logged when the Supervisor reboots an RPM.

Sensor Fail: Logged when a sensor failure occurs.

Background Fail: Logged when either a high or low background failure occurs.

Sensor Fail Cleared: Logged when the sensor failure is cleared.

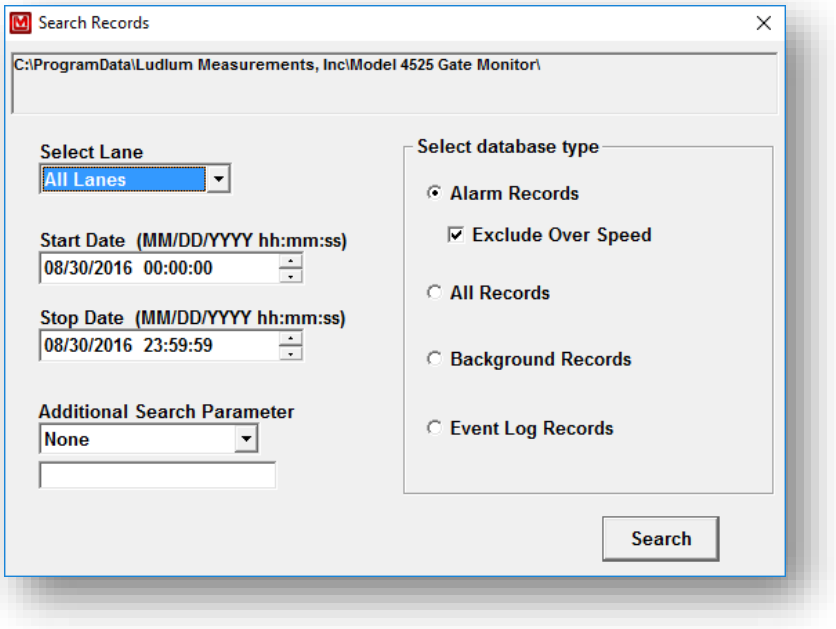
Background Alarm Cleared: Logged when the background alarm is cleared.

The Supervisor logs information about all active lanes and monitors when the program is first started and after the nightly archive process is complete.

Section 8 – Data Viewer Overview

The Data Viewer allows access to the database files generated by the Supervisor software. There are options to search the database, create new databases based on the current query, re-print alarm profile reports, and print summary reports.

Searching Data



To search the databases, click the Search button on the main screen. After selecting the options to configure the search parameters, click the Search button. The current database path is shown at the top of the window.

Select RPM: The search can include all lanes or a single lane.

Start Date: Specify the starting date for the search.

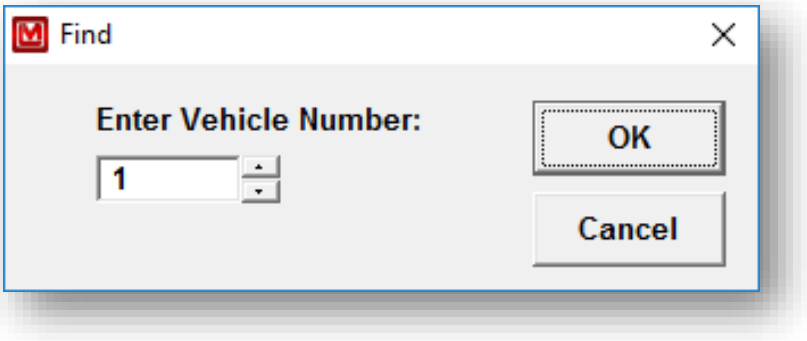
Stop Date: Specify the ending date for the search.

Additional Search Parameter: Specify an additional field to narrow the search.

Database Type: There are four database files used. The Background Database contains the background readings updated every minute. A maximum of 20,000 background

records can be viewed at a time. The Alarms database contains every vehicle that alarmed. The Exclude Over-Speed checkbox will exclude over-speed alarms from the search results. The No-Alarms database contains all vehicles that did not alarm (if enabled in Supervisor Software) and all vehicles that alarmed. The Event Log database shows the events that occurred since the last archive.

Finding a Specific Vehicle

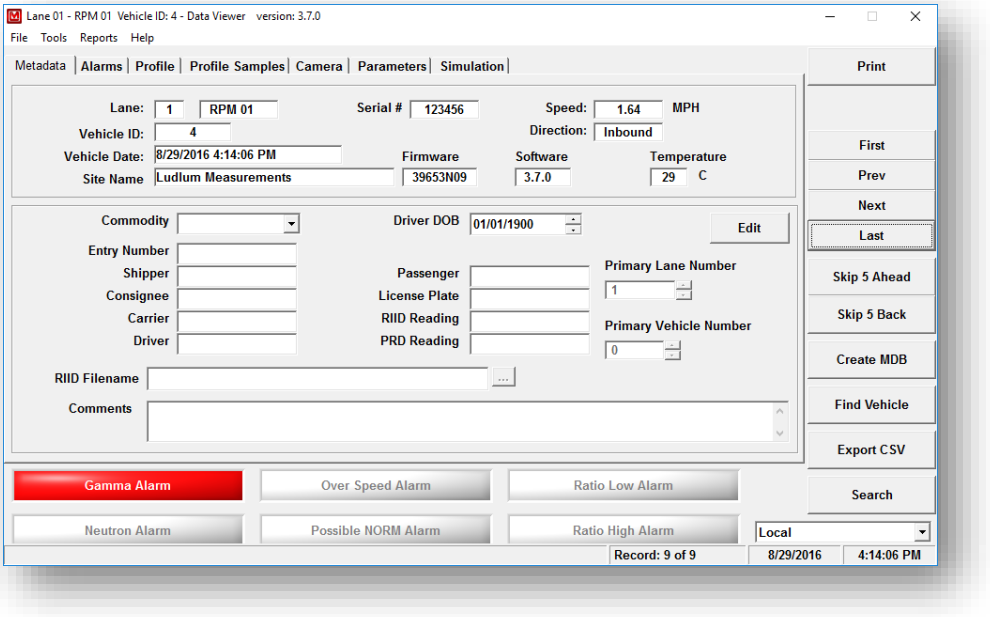


The Find Vehicle button on the main screen allows the user to find a specific vehicle number.

Create MDB

Clicking on this button will take the current search query results and save it as a new Access database. The user will be prompted to enter a file name and location to save the file.

Metadata Tab



The Data Viewer main screen consists of seven tabs when viewing vehicle data . These tabs group related data together for easier viewing. Along the right side of the main screen are several buttons allowing the user to print and navigate the search results. The first tab displays information relating to the occupancy, such as lane number, vehicle number, date, direction, and speed. This tab also allows the user to view and update the metadata association with this occupancy. A list box at the bottom allows the user to select from a list of sites configured from the Options screen.

Lane: The lane number and lane caption of the vehicle.

Vehicle #: The vehicle number.

Date/Time: The date and time this vehicle went through the RPM.

Speed: The speed of the vehicle.

Serial #: The serial number of the RPM.

Firmware Version: The version of the RPM firmware.

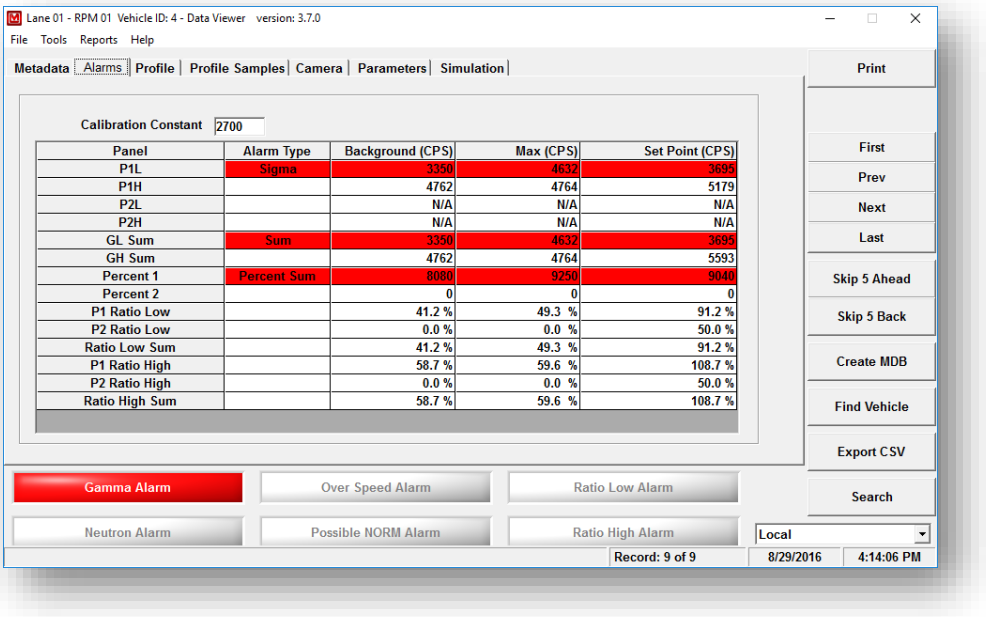
Software Version: The version of the Supervisor software.

