MAINTENANCE MANUAL

RS-200/300/400

Radiation Portal Monitoring Systems

MAINTENANCE MANUAL

Part Number P-1328.02.00

Revision 2.0

RADIATION SOLUTIONS INC.

A New Generation of Radiation Detection Technology

www.radiationsolutions.ca

Revision History			
Date	**Rev level**	**ECO #**	**Description**
May 20, 2010		N/A	Release Maintenance manual
Jun 16, 2010	01.04	NA	Fine tuning
Sep 2010	01.05		Upgraded check sheet
Apr 2011	01.06	130	Change OS wiring details
Jan 2013	01.07	NA	Update to incorporate new data and reformat manual
Apr, 2013	02.00	NA	Current Release – remove version level from Rev History

Product Manual - Disclaimers:

Due to our efforts to continuously improve this product; specifications, dimensions, operating features and procedures described in this manual are subject to frequent changes. The printed version of this manual reflects only the configuration current at the time of printing. The most current version of the manual is provided in electronic format on the Product Support CD supplied with the instrument. Please refer to the electronic version of the manual for the most accurate interpretation.

CONFIDENTIAL DISCLOSURE

USERS ARE HEREBY NOTIFIED THAT THIS MANUAL CONTAINS TECHNICAL INFORMATION OF A PROPRIETARY NATURE. THIS INFORMATION IS NECESSARY FOR TECHNICALLY KNOWLEDGEABLE USERS TO UNDERSTAND SYSTEM OPERATION AND TO SATISFY THEMSELVES THAT THE SYSTEM IS PERFORMING CORRECTLY.

RADIATION SOLUTIONS INC ACCEPTS THAT IT IS THE RIGHT OF SUCH USERS TO BE PRIVY TO THIS INFORMATION. HOWEVER THIS DOCUMENTATION IS PROVIDED SOLELY FOR THE BENEFIT OF OWNERS OF THE RS-700 SYSTEM AND DISSEMINATION OF THE DETAILED TECHNICAL INFORMATION PROVIDED MAY BE CONSIDERED AS LEGALLY CONTRAVENING THE NORMAL SUPPLIER/CUSTOMER RELATIONSHIP.

UNAUTHORIZED RELEASE OF DETAILED TECHNICAL INFORMATION TO A THIRD PARTY WILL BE CONSIDERED AS A CONTRAVENTION OF USER AGREEMENTS.

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Table of Contents

1.0 INTRODUCTION

1.1 Manuals

The following is a list of manuals available for the system – this manual is highlighted in **RED**.

There are various manuals available as noted below

1 **P-1324 – INSTALLATION manual**
2 **P-1327** – START-UP manual
3 **P-1323** – OPERATORS' manual
4 **P-1322** – RSO manual
5 **P-1328** – MAINTENANCE manual **(this manual)**

If the customer is doing system Start-UP please request the START-UP manual from RSI-Service – **service@radiationsolutions.ca.** Also see **Appendix Z** for Contact information.

USER, RSO and MAINTENANCE manuals will be supplied with the shipment

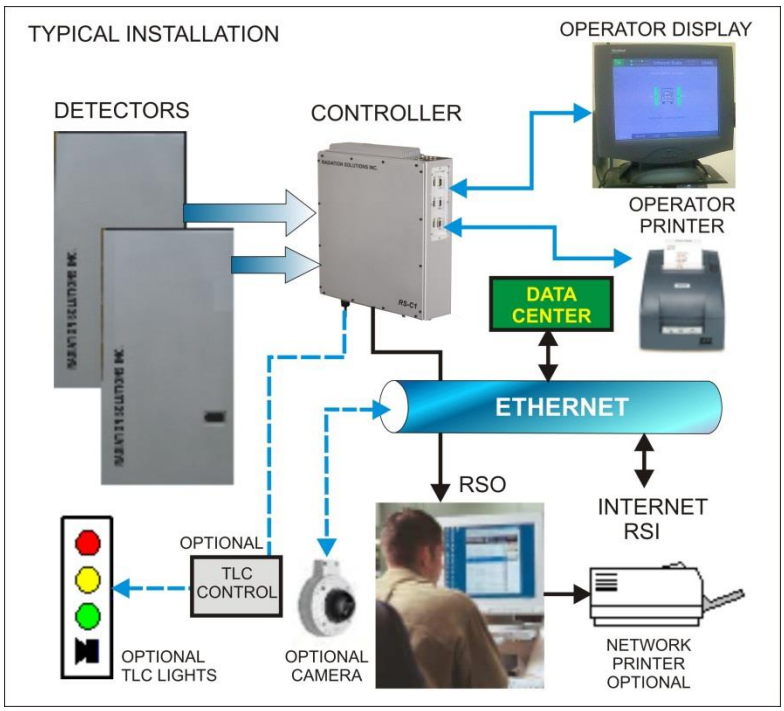
1.2 General

The RS-200/300/400 series of Radiation Detection Systems are primarily designed for use in the Steel and Metals Recycling Industry. Typically the units are used as Incoming Vehicle/Rail monitors to detect the presence of Radio-active material that could cause huge disruption and economic problems if melted in the EAF. Other applications include Charge-Bucket monitoring and other specialized uses such as EAF exhaust duct monitoring etc.

Note: The RS-200, 300 and 400 units are very similar except in detector size and # of PMTs so this manual covers both systems and differences are clearly noted.

1.3 System Overview

The system design is as shown on the block diagram.



Main Features:

a) Detectors are connected to the central system Controller via RS-485, permitting high speed data transfer over a long distance.

b) Detectors have modular design to permit easy servicing.

c) The system supports up to 14 detectors in 2 banks of up to 7 detectors each side.

d) The detectors are powered by 48V from the Controller thus permitting longer cable runs.

e) System **CONTROLLER** is a "black-box" system mounted in a convenient location that carries out all alarm analysis and data integration - NO USER INTERACTION IS REQUIRED.

f) The Controller provides connectivity to Displays/printers via VGA/USB/RS232 connections as well as full Ethernet connectivity to the plant network.

g) **DISPLAY** - a 15" touch screen display mounted conveniently for the operator is supplied with the system to permit easy user connectivity. System interaction and graphics have been optimized to make it easy-to-use.

h) **PRINTER** – no internal printers are used as this reduces system reliability. All systems are supplied with a small Point of Sale (POS) Printer system that prints a simple summary for each alarm as an aid to the user.

i) **TLC** – if required an optional Traffic Light Controller (TLC) can be supplied with the system to interface to external traffic lights and horns etc. **Note:** Lights are not included.

j) Wireless (or BT) is available if required to support remote data transfer etc.

1.4 Acronyms

The following Acronyms are used throughout this manual:

Hardware	**SDM**	Steel Detector Module
	SIM	Steel Interface Module
	VPM	Vehicle Presence Module
	SCT	Steel Controller Termination
	CPU	Computer Processing Unit
	LED	Light Emitting Diode
	OS	Optical Sensor
	TLC	Traffic Light Controller
	UPS	Uninterruptable Power Supply
	RCV	Receiver
	XMITTER	Transmitter
	XFORMER	Transformer
	POS	Point of Sale
	S.S.	Stainless Steel
Connections	**AUX**	Auxiliary
	DB9	RS-232 9 pin Connector
	RJ45	Ethernet Connector
	ETH	Ethernet
	GND	Ground
	PWR	Power
	AC	Alternating Current
	TRM	Termination
	COMM	Communication

2.0 MAINTENANCE ON RSI SYSTEMS

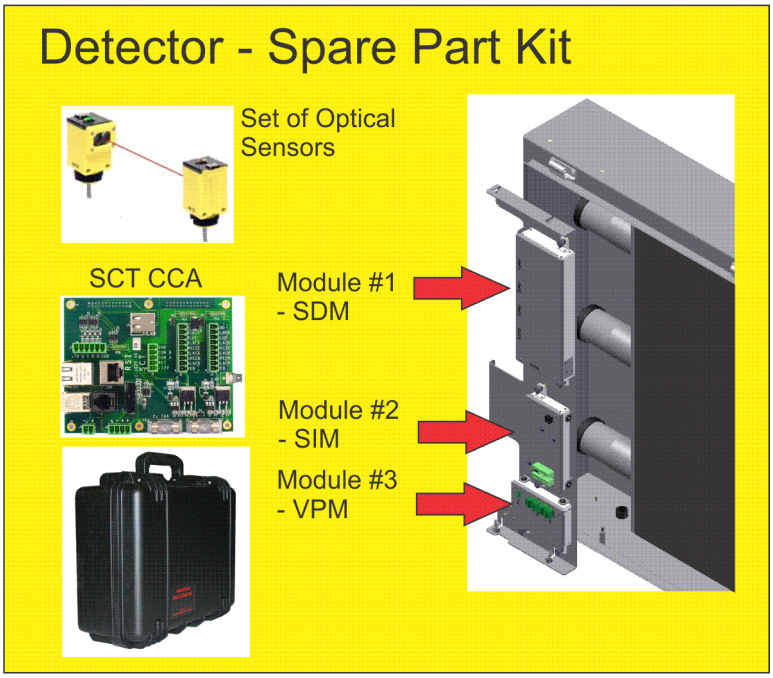
PRINCIPLES OF RSI-SERVICE SUPPORT:

1. **GENERAL: RSI SYSTEMS ARE VERY COMPLEX SO IN ORDER TO PROPERLY SUPPORT THE LOCAL MAINTENANCE STAFF – ALL SYSTEM TROUBLESHOOTING IS NORMALLY CARRIED OUT BY RSI-SERVICE STAFF.**

2. ***In order to provide 100% Performance Testing of remote systems, RSI recommends that an Internet Link between the customer and RSI be enabled.*** It is understood that some local IT groups have issues with this type of connectivity, but RSI recommends that maintenance work be performed concurrently with the local IT staff and RSI-SERVICE tech support. Without this Internet Link support is possible but it is extremely difficult and RSI-SERVICE cannot guarantee good results, with only a phone contact these issues are often extremely difficult to diagnose and result in expensive on-site service visits which can delay system repair by a significant time.