Temperature: The temperature recorded on the main board during the vehicle occupancy.

Site Location: The name of the site where the data was recorded.

Edit Button: The Edit button allows the user to add or update the metadata for this record.

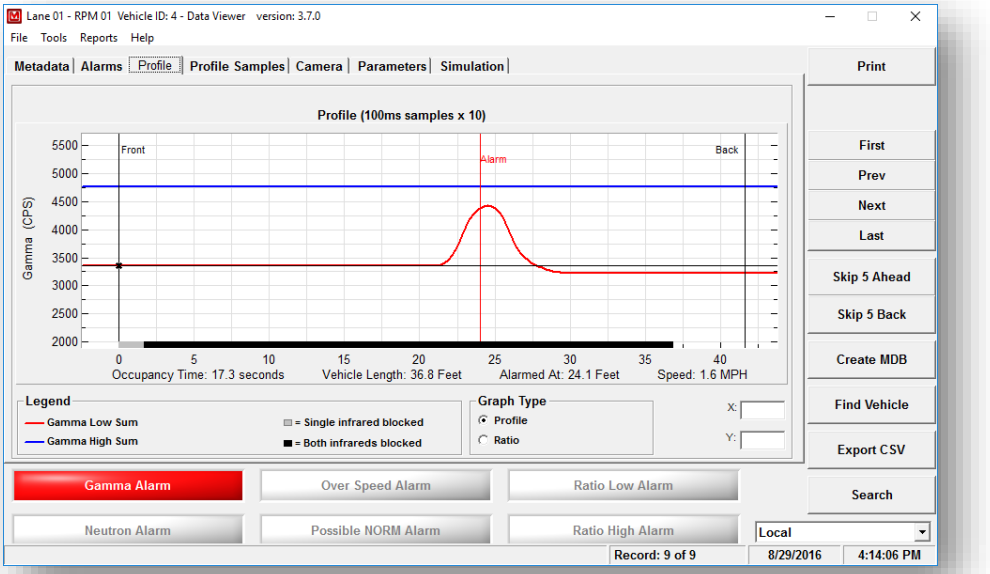
Alarms



Panel	Alarm Type	Background (CPS)	Max (CPS)	Set Point (CPS)
P1L	Sigma	3350	4632	3695
P1H		4762	4764	5179
P2L		N/A	N/A	N/A
P2H		N/A	N/A	N/A
GL Sum	Sum	3350	4632	3695
GH Sum		4762	4764	5593
Percent 1	Percent Sum	8080	9250	9040
Percent 2		0	0	0
P1 Ratio Low		41.2 %	49.3 %	91.2 %
P2 Ratio Low		0.0 %	0.0 %	50.0 %
Ratio Low Sum		41.2 %	49.3 %	91.2 %
P1 Ratio High		58.7 %	59.6 %	108.7 %
P2 Ratio High		0.0 %	0.0 %	50.0 %
Ratio High Sum		58.7 %	59.6 %	108.7 %

The Alarm tab displays the status for each detector panel and sum channel for the current record. The alarm type, background reading, max reading during the occupancy, and set point (if enabled) are shown. Any detector panel or sum channel that alarmed will be highlighted in red.

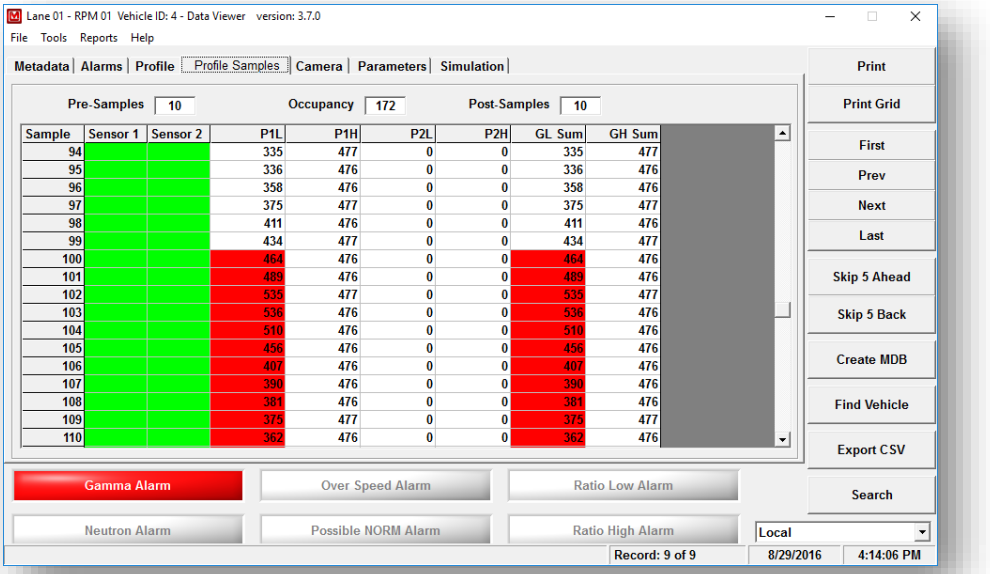
Profile Tab



The Profile tab displays a graph representing the background readings during the occupancy. Up to three plots are display, with each plot representing the sum of the left, right, and top (if available) panels. The readings are displayed in counts per second (CPS) or in µR/hr. If a valid speed was calculated for the occupancy, the X-Axis will display the profile samples in either feet or meters. If no speed was calculated, the X-Axis will display as 100 ms sample intervals. The front and back of the occupancy is denoted by two black vertical lines. A vertical red line will indicate the location of the gamma alarm. The status of the infrared sensors is plotted at the bottom of the graph as either dark red squares (one infrared sensor blocked) or bright red (both infrared sensors blocked). If enabled, the graph will also show the background averages used for the percent alarm calculation. These are only plotted when both infrared sensors are blocked and appear as dotted lines.

A movable cursor on the graph allows the user to move to any point on the graph and display the current X and Y values.

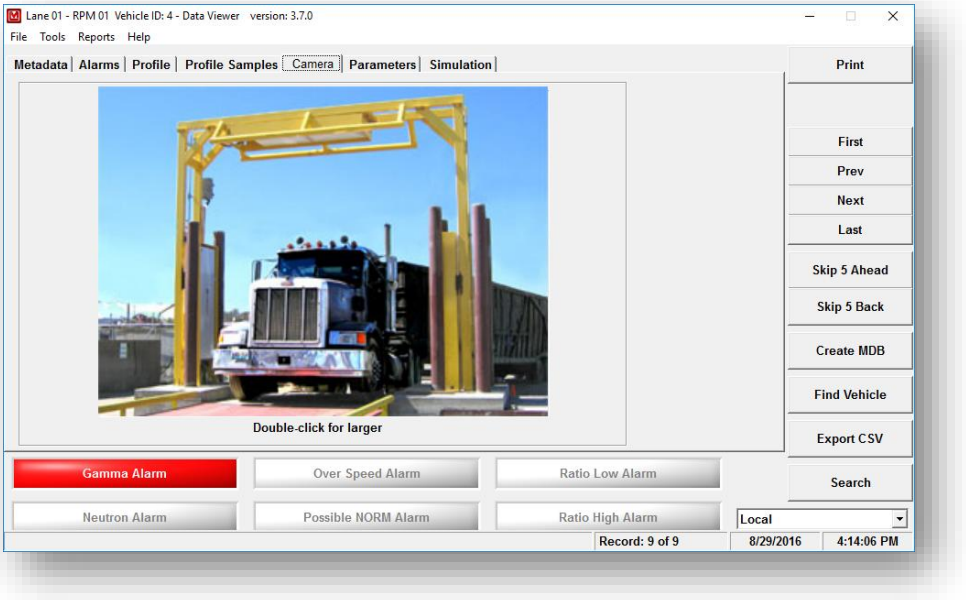
Profile Samples Tab



Sample	Sensor 1	Sensor 2	P1L	P1H	P2L	P2H	GL Sum	GH Sum
94			335	477	0	0	335	477
95			336	476	0	0	336	476
96			358	476	0	0	358	476
97			375	477	0	0	375	477
98			411	476	0	0	411	476
99			434	477	0	0	434	477
100			464	476	0	0	464	476
101			489	476	0	0	489	476
102			535	477	0	0	535	477
103			536	476	0	0	536	476
104			510	476	0	0	510	476
105			456	476	0	0	456	476
106			407	476	0	0	407	476
107			390	476	0	0	390	476
108			381	476	0	0	381	476
109			375	477	0	0	375	477
110			362	476	0	0	362	476

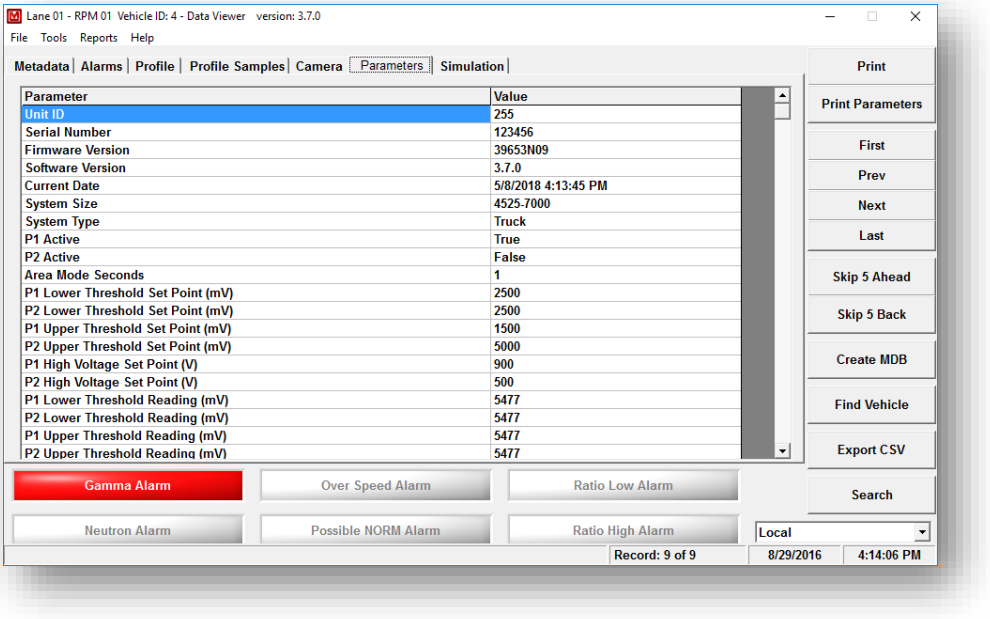
The Profile Samples tab shows the raw samples that were captured during the occupancy. The grid shows the sample number, infrared sensor 1 and 2 status, detector panel readings, and the sum. The readings are the counts received in 100 ms intervals and include the pre samples (values before the RPM is occupied), occupied samples, and the post-samples (readings after the occupancy). The background color for the infrared fields is green when a sensor is blocked. The background color for the panel readings are red to indicate where the background occurred.

Camera Tab



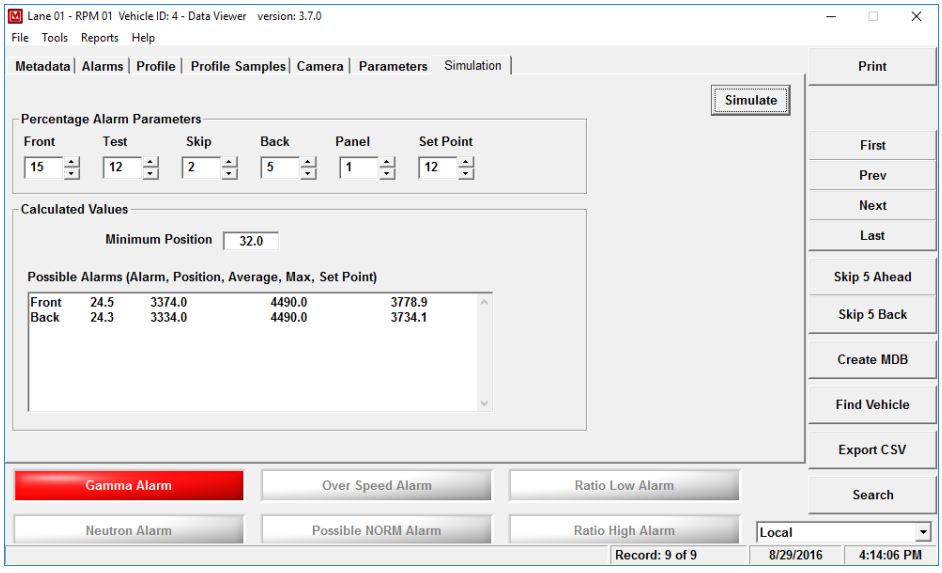
The Camera tab displays the image taken during the occupancy or a representation of the type of vehicle. If a camera is enabled, then the image captured during the occupancy will be displayed. The image may not be displayed immediately, depending on the camera's trigger time. If the camera is disabled, then either a picture of a truck or train car will be displayed. A radiation symbol will be displayed to indicate the approximate location of the alarm. Double-clicking on the image will display it in a larger window.

Parameters Tab



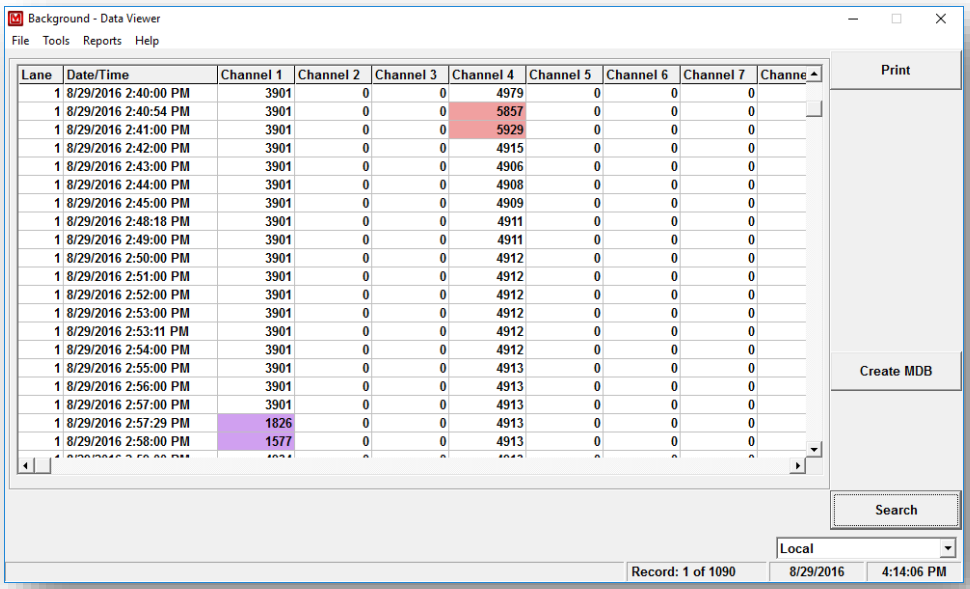
The Parameters tab displays all parameter settings that were used during the current record.

Simulation Tab



The Simulation tab can be used to modify the percentage alarm parameters and retest the vehicle for a percent alarm. Adjust the samples as desired, and click the Simulate button. The Minimum position of the alarm and the locations of possible alarms are calculated based on the current records' profile data.