3. In RSI's extensive experience, the vast majority of hardware failures on the installed radiation monitoring systems are in the **DETECTORS and Optical Sensors (OS)**. The 2 main reasons for this are that; 1) The Detectors and OS are exposed to extremes of weather and lightning because of their outdoor exposure, out in the scrap yard which is a magnet for lightning, and 2) The Controller, printer, etc. is usually installed in an office so is afforded much more protection.

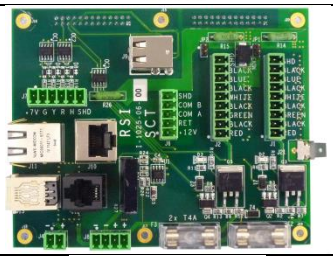
4. All systems are supplied with **1 set of DETECTOR Spare Parts** as these are the most vulnerable parts likely to fail. The concept is – RSI-SERVICE does the troubleshooting and narrows the problem down to the module – and local on-site Maintenance staff then changes the appropriate module. Defective modules are sent back to RSI for repair and RSI will then send replacement parts ASAP to ensure that the local user always has a proper Spares Kit on site.
   NOTE: Spare Kits are sold in addition to the system.



5. The **CONTROLLER** is a complex computer based system and is significantly less likely to fail than the exposed DETECTORS. RSI past experience has shown that replacing Circuit Card Assemblies within the Controller often compounds the problem and can delay system repair by a significant time, so it is RSI's policy that if Controller problems are diagnosed – the entire Controller is changed out. This is facilitated by a gland-seal system as described (see Section 8.3 for detailed procedures).

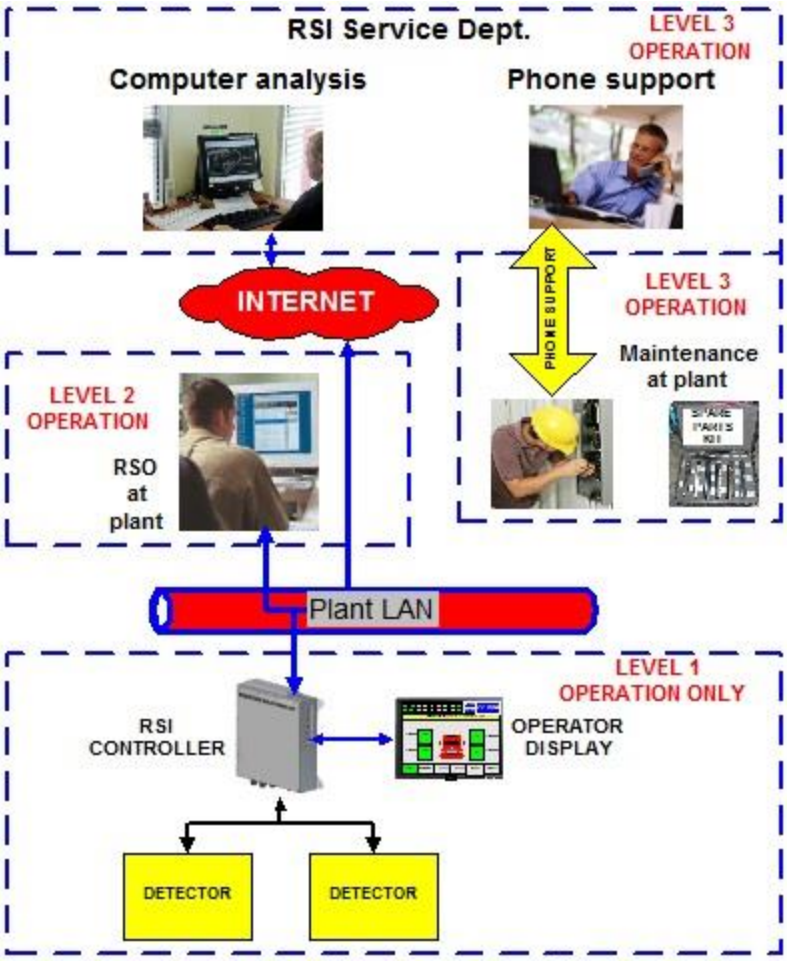
6. **OPTICAL SENSORS** can fail so a spare set of these is supplied in the Detector Spare Parts kit as they are relatively easy to change.

Using the above techniques, most system problems are usually diagnosed and repaired at a speed limited only by the local Maintenance Staff priority in changing defective parts.

DETECTOR SPARE PARTS KIT – RS-200/300/400 (C-1134)			
ITEM	**PART NUMBER**	**QTY**	**DESCRIPTION**
	P-1067 – Rx P-1068 – Tx	1	Set of Optical Sensors with Optical Sensor Cable (5m) - K-1143
	C-1110	1	Module #1 – SDM (Detector)
	C-1090	1	Module #2 – SIM (Detector)
	C-1091	1	Module #3 – VPM (Detector)
	I-1025	1	SCT Interface Assembly (Controller)
	XP-1203	5	Set of Controller Fuses (Qty 2) 4A – 250V IEC-Slo-Blo Fuses
Special Tools Kit (2 pieces)	XP-1460 & XP-1461	1 ea	7/64 Special Socket Screw Driver Slotted Screw Driver
	P-1259	1	Spare Parts Kit Carrying Case

NOTE: Spares Kit (**C-1102**) is also available (same as above but without OS)

The following figure shows the basic system operation and support concepts.



a) **LEVEL 1** – at this level the system Operator handles vehicle analysis and alarms as they occur and advise Maintenance of any Maintenance issues.

b) **LEVEL 2** – many “problems” in system operation are related to “strange” alarms, the RSO has special software (RadInspect) supplied by RSI that permits them to overview system operation and resolve this type of problem. Sometimes in this overview mode they see technical issues and may advise Maintenance if these occur.

c) **LEVEL 3** – **MAINTENANCE** issues – these occur at various levels:

1) AUTO ERROR REPORT - RSI systems have an error reporting capability built in, so in the event of an error being detected, if the Internet link is established the systems will automatically advise RSI-Service of a problem.

2) MAINTENANCE notes issues and advises RSI by phone or email.

3) RSI trouble shoots the system using the Remote link and advises local staff of problems and resolutions.

4) In most cases the Spares kit is used to fix the problem and RSI works with Maintenance to replace the defective unit and get the bad unit returned to RSI for repair.

5) As required special parts may be required to be sent to the plant to resolve the issue.

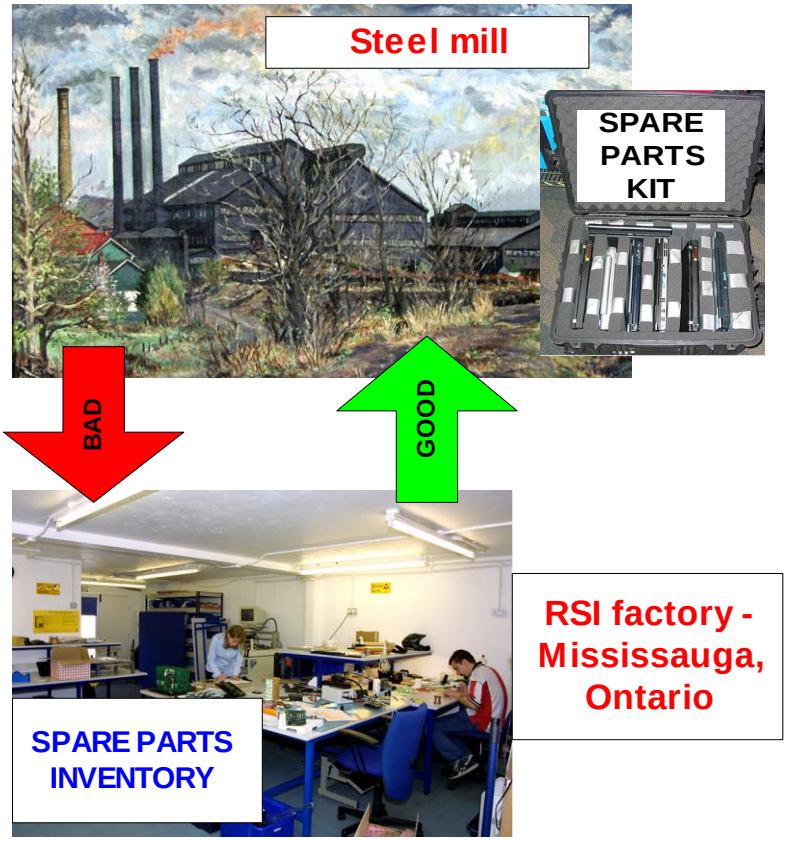
6) In special cases a RSI-Service on-site visit is required to resolve special problems.

IN MOST CASES THE INTENT IS TO USE RSI TO TROUBLE SHOOT THE SYSTEMS AND LOCAL STAFF TO REPLACE DEFECTIVE PARTS TO GET THE SYSTEM BACK UP ASAP.