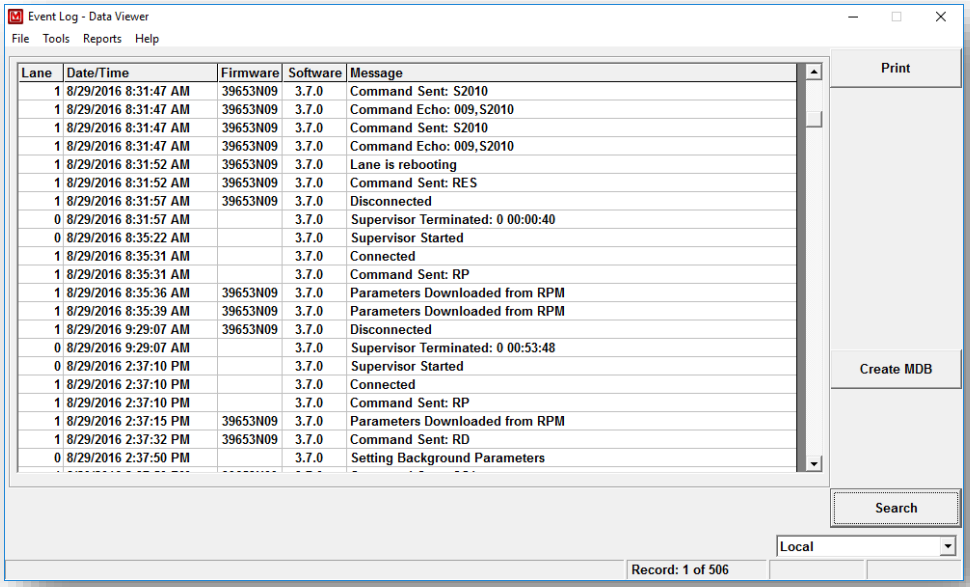
Background Data



Lane	Date/Time	Channel 1	Channel 2	Channel 3	Channel 4	Channel 5	Channel 6	Channel 7	Channe
1	8/29/2016 2:40:00 PM	3901	0	0	4979	0	0	0	
1	8/29/2016 2:40:54 PM	3901	0	0	5857	0	0	0	
1	8/29/2016 2:41:00 PM	3901	0	0	5929	0	0	0	
1	8/29/2016 2:42:00 PM	3901	0	0	4915	0	0	0	
1	8/29/2016 2:43:00 PM	3901	0	0	4906	0	0	0	
1	8/29/2016 2:44:00 PM	3901	0	0	4908	0	0	0	
1	8/29/2016 2:45:00 PM	3901	0	0	4909	0	0	0	
1	8/29/2016 2:48:18 PM	3901	0	0	4911	0	0	0	
1	8/29/2016 2:49:00 PM	3901	0	0	4911	0	0	0	
1	8/29/2016 2:50:00 PM	3901	0	0	4912	0	0	0	
1	8/29/2016 2:51:00 PM	3901	0	0	4912	0	0	0	
1	8/29/2016 2:52:00 PM	3901	0	0	4912	0	0	0	
1	8/29/2016 2:53:00 PM	3901	0	0	4912	0	0	0	
1	8/29/2016 2:53:11 PM	3901	0	0	4912	0	0	0	
1	8/29/2016 2:54:00 PM	3901	0	0	4912	0	0	0	
1	8/29/2016 2:55:00 PM	3901	0	0	4913	0	0	0	
1	8/29/2016 2:56:00 PM	3901	0	0	4913	0	0	0	
1	8/29/2016 2:57:00 PM	3901	0	0	4913	0	0	0	
1	8/29/2016 2:57:29 PM	1826	0	0	4913	0	0	0	
1	8/29/2016 2:58:00 PM	1577	0	0	4913	0	0	0	

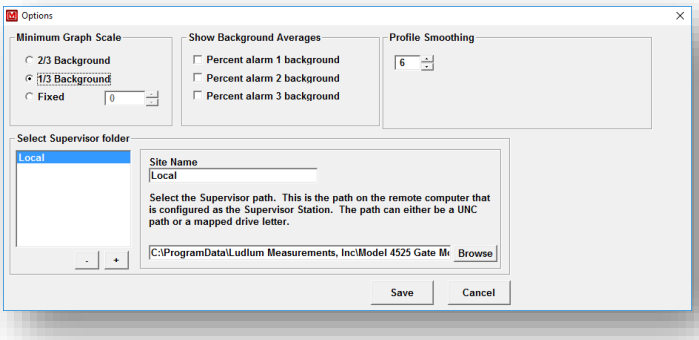
The main screen consists of a grid displaying the background readings recorded for all active RPMs when viewing background data. High background readings are colored with red, while low background readings are colored in purple.

Event Log Data



The main screen consists of a grid displaying the events recorded during the search query when viewing event log data.

Data Viewer Options



Minimum Graph Scale: Specifies the minimum graph scale for the Y-Axis on the profile graphs.

Show Background Averages: Specifies if the backgrounds used for the percentage alarm are plotted on the profile graph.

Profile Smoothing: Sets the number of samples that are averaged together to smooth out the plots on the profile graph.

Supervisor Path: The Supervisor path must point to the location of the Supervisor EXE file. The Echo supports creating a list of sites, each with its own Supervisor path.

Printing Reports

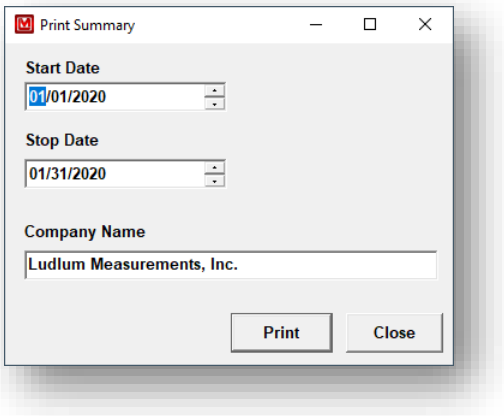
There are three options in the Reports menu – Print Profile, Print Summary, and Print Alarm Summary.

Print Profile will print the current occupancy profile report. This is the same as clicking on the main screen.

Selecting Print Summary Report will print a comprehensive summary report for the reporting period. This report is generated as a PDF file and is stored as:

C:\ProgramData\Ludlum Measurements, Inc\Model 4525 Gate Monitor\summary-report.pdf

After the file is generated, it can be printed. The PDF file will be overwritten each time the report is run.

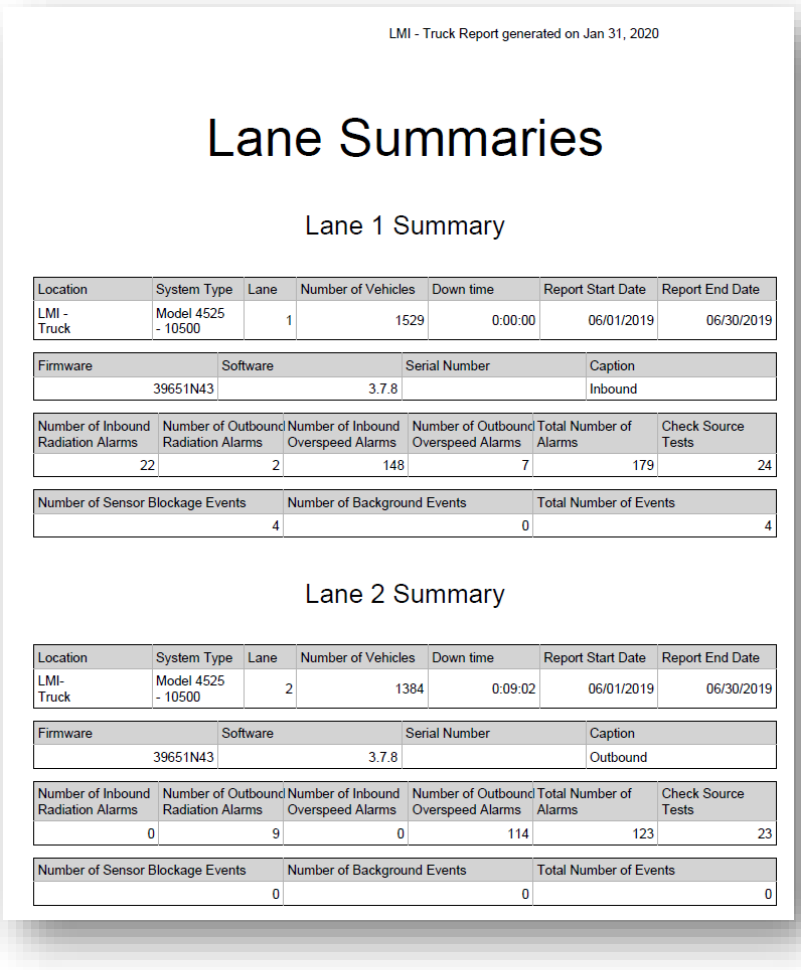


The summary report is separated into several sections which are:

- Lane Summaries – Shows the location, system type, firmware version, software version, and the total number of alarms and failures for the reporting period.
- Timeouts – Shows if the lane had any communication issues during the reporting period. The start, end, and total time the lane was missing is shown.

- Set Points – The values of key set points are shown for the beginning and end of the reporting period.
- Inbound/Outbound Radiation Alarms – Shows all alarms during the reporting period including which detector panel alarmed. If the occupancy also caused an over-speed alarm, it will be indicated here as well.
- Inbound/Outbound Over-Speed Alarms – Shows all over-speed alarms during the reporting period.
- Check Source Tests – Shows all alarms that were marked as check source tests.
- Events – Pulls data from the event log and displays it in a user-friendly table.
- Background Readings – Shows the minimum, maximum, and background average for each day in the reporting period.

Below is an example of the summary page from the report.