SPARE PARTS FLOW

The figure below explains the Parts flow concept:

- The local user uses the Spare Parts kit to repair the system using RSI-Service as a troubleshooting aid.
- The defective part is sent back to RSI.
- RSI sends a replacement part to the plant so the Spare Parts kit is always current.



3.0 SYSTEM BASICS

System operation has been simplified to make it as user-friendly as possible. The user interface is primarily with the large touch-screen color display (called **DISPLAY** in the manual). No pressure is required to activate the display just a simple **TOUCH**.

3.1 Power ON

The RS-Controller is wired to a UPS system. There is no power (ON/OFF) switch on the Controller as it is meant to function 24/7. Use the UPS control to power off the controller as required for maintenance purposes.

Note: The UPS is supplied by the customer.

After powering the UPS on, after 30 sec to 2 min, the LED's at the top of the Controller will light up as the internal computer systems starts its boot up sequence.

Most operators, use the **LED DISPLAY** for system status information, but these LEDs can also be used for Controller trouble shooting and the table below explains the functions.

LED 1	**Power Status** GREEN = Power OK
LED 2	**Health Status** GREEN = No Error YELLOW – Warning present RED – Error present
LED 3	**Alarm Status** GREEN = No Pending Alarm RED = At least one alarm is pending
LED 4	**Datacenter Communication Status** GREEN – Connected RED – Not Connected

For all further communication with the system, use the DISPLAY interactive touch screen.

3.2 Display Screen

Look at the Display Screen, various start up messages are seen then after approximately 2 minutes the boot up sequence is completed and the display should be as seen in the figure.

This is referred to as the **LIVE** screen

3.3 Status Bar

The Common top bar shows various data that are common to all pages.

This top left button is an Indicator Light and its color defines a function
GREEN = OK, **YELLOW** = Warning, **RED** = Alarm or Error. The button will display the following labels; – OK, Warning, Error and Alarm to advise the user of the current status.

NOTE: This button is also a touch button used for user response as noted below

Check that this light is **GREEN** – to show system is **OK**

This box shows the status of all detectors connected to the system. In this case this is a 4 detector system A1, A2, B1, B2 shown with **SQUARE** boxes. Green means that the detector is active, grey inactive.

"Detector" #5 in the figure is a **ROUND** symbol which designates it as a VPS or vehicle presence sensor system.

Another alternative is a **TRIANGULAR** symbol to designate a RFID system connection. This has not yet been implemented into this version of software.

The key thing here is that **ALL LIGHTS SHOULD BE GREEN** – if not this visually indicates an error and which detector is involved. These functions are described in more detail in the **STATUS** page description below (refer to **Chapter 4.0**).

This shows the SUM of all detectors connected to the system in **counts/second** and is a **5 second average** to make it easier to read. This information gives the user an idea of the current system status as this number stays approximately the same from day to day.

NOTE: The following screens display and describe a 4 DETECTOR system. The system can be configured from 1 up to 14 detectors in various configurations but for the purpose of this manual a 4 detector system is shown.

4.0 STATUS PAGE and SYSTEM ERRORS

This page shows the current Status of important parameters.

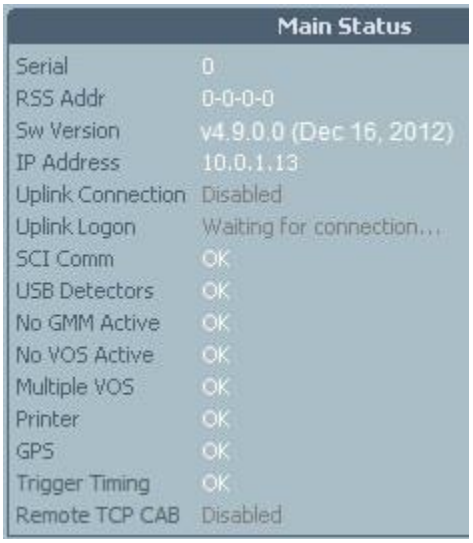
In the event of an error, the audio sounds and the top left red button shows:

User should silence the audio by pressing the button and the display automatically changes to this Error display to permit the user to assess the problem.

This screen can also be used to check the status of various functions as described below.

4.1 Main Status Data box

This data box shows various data about the system that is useful in troubleshooting.



Serial: this is the serial number of the installed system and is an import ID for RSI Service support.

RSS Addr: this is the System IP address on the Plant Network.

Sw version: the installed Controller software version.

IP address:the systems IP address on the Internet.

Uplink connection:an RSI set parameter to define the Controller's data level – normally this **should say ENABLED**

SCI Comm – shows communication with the Spectrometer units inside each detector is all **OK** – **should say OK**

USB Detectors – shows communication with USB connections to the detectors is **OK** - **should say OK**

No GMM active – shows that the configured detectors test **OK** – if the system detects an active detector that is NOT in the configuration it generates an error - **should say OK**

No VOS active – shows VOS unit test **OK** – if the system detects an active VOS that is NOT in the configuration it generates an error - **should say OK**

Multiple VOS – if the system detects multiple VOS units the system shows an error as only 1 VOS unit is required for correct system performance - **should say OK**

Printer – shows Printer is connected and test **OK** - **should say OK**

GPS – shows GPS is connected and tests OK - **should say OK**

Trigger Timing – shows Trigger is connected and tests OK - **should say OK**

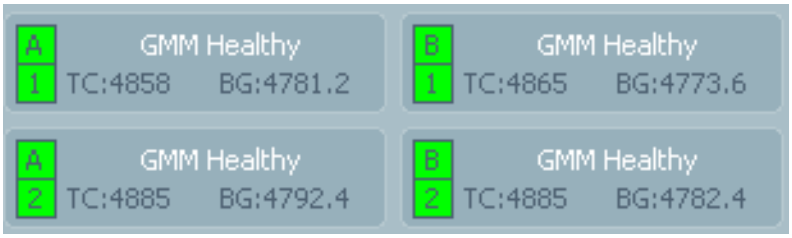
Remote TCP CAB – shows TCP CAB is DISABLED – normally this **should say DISABLED**

4.2 Detector Display

These data information show the status of various parts of the system. The rule-of-thumb is if all lights are **GREEN** then all is **OK**.

Line A (B) Healthy – the detectors are connected to the Controller unit via 2 separate cables. The detectors are setup on opposite sides so the vehicle must pass between them. All detectors on one side are designated **A** detectors (A1, A2…A7) and the other side are designated **B** detectors (B1, B2…..B7). Both these sets of detectors are fed into the Controller on SEPARATE cables and plugged into the Controller data inputs in the A input and the B input. A green light here means that the Controller can read these input ports **OK** so the data INPUT is functional.

GMM Healthy – this is the Gamma Data (GMM) for the detectors. The example given here is for a 4 detector system designated A1, A2 and B1, B2. The green label for each detector shows that the detectors are functioning **OK**.



TC:4858 - is the Total Count data from each detector.

BG:4781.2 - is the stored Background data for each detector.

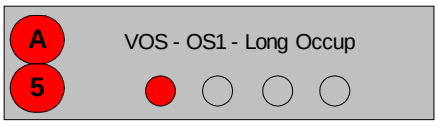
VOS Healthy – the semi-circular icon shows that this "detector" is actually a Vehicle Occupancy Sensor (VPS) and is functioning **OK (GREEN)**. As a vehicle passes, the 4 lower "lights" will light up as the OS are activated. The example shows OS1 and 2 activated. As a typical scrap truck passes action on all 4 OS should occur.

If any OS is inactive or "stuck on" then an error will occur and the appropriate OS will show a **RED** light to indicate the error.

SCAN ERROR (OS ERRORS)

If any OS is inactive or "stuck on" then an error will occur and the appropriate OS will show a **RED** light to indicate the error.

A typical example is if the OS unit is misaligned – system logic sees this, the same as if it was covered for a long period of time. The system has an internal error check and no OS is expected to stay on for longer than the typical 20 secs max of vehicle transit. An internal system timeout is set at 900 seconds. After this time period the ERROR message is given and the OS STATUS shows as follows. The OS should be checked at the detector, refer to Chapter 7.0 Optical Sensor Issues.



OS1 OS2 OS3 OS4

NOTE: WHEN THE SYSTEM IS BEING TESTED and DETECTOR DOORS ARE OPENED etc. NO VEHICLES SHOULD BE PERMITTED TO PASS THROUGH THE SYSTEM OR ERRORS WILL OCCUR – SPECIFICALLY SCAN ERRORS. WHILE THIS IS NOT A HUGE PROBLEM EACH ERROR REQUIRES THE USER TO RESPOND TO IT SO REPEATED UNNECESSARY ERRORS ARE ANNOYING.

STATUS ERRORS

When the system first starts it must compute the local background levels as a reference. During this time the "**COMPUTED BACKGROUND**" is shown as:

- **Init. BG 9 [2]**

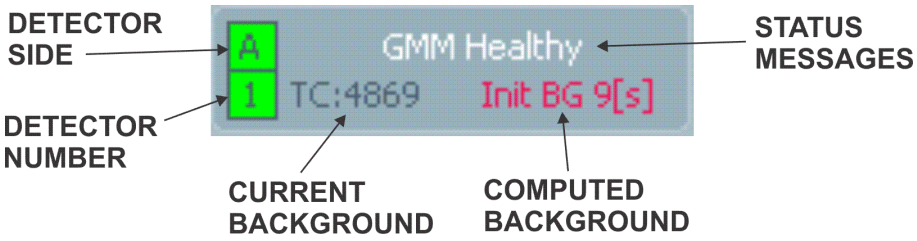
Where: **Init. BG** = the label showing that the local Background is being computed.