LMI - Truck Report generated on Jan 31, 2020

Lane Summaries

Lane 1 Summary

Location	System Type	Lane	Number of Vehicles	Down time	Report Start Date	Report End Date
LMI - Truck	Model 4525 - 10500	1	1529	0:00:00	06/01/2019	06/30/2019

Firmware	Software	Serial Number	Caption
39651N43	3.7.8		Inbound

Number of Inbound Radiation Alarms	Number of Outbound Radiation Alarms	Number of Inbound Overspeed Alarms	Number of Outbound Overspeed Alarms	Total Number of Alarms	Check Source Tests
22	2	148	7	179	24

Number of Sensor Blockage Events	Number of Background Events	Total Number of Events
4	0	4

Lane 2 Summary

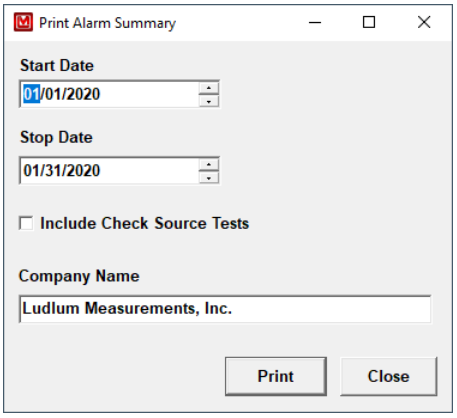
Location	System Type	Lane	Number of Vehicles	Down time	Report Start Date	Report End Date
LMI- Truck	Model 4525 - 10500	2	1384	0:09:02	06/01/2019	06/30/2019

Firmware	Software	Serial Number	Caption
39651N43	3.7.8		Outbound

Number of Inbound Radiation Alarms	Number of Outbound Radiation Alarms	Number of Inbound Overspeed Alarms	Number of Outbound Overspeed Alarms	Total Number of Alarms	Check Source Tests
0	9	0	114	123	23

Number of Sensor Blockage Events	Number of Background Events	Total Number of Events
0	0	0

Selecting Print Alarm Summary will print a report that shows a summary of the alarms during the specified time period.



The Alarm Summary report shows the following information:

- Lane Number
- Occupancy Date
- Vehicle Number
- Driver
- Commodity
- License Plate
- Speed
- Alarm Type – This is specified using the watermark feature of the Supervisor.
- Sum counts in cps
- Comments – This will expand if necessary to show the comment.

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Qatar Steel 1/31/2020

Alarm Summary: 6/1/2019 to 6/30/2019 **Total Alarms: 80**

Lane	Vehicle Date	Vehicle	Driver	Commodity	License Plate	Speed (mph)	Alarm Type	Sum	Comments
1	06/01/2019	4		Check Source Test		0.50	Level 3	48867	
1	06/03/2019	1		Check Source Test		0.01	Level 3	48819	
1	06/04/2019	2		Check Source Test		0.43	Level 3	47494	
1	06/05/2019	2		Check Source Test		0.57	Level 3	48988	
1	06/06/2019	2		Check Source Test		0.51	Level 3	48225	
1	06/06/2019	5	John Doe	Widgets	BR549	3.97	Level 3	11187	Comments go here. What else can I say.
1	06/07/2019	2		Check Source Test		0.41	Level 3	48940	
1	06/07/2019	8				3.24	Level 3	12217	

Section 9 – RPM Operation

This section is dedicated to the operation of the RPM apart from the system computer and software, except where noted.

Controls and Functions

The following is a description of the controls and functions on the electronics panel, which is housed within the master detector enclosure.

READOUT: Liquid Crystal Display (LCD), 4-line by 20-character alphanumeric display, backlit while on AC power. Setup information, background, and count data is displayed.

ENTER Key: Selects or advances the display. If the enter key is pressed while turning the instrument on, the Model 4525 is loaded with a set of default parameters.

LINE FUSE: Fuse to limit current from the AC mains input. The fuse is 250 Vac at 1A (AGC1) or equivalent.

BAT FUSE: Fuse to limit current from the battery. The fuse is 10A (ABC10) or equivalent.

Mains Supply: Line Voltage input of 100-240 Vac, 50-60 Hz, 250 W.

BATTERY: Back-up power is provided by a 12 V, 12 amp/hr battery.

Power on Self Test (POST)

When the RPM is first powered up, all relays, lights, and audio devices are momentarily activated. This POST is done in order to give the user an opportunity to ensure that all applicable devices are working. The test lasts for about three seconds and may be activated anytime by pressing the reset button for greater than five seconds, or by selecting the Reboot function within the software (Set Parameters window).

After POST, the system will establish the level of background radiation. On the remote display, the power ok indicator turns on, and the checking indicator blinks for 30 seconds. At the end of the background update, the checking indicator should stay off, and only the power ok indicator should be lit. The system then begins updating background radiation levels

every second and will also continue looking for anything that may be passing through the portal.

Normal Operation

When the occupancy sensors detect an object passing through the portal, the *checking* indicator on the remote display immediately turns on, and the system begins checking for radiation levels above background. As long as the RPM senses an object passing through, the system will continue checking for an alarm condition for as long as is specified by the *sensor fail time* (typically several minutes). If the RPM does not sense an alarm condition, the *checking* indicator will turn off when the occupancy sensors no longer detect an object passing through. As soon as the RPM senses an alarm condition, the appropriate lights, audio, and relays are activated and the system continues collecting data until the occupancy sensors have been cleared.

Separate indicators on the RPM warn of *gamma alarm* and *overspeed*. The alarm status is normally latched (held in an 'on' state) until the reset button is pressed. However, a period of time can be specified for automatic resetting of the alarm status instead of having to operate the manual reset button each time.

Note:

The alarm status cannot be reset until the occupancy sensors have been cleared; pressing the reset button prior to the end of occupancy will just silence the audio.

Be aware that the *reset* button on the remote display serves several purposes: 1) clear an alarm status, 2) reboot of the entire system when depressed for more than five seconds (as in POST), and 3) to silence the audio alarm.

This reboot function can be useful for system malfunctions or for periodic checks of proper system operation, including relays and indicators.

Instrument Warning

There are two conditions the system gives warning of (while continuing to operate normally):

1. If the mains AC voltage is removed without turning off the system, the system activates an orange indicator light on the remote display (indicating battery power use), and the audio alarm is activated. Pressing the reset button will clear the audio, but the indicator light will stay on until the mains AC power is restored.

2. The *on bat* indicator will blink to warn of impending battery failure approximately two to four hours before failure takes place. The RPM can operate from the

internal battery backup for approximately 20 hours. When the battery is exhausted, a relay-disconnect activates, keeping the battery from discharging any further and preventing damage. Restoring the mains AC voltage is the only means of resetting the relay.

Instrument Failure

There are three common conditions that cause system failure:

1. **SENSOR FAIL:** A sensor fail parameter can be set to establish a maximum normal occupancy time. If the RPM is occupied for longer than this maximum time, a *sensor fail* condition occurs; the orange strobe and audio on the master panel will be activated and the remote display will show both a *checking* indicator and the *inst fail* indicator. Pressing reset will clear the audio, but the visual indicators will remain on until the condition is cleared. This mode is meant to warn of either sensor failure or sensor blockage (build-up of snow, ice, dirt, etc. on the sensors). If desired, the sensor fail parameter can be set to deactivate this feature.

2. **LOW BACKGROUND:** The instrument continually checks the gamma detectors for abnormally low readings. When this condition is detected, the orange strobe and audio on the master panel will activate. The remote display will show an orange *inst fail* indicator, and the remote audio will sound. Pressing *reset* will silence the audio, but the visual indicator will remain on until the condition is cleared. This condition normally signals a failure of either the detector or its associated preamp electronics. The condition can be cleared by disabling the detector through the software. The system can then continue to operate with reduced sensitivity until the detector can be fixed and placed back into service.

3. **HIGH BACKGROUND:** The instrument continually checks the gamma detectors for abnormally high readings. When this condition is detected, the orange strobe and audio on the master panel will activate. The remote display will show an orange inst fail indicator, and the remote audio will sound. Pressing reset will silence the audio, but the visual indicator will remain on until the condition is cleared. This condition normally signals a failure of either the detector or its associated preamp electronics but can also warn of some nearby strong source of radiation. At any rate, the possibility of such a nearby strong source of radiation warrants further investigation, especially when multiple nearby RPMs simultaneously enter this mode (inst fail).

Section 10 – Data Archiving

When the first vehicle passes through the portal after midnight, the Supervisor software automatically performs an archive and backup operation on the data files. The archive folder can be in any location that will allow files to be written. This includes network drives.

The data is archived into the "archive" folder located in “C:\Program Files\Ludlum Measurements, Inc\Model 4525 Gate Monitor\Supervisor\Archive.”

This is where the Data Viewer software gets its information. The databases will be automatically purged from this folder when the total amount of free space on drive C: goes below 20%.