9 = this is the count rate of the detector in counts/second and this number varies depending on detector location but is typically 3000 to 5000cps.

[s] = this is the preset time countdown – and progresses usually from 60 seconds (parameter preset value) down to 0. When the detector BG countdown gets to 0 the computed value is displayed, the countdown disappears and the data changes from red to white to show that all is now **OK.**

At the same time the **ERROR** button (top left) automatically changes to Green **OK** when all detectors backgrounds are computed **OK**.

Problems that can occur are displayed in the "**STATUS MESSAGE**" box shown in the figure. Messages, meaning and recommended actions are show in the table below.

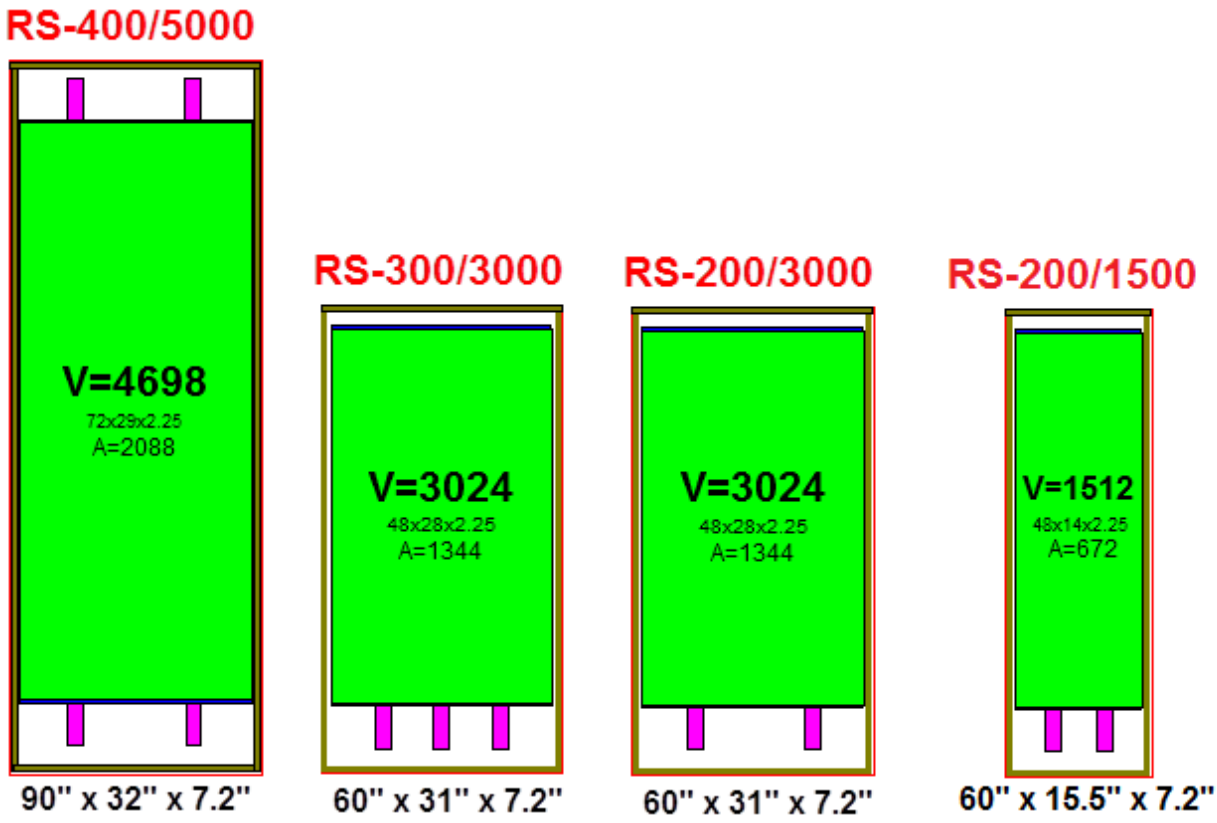


5.0 RS-200/300/400 Detectors Tech Notes

The RS-200 detector has either 1512 or 3024 cu in of detector volume and uses 2PMT technology. The detector assembly has been designed to be **exactly the same size** as the majority of older technology detectors to permit direct replacements without changing the installation.

The RS-300 detector has 3024 cu in of detector volume and uses 3PMT technology. The detector assembly has been designed to be **exactly the same size** as the majority of older technology detectors to permit direct replacements without changing the installation.

The RS-400 detector has 4698 cu in of detector volume and uses RSI's new 4PMT technology with PMTs at both ends of the detector to compensate for light losses along these extra long detectors.



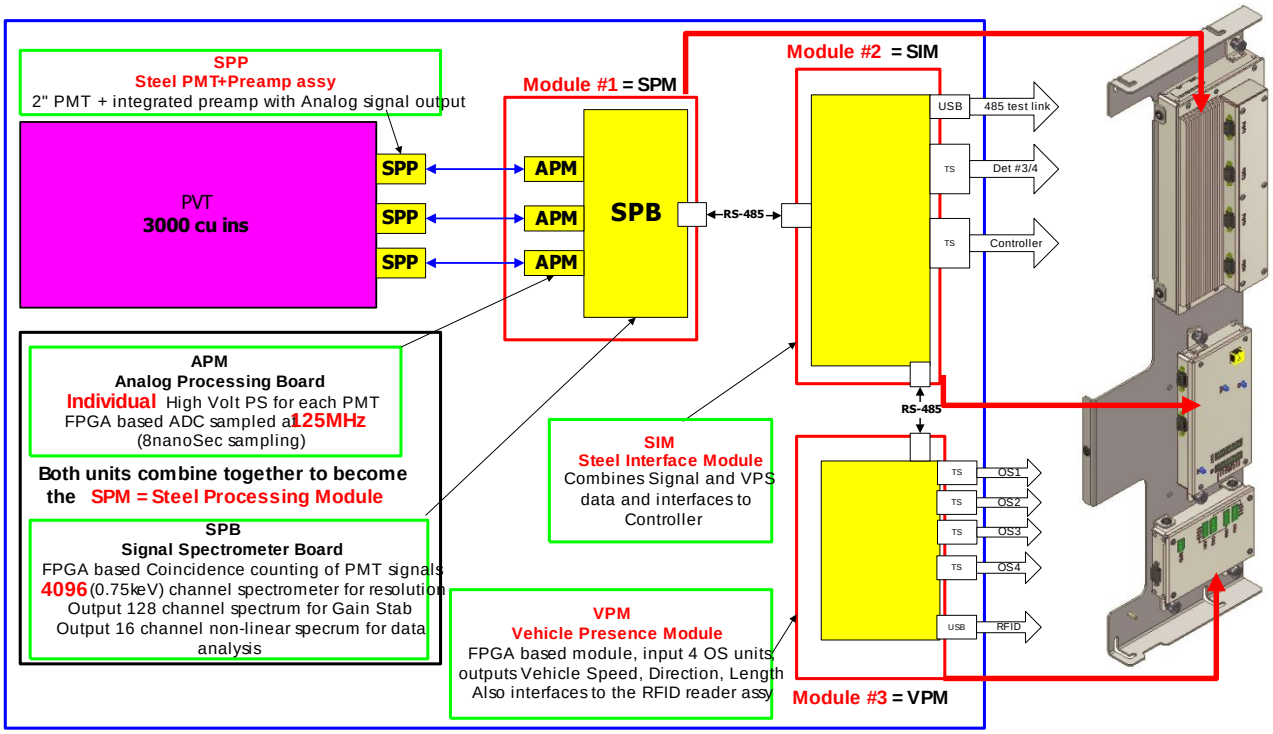
NOTE: The electronic section is available to previous customers with Module 1 = SPM (a module comprised of two sub-assemblies APB and SPB boards) and present customers with Module 1 = SDM Steel Detector Module (comprised of the SPB board). The two configurations are depicted in Sections 5.1 and 5.2.

5.1 RS-200/300/400 Detector System (with SPM Technology)

5.1.1 RS-200/300 Detector System

The detector comprises various sub-assemblies. For ease-of-service there are 3 main electronic modules as shown in the figure - Module 1, 2 and 3 outlined in red. All these modules are plug-and-play so if they need to be replaced with a new module, the unit will automatically reload the correct operating parameters without user intervention.