The data to be backed up is copied to a CD folder located in “C:\Program Files\Ludlum Measurements, Inc\Model 4525 Gate Monitor\Supervisor\CD.” If a backup process is unsuccessful, the data will remain in the CD folder until a backup has been completed successfully.

Archive/Backup process

1. The Alarms.mdb is copied to the CD folder and then moved to the archive folder. The Alarms.mdb file is renamed to include the current date and time (20030128_000113_Alarms.mdb).

2. The NoAlarms.mdb is copied to the CD folder and then moved to the archive folder. The NoAlarms.mdb file is renamed to include the current date and time (20030128_000113_NoAlarms.mdb).

3. The Background.mdb is copied to the CD folder and then moved to the archive folder. The Background.mdb file is renamed to include the current date and time (20030128_000113_Background.mdb).

4. The Event Log.mdb is copied to the CD folder and then moved to the archive folder. The Event Log.mdb file is renamed to include the current date and time (20030128_000113_EventLog.mdb).

5. If during the copy or move steps the database is opened by another user (for example, Data Viewer loading data from the live database), the archive process will retry the operation for 20 seconds. If the file is still locked after 20 seconds the archive/backup process will abort.

6. If the cameras are active, the images will be copied to the CD folder. The images are only copied to the CD folder and not moved to the archive folder. Only the path and file name are stored in the database. The images are stored separately as standard JPEG files. The images are stored in the following directory structure:

    i. Images_f\lane_xx\YYYYMMDD\.

    ii. Images_f store the front camera images. There are separate folders for each lane.

7. New databases are created for alarms, no alarms, and background.

8. The databases in the CD folder are moved to the backup drive.

9. The images in the CD folder are moved to the backup drive.

10. The free space on drive C is checked. If it is less than 25%, a warning appears in the status bar indicating that a purge will begin when the free space drops below 20%. At 20%, the oldest databases and images files are deleted. The databases and images for each day are deleted until the free space is above 20%.

    i. There is also a menu option under the Tools menu called "Archive Databases" that starts an archive/backup process without having to wait until the user-defined archive time has passed.

    ii. The archive drive letter in Options determines where the files will backed up. The drive letter can be either a local hard drive or a network drive mapped to a local drive letter

Section 11 – Troubleshooting

Occasionally, you may encounter problems with your RPM system that may be repaired or resolved in the field, saving turn-around or the need for a field service technician visit. LMI technical support staff offer the following tips for troubleshooting the most common problems. Where several steps are given, perform them in order until the problem is corrected.

We hope these tips will prove to be helpful. As always, please call our technical support staff if you encounter difficulty in resolving a problem or if you have any questions.

Troubleshooting RPM-to-Computer Connection

Use the Device Finder utility to verify that all RPMs are found.

If the Model 4525 is shown:

1. Make sure the subnet mask is the same for the RPM and the computer.
2. The default IP address on the system outside should be 192.168.200.1, or similar to it.
3. The normal setting for the Supervisor IP address should be 192.168.200.2, or similar to it.
4. See pages 42-44 for information about *Configuring/Assigning Lanes.*

If the Model 4525 is NOT shown:

1. Make sure the RPM is on.
2. Check to see if Ethernet wires are connected.
3. Check the cross-over cable and replace if necessary. For information about the cross-over cable, please refer to the Installation manual.

Troubleshooting Complex Network Connection without Wireless

If the Model 4525 is shown:

1. Make sure the subnet mask is the same for the RPM and the computer.
2. The default IP address on the system outside should be 192.168.200.1, or similar to it.
3. The normal setting for the Supervisor IP address should be 192.168.200.2, or similar to it.
4. See pages 42-44 for information about *Configuring/Assigning Lanes.*

If the Model 4525 is NOT shown:

1. Make sure the Model 4525 RPM is on.
2. Make sure a router/firewall is not blocking it.
3. Check the Ethernet cable connection.
4. Look for a link light on the switch or media converter plugged directly into the Model 4525 RPM.
    a. If NO link light, make sure a straight-through CAT5 cable is making connection and replace if necessary. If a media converter is in use, make sure both are turned on and the fiber-optic cables are correctly connected.
    b. Make sure the Ethernet switch/hub that the Model 4525 is plugged into has 10BASE-T capabilities and is set up to use those capabilities.
    c. If a link light does exist, use Device Finder on a computer plugged directly into that switch. If the Model 4525 is shown on the Device Finder, trace the network to make sure there is not a router/firewall blocking the connection and ensure the cables are working correctly.
5. If the communications are intermittent on very long lengths of cable (300 feet or greater), remove the surge protector connected to the Model 4525.

Note:

Operation of the Model 4525 without a surge protector is not suggested due to danger of lightning damage, but by removing the surge protector, you should be able to tell if the Ethernet cable length is too long.

Troubleshooting Network Connection with Wireless

Remove all other network connections to test the wireless connection at the local wireless Access Point (AP). You can do this by connecting a laptop to the switch/hub connected to the wireless AP or by connecting the laptop directly to the AP.

Make sure you can ping the local wireless AP. If you cannot ping the local AP, make sure you have a link light on the laptop. Next, make sure the laptop's subnet mask is the same as the AP, and the laptop IP address is compatible with the AP's IP address. Use the Basic Wireless Setup below to check the settings of the wireless connection. If it still does not work, then it is recommended to follow the Netgear instructions for setup. Once the wireless is working, refer to *Troubleshooting Complex Network Connection without Wireless* on the previous page for all of the other connections in the network.

For an **Intermittent Connection**, check the alignment of the antenna. The smaller flat part of the smaller 8.5 dB antenna is the front so it needs to be pointed towards the larger antenna. The *Data Rate* in the wireless settings may need to be changed to a lower setting to obtain maximum range. Next, change the wireless channels on both Access Points.

Team Viewer (Ludlum Quick Support)

Users who are in need of remote access technical support, may connect to our website at http://www.ludlums.com, mouse over the Support menu, then click on Software Downloads. Then, scroll to the bottom of the web page and click on the icon that reads, "Download Ludlum Quick Support."

This will allow the user to run the program from his or her computer. Once the program is running, a dialogue box will appear, which generates a user ID and password automatically. This information will be needed once the user is in contact with Ludlum technical support.

Note:

The Ludlum Quick Support application is not installed permanently to the user's computer, but only runs it each time a user needs assistance. A new password is generated each time the application is opened and is only used for that session. Once the user closes the program, the user ID and password no longer work. Ludlum Measurements technical support can only have access to the computer when the program is started by the user and the ID and password are known.

When technical support has logged onto the user's computer through an encrypted connection, the support technician and user can interact with one another while the support technician troubleshoots the problem, and the user is able to watch every step. The user may also continue to control the computer with the support technician's guidance.

Once the Ludlum Quick Support application is closed, the support technician can no longer connect to the user's computer.

Common Symptoms and Possible Solutions

Infrared Sensor Fail

1. Check for object blocking infrared beam.
2. Check infrared sensor alignment.
3. Clean infrared sensors.
4. Check infrared sensor signal strength.

Communication Error

1. Check all CAT 5 cable connections.
2. Check computer and RPM IP Addresses.
3. Bypass surge protection in control and at computer if applicable.

Dead Channel or Loss of Counts

1. Make sure the preamp is not dead by checking for the red Power OK LED.
2. Check to see if photo-multiplier tubes are bad.
3. Check all MTA connections.

High Background

1. Use a portable radiation meter and check for material in area that might cause higher background readings.

2. Check if anyone has been exposed to radiation as part of a medical procedure (some people may be “hot” for weeks).

AC Fail

1. Check to see if AC voltage is present at the power supply.

2. Check all fuses.

Printer Failure

1. Check that there are not two versions of the printer driver installed.

2. Check that there is only one file for the printer.

3. Check if printer is out of paper or ink.

Section 12 - Safety Considerations

Environmental Conditions for Normal Use

- Indoor or outdoor use (excluding indoor computer, if applicable)
- No maximum altitude
- Temperature range of -40 to 50 °C (-40 to 122 °F)
- Maximum relative humidity of less than 95% (non-condensing)
- Mains supply voltage range 100-240 Vac, 50-60 Hz single phase (less than 1 A)
- Maximum transient voltage of 1500 Vac
- Installation Category II (Overvoltage Category as defined by IEC 1010-1)
- Pollution Degree 3 (as defined by IEC 664)

Notice:

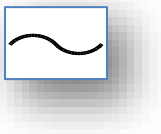
In order to ensure safe working conditions, it is a requirement of Ludlum Measurements that all work platforms and equipment used by Ludlum employees while on a customer's site meet OSHA requirements and the requirements specified in the Ludlum Safety Manual. Ludlum employees will have most tools required for sitework. Larger equipment, such as, but not limited to, the following: man-lifts (scissor lifts, bucket lifts, etc), ladders, scaffolding, cranes, and other lifting devices, etc., will be the responsibility of the customer to provide.

Warning Markings and Symbols

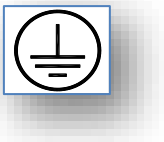
Caution!

The operator or responsible body is cautioned that the protection provided by the equipment may be impaired if the equipment is used in a manner not specified by Ludlum Measurements, Inc.

The Model 4525 may be marked with the following symbols:



ALTERNATING CURRENT (AC) (IEC 417, No. 5032) - designates an input receptacle that accommodates a power cord intended for connection to AC voltages.



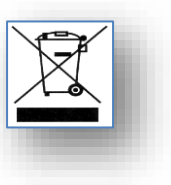
P**ROTECTIVE CONDUCTOR TERMINAL** (per IEC 417, No. 5019) – designates the central grounding point for the safety ground.

CAUTION (per ISO 3864, No. B.3.1) – designates hazardous live voltage and risk of electric shock. During normal use, internal components are hazardous live. This instrument must be isolated or disconnected from the hazardous live voltage before accessing the internal components.

Warning!

The operator is strongly cautioned to take the following precautions to avoid contact with internal hazardous live parts that are accessible using a tool:

1. Turn the instrument power off and disconnect the power cord.
2. Allow the instrument to sit for one minute before accessing internal components.



The "**crossed-out wheelie bin**" symbol notifies the consumer that the product is not to be mixed with unsorted municipal waste when discarding; each material must be separated. See "Recycling," for further information.

The "CE" mark is used to identify this instrument as being acceptable for use within the European Union.

Replacement of Fuses

Warning!

For continued protection against risk of fire, replace only with fuses of the specified type and current rating!

Cleaning Precautions

The Model 4525 is ruggedly designed and requires very little maintenance. The only routine maintenance item is the periodic cleaning of the infrared occupancy sensors. Cleaning of the sensors should be done using a soft cloth and water only.

Recycling

Ludlum Measurements, Inc. supports the recycling of the electronic products it produces for the purpose of protecting the environment and to comply with all regional, national, and international agencies that promote economically and environmentally sustainable recycling systems. To this end, Ludlum Measurements, Inc. strives to supply the consumer of its goods with information regarding reuse and recycling of the many different types of materials used in its products. With many different agencies – public and private – involved in this pursuit, it becomes evident that a myriad of methods can be used in the process of recycling. Therefore, Ludlum Measurements, Inc. does not suggest one particular method over another, but simply desires to inform its consumers of the range of recyclable materials present in its products, so that the user will have flexibility in following all local and federal laws.

The following types of recyclable materials are present in Ludlum Measurements, Inc. electronic products, and should be recycled separately. The list is not all-inclusive, nor does it suggest that all materials are present in each piece of equipment:

- Batteries
- Glass
- Aluminum and Stainless Steel
- Circuit Boards
- Plastics
- Liquid Crystal Display (LCD)

Ludlum Measurements, Inc. products, which have been placed on the market after August 13, 2005, have been labeled with a symbol recognized internationally as the “crossed-out wheelie bin.” This notifies the consumer that the product is not to be mixed with unsorted municipal waste when discarding; each material must be separated. The symbol will be placed near the AC receptacle, except for portable equipment where it will be placed on the battery lid.

The symbol appears as such:

Section 13 – Parts and Consumables

Parts for Repair

The following list contains the recommended parts needed to quickly return the Model 4525 into service in the event of failure. See Model 4525 Parts Catalog for a full list with photos.

Quantity	Description	Part Number
2 ea.	Model 4525 Ethernet Surge Protector with Lug	8517-622
1 ea.	Power Supply Kit	4517-415
1 ea.	Main Board	5396-565
1 ea.	Dual Preamp Board	5558-344
1 ea.	I/O Board	5396-933
2 ea.	Fuse #312001	21-9277
2 ea.	Fuse – 10 AMP	21-9511
2 ea.	Fuse – 1 AMP	21-9664
2 ea.	Fuse – 2 AMP	21-9988
1 ea.	Model 44-196 PMT Assembly	4511-853PR
1 ea.	Computer Replacement Kit	4517-421
1 ea.	Mini USB Keyboard with Touchpad	2311140
1 ea.	22 inch LCD Monitor	2311753
1 ea.	Printer-Brother HL L-3230	2313797
1 ea.	UPS-APC BE 425M	2310985
1 ea.	Charger Board	5558-464

Consumables

Consumbers include printer ink cartridges and paper (if printer is used).

Consult the accompanying manufacturer printer manual for instructions on printer maintenance and appropriate replacement parts.

Section 14 – Software and Firmware Change History

Software and Firmware Compatibility

Version 3.9.3 – 39651n31, 39651n40 or higher, 39653n09 or higher
Version 3.9.2 – 39651n31, 39651n40 or higher, 39653n09 or higher
Version 3.9.1 – 39651n31, 39651n40 or higher, 39653n09 or higher
Version 3.9.0 – 39651n31, 39651n40 or higher, 39653n09 or higher
Version 3.8.9 – 39651n31, 39651n40 or higher, 39653n09 or higher
Version 3.8.8 – 39651n47
Version 3.8.7 – 39651n31, 39651n40 or higher, 39653n09 or higher
Version 3.8.6 – 39651n31, 39651n40 or higher, 39653n09 or higher
Version 3.8.5 – 39651n31, 39651n40 or higher, 39653n09 or higher
Version 3.8.4 – 39651n31, 39651n40 or higher, 39653n09 or higher
Version 3.8.3 – 39651n31, 39651n40 or higher, 39653n09 or higher
Version 3.8.2 – 39651n31, 39651n40 or higher, 39653n09 or higher
Version 3.8.1 – 39651n31, 39651n40 or higher, 39653n09 or higher
Version 3.8.0 – 39651n31, 39651n40 or higher, 39653n09 or higher
Version 3.7.8 – 39651n31, 39651n40 or higher, 39653n09 or higher
Version 3.7.7 – 39651n31, 39651n40 or higher, 39653n09 or higher
Version 3.7.6 – 39651n31, 39651n40 or higher, 39653n09 or higher
Version 3.7.5 – 39651n31, 39651n40 or higher, 39653n09 or higher
Version 3.7.4 – 39651n31, 39651n40 or higher, 39653n09 or higher
Version 3.7.3 – 39651n31, 39651n40 or higher, 39653n09 or higher
Version 3.7.2 – 39651n31, 39651n40 or higher, 39653n09 or higher
Version 3.7.1 – 39651n31, 39651n40 or higher, 39653n09 or higher
Version 3.7.0 – 39651n31, 39651n40 or higher, 39653n09 or higher
Version 3.6.2 - 39653n08 or higher
Version 3.6.1 - 39653n08 or higher
Version 3.6.0 - 39653n08 or higher
Version 3.5.4 - 39653n06 or higher
Version 3.5.3 - 39653n06
Version 3.5.2 - 39653n05
Version 3.4.0 - 39653n01
Version 3.3.0 - 39651n36 or higher
Version 3.2.4 – 39651n31 or higher
Version 3.2.3 – 39651n31 or higher
Version 3.2.2 – 39651n31 or higher

Version 3.2.1 – 39651n31 or higher
Version 3.2.0 – 39651n31 or higher
Version 3.1.2 – 39651n31 or higher
Version 3.1.1 – 39651n31 or higher
Version 3.1.0 – 39651n31 or higher
Version 3.0.0 – 39651n31 or higher
Version 2.9.6 – 39651n31 or higher
Version 2.9.5 – 39651n30
Version 2.9.4 – 39651n30
Version 2.9.3 – 39651n30
Version 2.9.2 – 39651n30
Version 2.9.1 – 39651n30
Version 2.9.0 – 39651n30
Version 2.8.1 – 39651n25 to 39651n28.
Version 2.8.0 – 39651n25 to 39651n28.
Version 2.6.1 -- 39651N22 and 39651n29
Version 2.6.0 -- 39651N22
Version 2.5.0 -- 39651N20
Version 2.4.0 -- 39651N18
Version 2.3.0 -- 39651N16
Version 2.1.0 -- 39650N02, 39650N32, 39651N03 and 39651N04
Version 2.0.0 -- 39650N32 and 39651N01
Version 1.0.10 -- 39650N23 and 39650N30, 39650N31 and 39650N32
Version 1.0.9 -- 39650N30, 39650N31 and 39650N32
Version 1.0.8 -- 39650N23 and 39650N30
Version 1.0.6a -- 39650N23 only

Current Firmware

39651N46

Added a “sleep” mode. This is useful for customers who have to leave a vehicle parked in the portal for an extended period of time and allows the portal to automatically acquire a fresh background.