The following briefly describes each part of the detector to allow the user to more fully understand detector operation.



a) **PVT detector** – shown in **purple**. This is the Polyvinyl Toluene detector which looks like a big piece of acrylic plastic wrapped in a black plastic cover to eliminate light leaks. Gamma rays are absorbed by this detector and create light flashes proportional to the energy of the gamma-ray radiation.

b) **SPP assy** – short for **S**teel **P**MT and **P**reamp assembly - this assembly comprises a 2" diameter Photomultiplier Tube coupled to a special preamplifier board that provides proper voltages to the PMT. This system converts the light flashes in the detector to voltage pulses proportional to the energy of the gamma-ray radiation pulse. This assembly outputs this analog signal to the SSM assembly after which all processing is digital.

c) **Module #1 – SPM** – short for **S**pectrometer **P**rocessing **M**odule – this module comprises 2 sub-assemblies

   i. **APB board** - takes in the analog incoming signals from the PMT, samples them at 128MHz (8 nanoSec) and converts them to a digital signal whose value is proportional to the incoming signal amplitude. This board also houses a HVPS to provide high voltage to the PMT (usually 900V). Note that each PMT has its own HVPS for reliability and backup.

   ii. **SPB board** – takes the incoming signals from the 3 PMTs via the APB board, performs time-Coincidence on them to remove PMT noise then converts them to a 16bit – 65,000 channel spectrum. After sophisticated filtering etc. a 128 channel linear spectrum is produced as well as a 16 channel non-linear spectrum for data analysis. Note these spectra are generated 10 times/second.

d) **Module #2 – SIM** – short for **S**teel **I**nterface **M**odule – this module takes the incoming 48V DC power from the Controller and converts it to 5V for the CPU and 12V for other circuitry. In addition it buffers the RS-485 spectra output from the SSM module. The vehicle presence info from the VPM module is also buffered here and the combined dataset transmitted to the Controller at a 10 times per second data rate. Note that any additional detectors are also combined into the data stream in this module. This module has a RS-485 connection permitting laptop analysis of the detectors **at the detectors** making trouble shooting more efficient.

e) **Cabling** - for security the detectors into the Controller are divided into LEFT and RIGHT. So

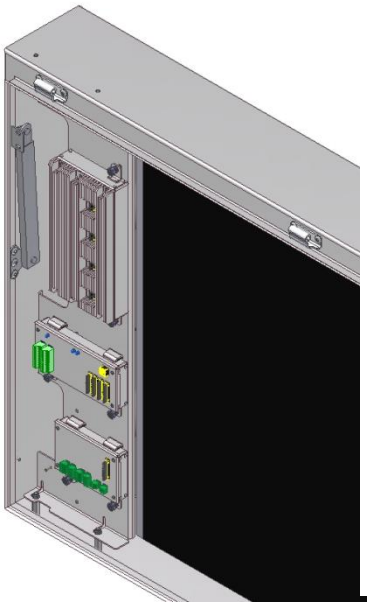
detectors are labeled L1, L2, L3 etc or R1, R2, R3 etc. depending on the installation. Separate cable runs from LEFT and RIGHT detector arrays are used so in the event of cable damage at least half the detectors would still be connected.

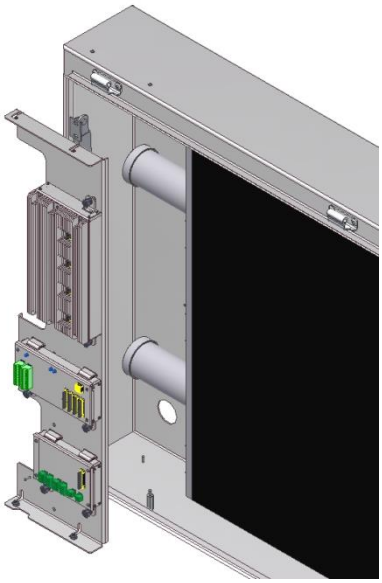
f) **Module #3 – VPM** – short for **V**ehicle **P**resence **M**odule – this FPGA based device takes data inputs from the 4 Optical sensors units and samples them at a 500Hz data rate. Signal analysis is performed on all 4 OS units in defined logic and the resulting output of this module are Vehicle #, Direction, Speed and Length and these are fed to the Controller to define data analysis limits. In older systems this OS analysis is performed in the system console but this slows overall data processing so RSI has moved to a distributed processing model for higher data analysis capability without restricting throughput. This module also supports special camera inputs used typically in rail applications to reliably separate rail-cars as well as RFID tag interfacing.

Note: The 3 main modules #1, 2, 3 are mounted on any easy access tray for fast, reliable trouble shooting and module replacement.

Detector Box

The RSI detector boxes are designed for easy installation and easy service. The entire detector base is manufactured out of aluminum to prevent corrosion problems on site. The front lid (cover) has been specially designed by RSI to use fiberglass design that significantly improves low energy performance as steel and aluminum lids absorb much of the low energy signal so important to be able to detect deeply buried sources. The lid (cover) has a special door opening lock device that is key-locked to prevent unauthorized entry. Once unlocked then a single handle assembly frees the door and it opens immediately. A dual locking hinge is incorporated so once the door is opened it locks in place for easy access – NO MULTIPLE SCREWS AS ON OLDER SYSTEMS. When service is complete a simple motion unlocks the hinges and allows the door to close and lock. The huge advantage of this design is no nuts/screws clamping the door that makes access so difficult on older systems.



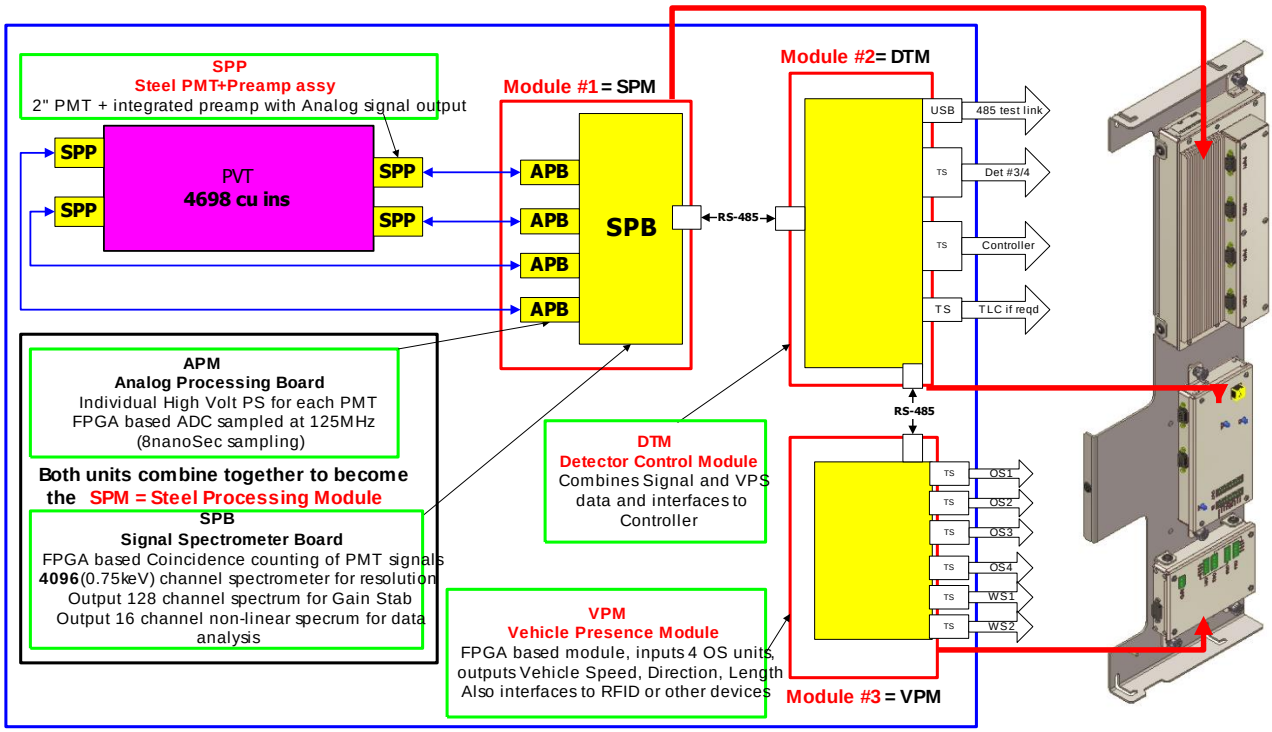


In addition each detector is SHOCK-MOUNTED to the detector case to minimize shock and vibration causing premature system degradation. In older systems this was achieved with foam rubber but this material compresses with time so eventually there is no effective shock protection. The additional benefit of the RSI shock mount design is that the interior of the detector is not cluttered with material allowing simple easy access as required.

5.1.2 RS-400 Detector System

The detector block diagram is very similar to the RS-300. The differences are that the PVT detector is longer and the system uses 4PMTs 2 at each end of the detector to compensate for the extra length. Since there are 4PMTs there are 4 APB boards but otherwise the block diagram and its components are the same.

The comments re the RS-300 detector directly apply here as well except there are now 4 PMTs.



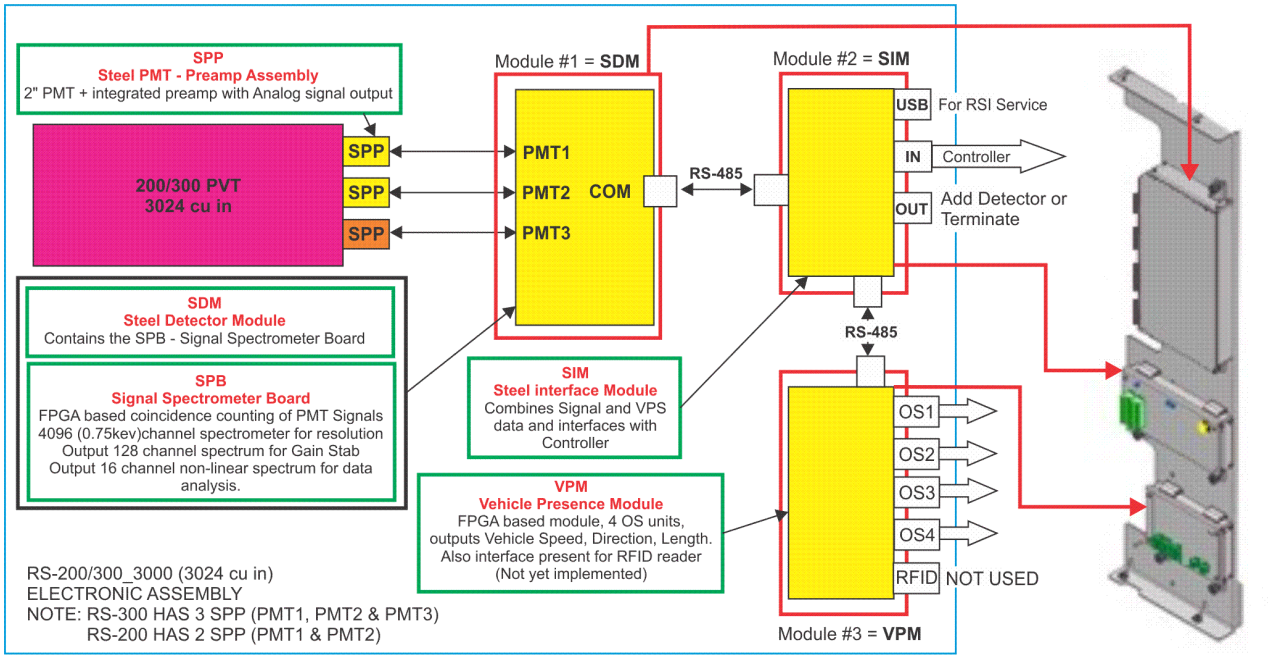
5.2 RS-200/300 Detector System (with SDM Technology)

5.2.1 RS-200/300 Detector System

The detector comprises various sub-assemblies. For ease-of-service there are 3 main electronic modules as shown in the figure - Module 1, 2 and 3 outlined in **RED**. These modules are plug-and-play so if they need to be replaced with a new module, the unit will automatically reload the correct operating parameters without user intervention. These modules are supplied with the Detector Spare Parts Kit PN C-1134.

Note: The RS-200/3000 and RS-300/3000 are virtually the same. The difference being that the RS-200/3000 has 2 PMTs instead of the 3 PMTs as shown for the RS-300/3000.

The following figure briefly describes each part of the detector to allow the user to more fully understand detector operation.



a) **PVT Detector** – shown in **red**. This is the Polyvinyl Toluene detector which looks like a big piece of acrylic plastic wrapped in a black plastic cover to eliminate light leakage. Gamma rays are absorbed by this detector and create light flashes proportional to the energy of the gamma-ray radiation.

b) **SPP Assy** – short for **S**teel **P**MT and **P**reamp assembly - this assembly comprises a 2" diameter Photomultiplier Tube coupled to a special preamplifier board that provides proper voltages to the PMT. This system converts the light flashes in the detector to voltage pulses proportional to the energy of the gamma-ray radiation pulse. This assembly outputs this analog signal to the SDM assembly after which all processing becomes digital.

c) **Module #1 – SDM** – short for **S**teel **D**etector **M**odule – this module comprises the following assembly.

SPB board – The Signal Spectrometer Board (SPB) takes the incoming signals from the 2 to 3 PMTs (3 shown in this example), performs time-coincidence on them to remove PMT noise then converts them to a 16bit – 65,000 channel spectrum. After sophisticated filtering etc. a 128 channel linear spectrum is produced as well as a 16 channel non-linear spectrum for data analysis. Note these spectra are generated 10 times/second.

d) **Module #2 – SIM** – short for **S**teel **I**nterface **M**odule – this module takes the incoming 48V DC power from the Controller and converts it to 5V for the CPU and 12V for other circuitry. In addition it buffers the RS-485 spectra output from the SSM module. The vehicle presence info from the VPM module is also buffered here and the combined dataset transmitted to the Controller at a 10 times per second data rate. Note that any additional detectors are also combined into the data stream in this module. This module has a RS-485 connection permitting laptop analysis of the detectors **at the detectors** making trouble shooting more efficient.

e) **Cabling** - for security the detectors into the Controller are divided into RIGHT and LEFT. So detectors are labeled A1, A2, A3 etc or B1, B2, B3 etc. depending on the installation. Separate cable runs from RIGHT (A) and LEFT (B) detector arrays are used so in the event of cable damage at least half the detectors would still be connected.

f) **Module #3 – VPM** – short for **V**ehicle **P**resence **M**odule – this FPGA based device takes data inputs from the 4 Optical sensors units and samples them at a 500Hz data rate. Signal analysis is performed on all 4 OS units in defined logic and the resulting output of this module are Vehicle #, Direction, Speed and Length and these are fed to the Controller to define data analysis limits. In older systems this OS analysis is performed in the system console but this slows overall data processing so RSI has moved to a distributed processing model for higher

data analysis capability without restricting throughput. This module also supports special camera inputs used typically in rail applications to reliably separate rail-cars as well as RFID tag interfacing.

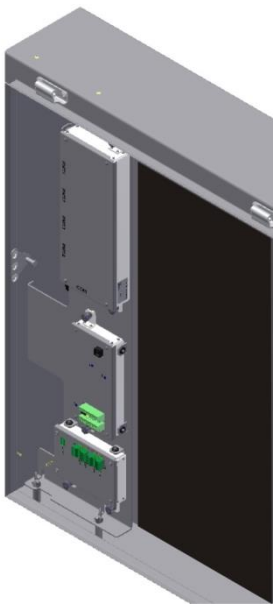
NOTE: The 3 main modules #1, 2, 3 are mounted on any easy access tray for fast, reliable trouble shooting and module replacement. Each of the modules is secured to the access tray with thumbscrews for easy replacement.

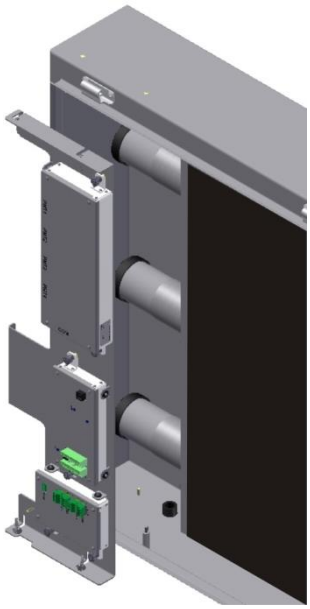
Detector Box

The RSI detector boxes are designed for easy installation and easy service. The entire detector base is manufactured out of aluminum to prevent corrosion problems on site. The front lid (cover) has been specially designed by RSI to use fiberglass design that significantly improves low energy performance as steel and aluminum lids absorb much of the low energy signal so important to be able to detect deeply buried sources. The lid (cover) has a special door opening lock device that is key-locked to prevent unauthorized entry. Once unlocked then a single handle assembly frees the door and it opens immediately. A dual locking hinge is incorporated so once the door is opened it locks in place for easy access – NO MULTIPLE SCREWS AS ON OLDER SYSTEMS. When service is complete a simple motion unlocks the hinges and allows the door to close and lock. The huge advantage of this design is no nuts/screws clamping the door that makes access so difficult on older systems.

RS-200/3000, 300/3000, 400/5000 Configuration:

Note: The modules are mounted as shown on a 28” or 29” access tray to fit the width of the detector box.





In addition each detector is SHOCK-MOUNTED to the detector case to minimize shock and vibration causing premature system degradation. In older systems this was achieved with foam rubber but this material compresses with time so eventually there is no effective shock protection. The additional benefit of the RSI shock mount design is that the interior of the detector is not cluttered with material allowing simple easy access as required.

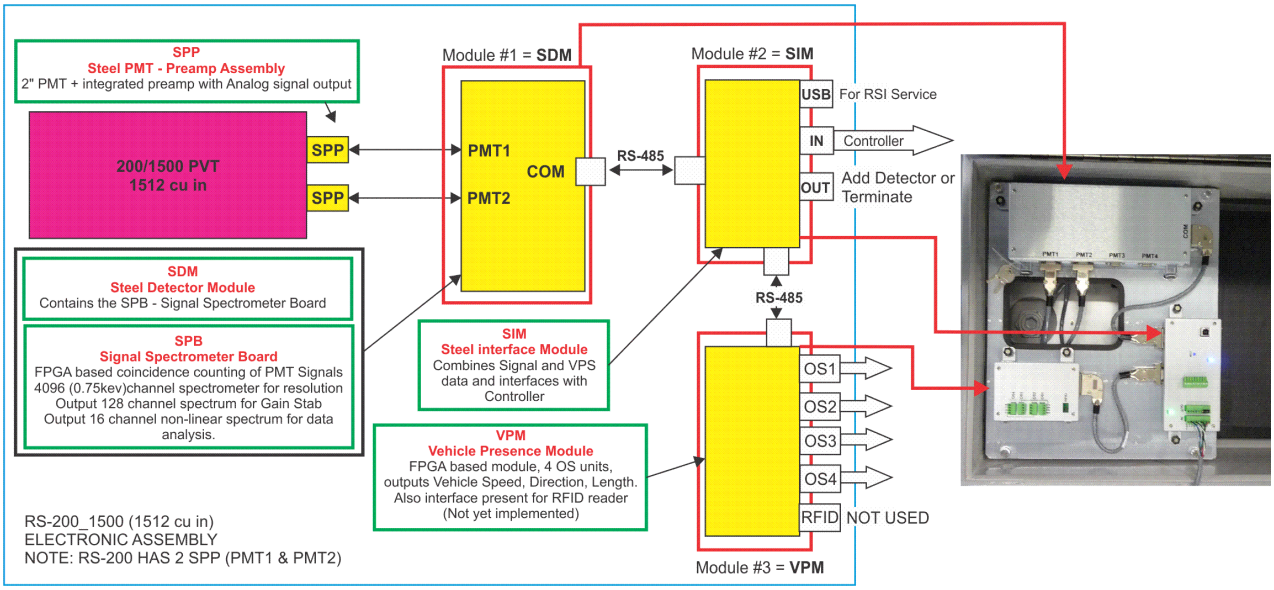
RS-200 (1500) Detector Configuration:

The RS-200/1500 is the same in all respects as the RS-200,300/3000 and RS-400/5000 units with the exception of the detector width and number of PMTs. The 3 modules are the same but are configured differently to fit the 14” access tray.