Software Change History

Version 3.9.9a – May 2026
Fixed issue where Dataviewer didn't correctly parse the display units.
Version 3.9.9 – May 2026
Added support for µSv/hr.
Version 3.9.8 – May 2025
Updated German translation.
Version 3.9.7 – March 2025
Updated German translation.
Version 3.9.6 – October 2024
Updated German translation.
Updated all wav files.
Version 3.9.5 – August 2024
Added support tamper input.
Version 3.9.4 – March 2024
Added support for German language.
Fixed issue where 14000 system with neutron didn't display panels correctly on main and fail screens.
Version 3.9.3 – June 2023
Added support for 4530. Requires firmware 39653N18 for 4530 system types.
Added preliminary support for Japanese language.
Version 3.9.2 – February 2023
Updated Spanish translation.
Version 3.9.1 – January 2023
Added information for the ESP32 Ethernet board which replaces the RCM3750 Ethernet board.
Version 3.9.1 – September 2022
Fixed issue on 7600, 10000, and 14000 systems using dual channel firmware where Supervisor would not show the correct data in the alarm grid for channel 2.
Version 3.9.0
Added in option to save status and results file for CeMoSys.
Fixed where RPM might not be found when searching based on regional settings.
Version 3.8.9
If camera is enabled, the image will be sent in the email message for alarming vehicles.
Version 3.8.8
Special for Clean Harbors to allow sigma set point to 6553.5.
Version 3.8.7
Tweaked alarm summary report to work better when readings are set to µR/hr.

Version 3.8.6
Added in Alarm Summary Report
Simplified camera options to only use a single URL. Image is captured every second as a JPEG image. RTSP proved to be to resource intensive for computers used prior to the NUC model we currently use.
Version 3.8.5
Change network caching to help decrease lag with RTSP.
Version 3.8.4
Updated wiring for 17500-2 and 21000-2.
Version 3.8.3
Changed to use real time streaming protocol (RTSP) for cameras.
Version 3.8.2
Added updated summary report.
Version 3.8.1
Fixed where speed wasn't cleared in certain circumstances.
Version 3.8.0
Changed E-Mail to use authentication as well as adding three groups with filters to send messages. Added option to set two different vehicle types with sigma and percent alarm points that can be toggled. Search should now only show 4525 systems. Added message that user needs to restart application when changing station type.
Version 3.7.8
Added option send email alert as soon as alarm occurs in addition to email sent at end of occupancy. This will help customers who are rely solely on email for notification of alarm. Added beginnings of French language.

Version 3.7.7
Added option to ignore n seconds at the front of the vehicle to prevent alarming on truck radiators.
Version 3.7.6
Changed camera control to use the axis media control. This better supports other cameras beside iqeye (vicon).
Version 3.7.5
Email messages are stored in a queue before sending.
Changed format of email subject line, use dashes instead of brackets to separate the sections.
Added lane caption to the email subject line.
Added eventlog messages for copying data for the report service.
Version 3.7.4
Fixed issue saving percent 2 alarm flag in database.

Changed “1 Infrared” detector to work better.
Fixed issue where fail window incorrectly shows ac power recovered.
Fixed issue where micro symbol shows an extraneous character.

Version 3.7.3

Minor bug fixes. Removed single infrared percent alarm setting.

Version 3.7.2

Minor bug fixes.

Version 3.7.1

Minor bug fixes.

Version 3.7.0

Added support for new preamp boards.
Single software version supports both steel (39651N31 and 39651N40) firmware and Security (39653N09) firmware.

Version 3.6.2

Fixed bug when search for RPM with RCM4300.

Version 3.6.1

Minor bug fix in data viewer.

Version 3.6.0

Added support for the 28000E.

Version 3.5.4

Added support for downloading logged data from the SD Card with the RCM4300 Ethernet board.

Version 3.5.3

Bug fixes

Version 3.5.2

Added support for new detector configurations

Version 3.3.0

Added Ratio alarms.

Version 3.3.0

Added NORM support.
Added MX Lookup options.
Added ability for Data Viewer to highlight background failures. Required background.mdb format to be changed.

Version 3.2.4

Minor bug fixes.

Version 3.2.3

Minor bug fixes.

Version 3.2.2

Fixed issues with how neutron detectors is displayed on 14000N system.
Fixed event log display in Data Viewer.

Version 3.2.1

Fixed issues using non-neutron firmware.
Fixed issue with Taiwan locale (? characters).

Version 3.2.0

Added support for neutron detectors.
Compatible with N31 (Non-neutron) and N33(Neutron) or higher firmware.

Version 3.1.3

Fixed issue with Data Viewer and date formats.
Fixed formatting issues with Italian.

Version 3.1.2

Fixed issue with camera images.

Version 3.1.1

Fixed issue with Chinese locale and saving camera images.
Fixed Data Viewer to create a default 'local' site when installed.

Version 3.1.0

Added ability to configure multiple sites for the Echo and Data Viewer.

Version 3.0.0

Finalized Chinese support.

Version 2.9.6

Added support for Spanish and Chinese.
Added support for firmware 39651n31.
Added parameter to disable train proximity alarms.
Added parameter for rail car gap skips.

Version 2.9.5

Added support for localization.
Updated rail car and truck images.
Fixed bug updating metadata from the alarm screen.

Version 2.9.4

Fixed bug formatting IP Addresses when searching for RPMs.

Version 2.9.3

Fixed bug where profile graph displayed incorrectly for a 14000 system.
Fixed bug where Data Viewer did not show alarm location.

Version 2.9.2

Fixed bug in Data Viewer where alarm location graphic would be placed beyond the right margin on the profile report.

Version 2.9.1

Minor bug fixes.

Version 2.9.0
Cloned from 2.8.1
Moved wav files into wav folder.
Moved graphic files into gfx folder.
Cleaned up project file names.
Uncluttered Parameters screen (copied from 2.9.0pre).
Removed Settings folder and changed ini file to settings.ini.
Fixed Supervisor parameter entry for sigma augmentation. Parameter can only accept values from 0 to 25.5 because parameter is only 1 byte (#506).
Major rewrite of most code to simply remove unnecessary variable, 4500 code, etc.
Echo is no longer a separate program and is integrated into Supervisor.
Profile report is now a data report using a designer instead of having to manually create it.
Removed option for small format printer.
Change camera configuration so it should work with other cameras. Currently supports live streaming on the IQeye camera. Other cameras should work with static images.
Database is incompatible with all previous versions. Use older Data Viewer to see older data.
Infrared sensors are no longer represented with Xx. Use annotations to be clearer and more visible.
All controls that accept numeric input have been changed to up/down controls for better validation.
Installation changed to use inno setup instead of PDW.
Version 2.8.1
Minor bug fixes.
Version 2.8.0
Minor bug fixes.
Version 2.7.0 (Internal Test –Not Released)
Version 2.6
Added compatibility with monitor
Added Audible Alert Language
Version 2.5
Added counter grid on main window
Added background average expand to all panels on main
Added cartoon truck and train on screen and color change
Added the screen window to change size
Added Sigma Augmentation
Added separate over-speed hold
Added Abridged Over-speed Alarm
Added Alarm Ack password
Added Auto Counter Reset

Added metric
Added Min Graph Value

Version 2.4

Added 13200 size
Added control of four more panels

Version 2.3.0

Fixed camera problems
Fixed other minor problems

Version 2.1.0

Added compatibility with 39651N04 and new percentage alarm

Version 2.0.0

Added 6600 capability
Fixed database and miscellaneous errors
Fixed camera pausing

Version 1.0.10

Fixed compatibility problems with N23
Fixed problems with a long sensor timeout, affecting sensor triggered graph

Version 1.0.9

Added cursers marking the start of the alarm
Added cursers marking when the sensors are triggered

Version 1.0.8

Fixed e-mail printout
Fixed multiple camera problems
Fixed Archiver (archive alarm images only) problem
Fixed to work internationally

Version 1.0.7

Added µR/hr display formats
Added the ability to reset detector from the computer
Fixed camera timing in vehicle mode, taking of pictures in train mode
Fixed e-mailing every train even if no alarm

Version 1.0.6

Fixed Options not saving direction
Fixed alarm count not updating correctly

Version 1.0.5

Added ability to exclude events from sending e-mails

Version 1.0.4

Added direction (north, south, east, and westbound) of occupancy.
Added “Rail” System type
Added ability to count rail cars

Fixed Data Viewer not showing speed under graph
Resized main screen so its not necessary to hide the taskbar
Added e-mail support
Added conversion to µR/hr on alarm popup and reports

Version 1.0.3

Initial release