Note: The modules are mounted as shown on a 14" access tray to fit the width of the detector box.

5.2.2 RS-200 Detector System

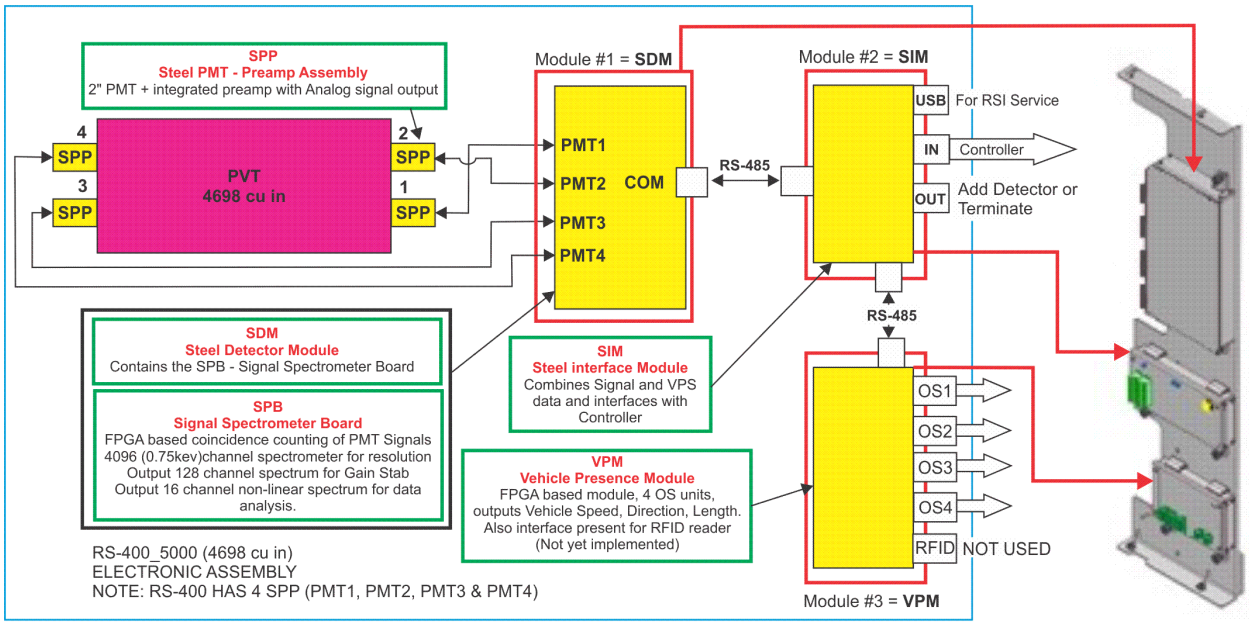
The detector block diagram is very similar to the RS-300. The differences are that the PVT detector for the RS-200/1500 is half the width of the RS-200/3000 and the electronic assembly is configured differently. The **SPB board** – takes the incoming signals from the 2 PMTs.



5.2.3 RS-400 Detector System

The detector block diagram is very similar to the RS-300. The differences are that the PVT detector is longer and the system uses 4PMTs 2 at each end of the detector to compensate for the extra length. Since there are 4PMTs there are 4 PMT connections on the SDM Module but otherwise the block diagram and its components are the same. The **SPB board** – takes the incoming signals from the 4 PMTs.

See **Chapter 5.0** for the component descriptions noting the difference(s) above.


SPP
Steel PMT - Preamp Assembly
2" PMT + integrated preamp with Analog signal output
4
SPP
3
SPP
PVT
4698 cu in
2
SPP
1
SPP
Module #1 = SDM
PMT1
PMT2
COM
PMT3
PMT4
RS-485
Module #2 = SIM
USB
For RSI Service
IN
Controller
OUT
Add Detector or Terminate
RS-485
SDM
Steel Detector Module
Contains the SPB - Signal Spectrometer Board
SPB
Signal Spectrometer Board
FPGA based coincidence counting of PMT Signals
4096 (0.75kev)channel spectrometer for resolution
Output 128 channel spectrum for Gain Stab
Output 16 channel non-linear spectrum for data analysis.
SIM
Steel interface Module
Combines Signal and VPS data and interfaces with Controller
VPM
Vehicle Presence Module
FPGA based module, 4 OS units, outputs Vehicle Speed, Direction, Length.
Also interface present for RFID reader
(Not yet implemented)
OS1
OS2
OS3
OS4
RFID
NOT USED
Module #3 = VPM
RS-400_5000 (4698 cu in)
ELECTRONIC ASSEMBLY
NOTE: RS-400 HAS 4 SPP (PMT1, PMT2, PMT3 & PMT4)

6.0 DETECTOR REPAIRS

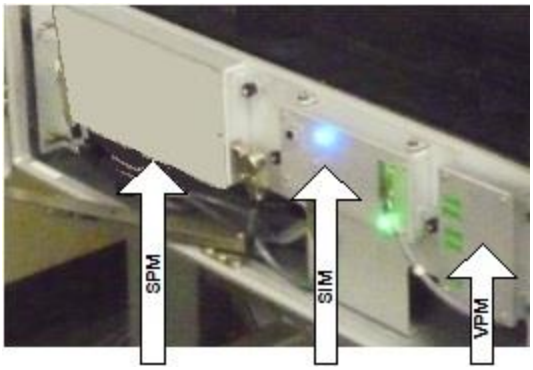
As commented previously, because the electronic design is so complex, RSI-Service will do the first level trouble shooting on the system in response to user request. Usually via the Internet link, RSI-Service can fully trouble shoot the problem and then contact the local Maintenance staff regarding a repair procedure.

Since each site has a **Spares Kit**, local detector repairs usually involve module replacement as follows:

1. **POWER OFF THE SYSTEM AT THE UPS OR FAILING THAT UNPLUG THE AC LINE – FAILURE TO POWER OFF THE SYSTEM CAN RESULT IN MANY ERRONEOUS ALARMS AND ERRORS.**
2. All detectors are labeled at **System Start-Up** as A1, B1 etc and this label is affixed to the appropriate detector. To avoid any confusion, it is imperative that the local maintenance staff, are fully aware of the naming convention and that they are clear as to the detector nomenclature.
3. RSI-Service has diagnosed the problem the result being a faulty module in Detector A1 – repairs would proceed as follows:
4. User would open the appropriate detector door and latch it in place (as shown).
5. **IF POWER IS STILL PRESENT (LEDs alive)** unplug the Terminal strip on the **SIM Module** that connects to the Controller – this will kill the power.

Remove Faulty Module:

NOTE: The modules are all attached to the electronics bracket in the same manner. Thumb screws secure the modules to the bracket.



6. Locate the **Faulty Module** – RSI recommends that you mark the faulty module to prevent a mix-up on installation.
7. Remove any connections from the faulty module using the connector slide-lock where required.
8. Remove the **Faulty Module** using the thumb screws.
9. Replace the **Faulty Module** with the new one and fasten in position with the thumbscrews. Re-connect all cabling.
10. Plug in the **SIM terminal strip** if removed in **step 5**.
11. Close and lock the outer box lid.
12. Power the UPS AC **ON** and let it start-up – **ensuring no vehicles pass during this period or errors will occur.**
13. If the top left status "**button**" on the Display is green, all should be **OK**.
14. Return the faulty module to **RSI-Service** and ask them to check for system operation and advise local maintenance that all is **OK** or discuss other repairs as required. Request a replacement for your Spares Kit.

7.0 OPTICAL SENSOR ISSUES

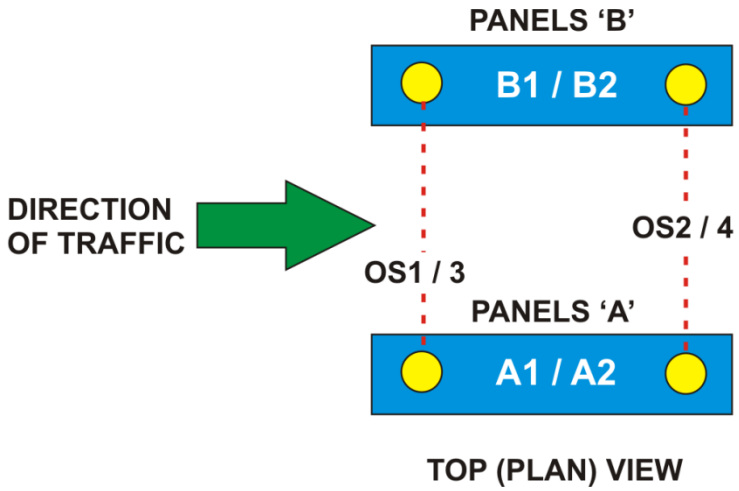
In most installations, Optical Sensor (OS) issues cause some problems. This is because of many factors but the following explains correct operation and alignment/repairs etc.

7.1 Identify OS Units

For proper operation of the system, the OS units must be installed in a particular manner – this is carried out during system **Start-Up (refer to Start-Up Manual PN P-1327.xx.xx)** but Maintenance staff must be able to ID the OS units to ensure proper settings and repairs. The following procedure explains the installation requirements and Maintenance staff should inspect this info, identify the OS units and label them to make service easier (units should be labeled during **Start-up** but sometimes labels get lost).

The convention is as shown in the diagram – incoming vehicles pass through the OS beams cutting the OS1/3beam first then the OS2/4 beam.

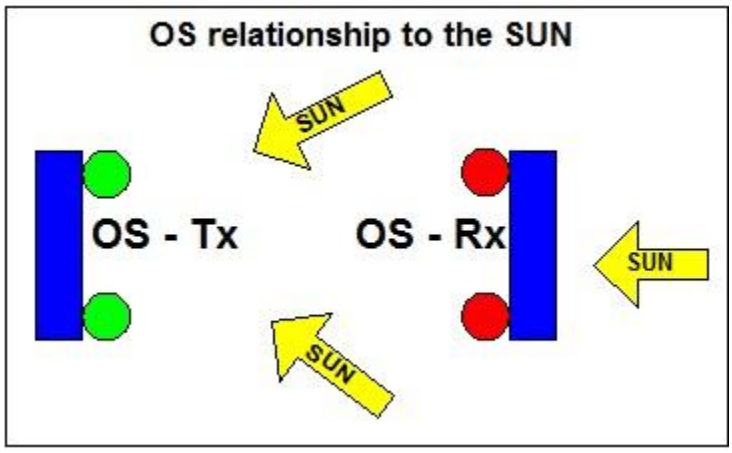
NOTE: 2 OS systems only use OS1 and OS2.



Optical sensors have a high level of sunlight immunity but experience has shown that during installation direct sunlight into the beam should be avoided or minimized. The Optical sensor system comprises 2 parts – the **RECEIVER (Rx)** and the **TRANSMITTER (Tx)**.

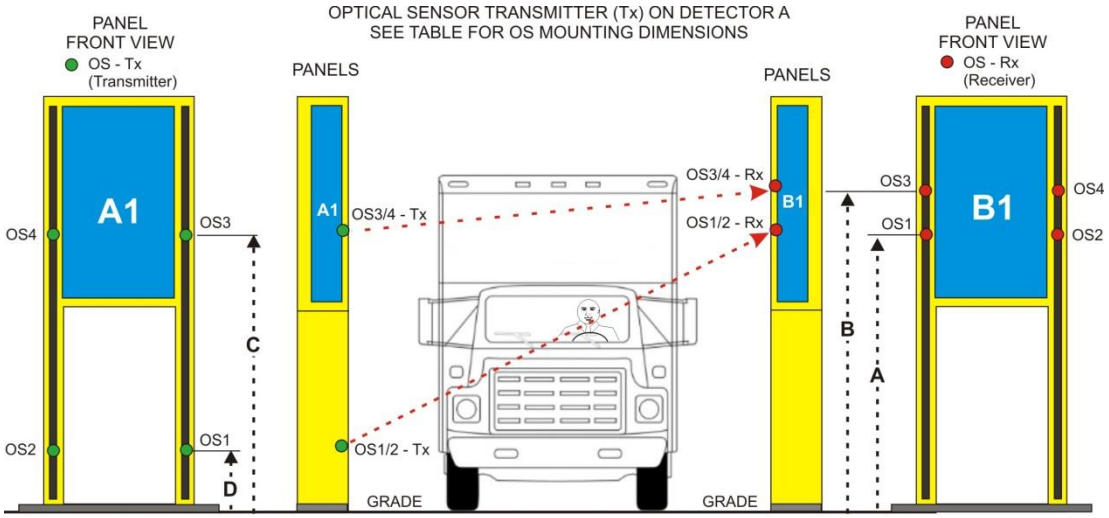
The TRANSMITTER is essentially immune to sunlight so as the figure shows, the **Tx** should be positioned on the detector side that faces the most direct sunlight.

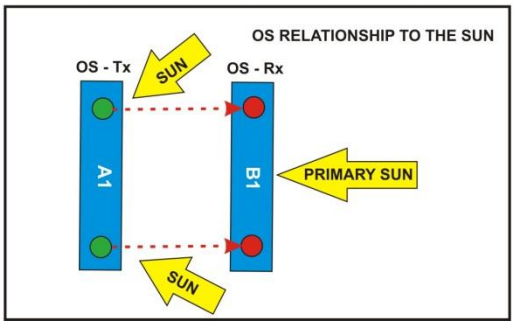
The RECEIVER is somewhat susceptible to sunlight so it should be mounted on the opposite side from the nominal sunlight direction. **THE RECEIVER HAS A RED LIGHT ON TOP.**

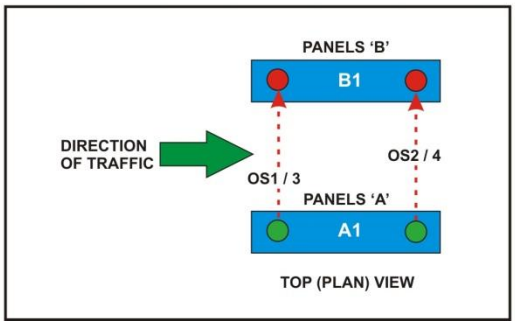


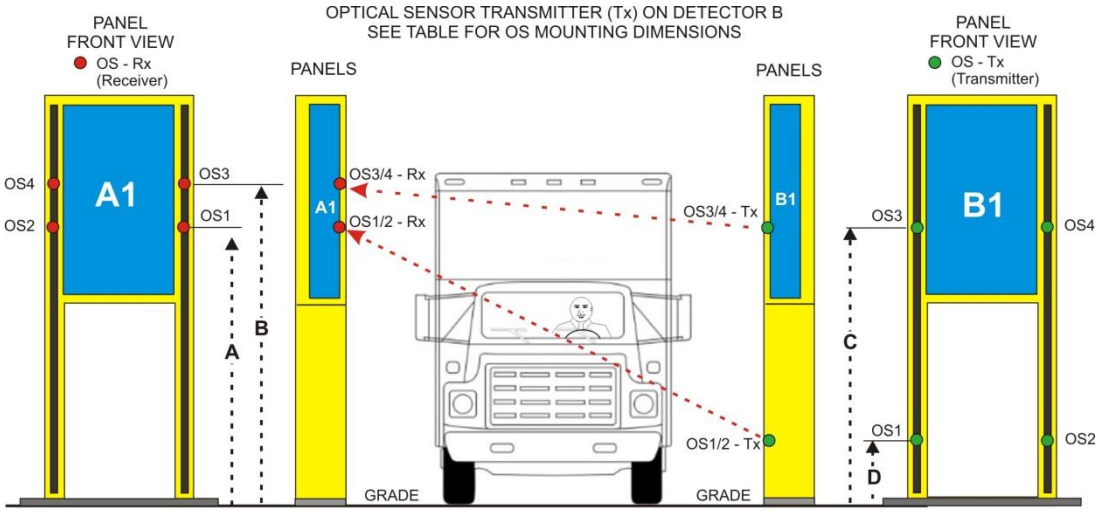
So sometimes the Transmitter units are on the **A** detector and sometimes on the **B** detector depending on the direction of the sun.

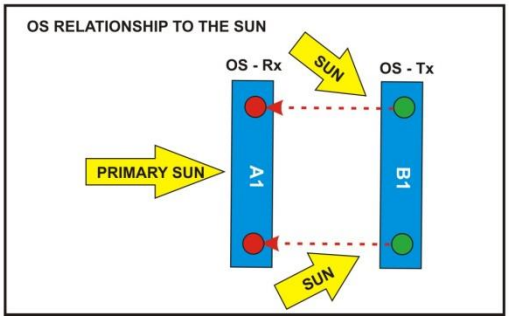
To minimize confusion the following OS drawings cover both configurations.

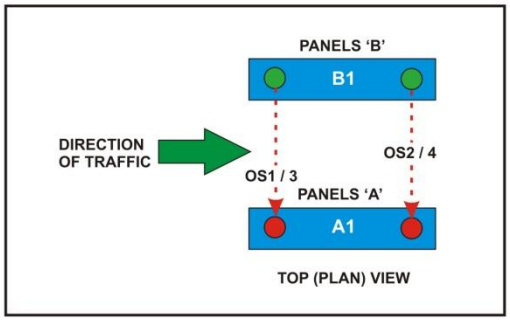






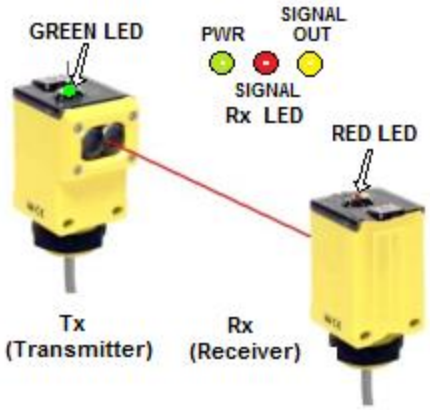






7.2 Verify Proper OS Operation

Once the correct OS units are identified by position and labeled it is essential to ensure that they are wired correctly into the system.



a) Check the Alignment

First of all ensure that all OS pairs are properly aligned. The easiest test is to move your hand in front of the Rx (Receiver) unit and check that the RED LED goes OFF when the "beam" is covered and is ON when uncovered.

NOTE: the "beam" is Infrared (IR), so it is invisible.

IR is electromagnetic radiation with longer wavelengths than visible light.

b) Verify Identity

On the system Display screen, select the STATUS page.

Identify **OS1** from the figures above then either cover it with a plastic cup or get someone cover it for you. **BE VERY CAREFUL WHEN YOU COVER IT TO ENSURE THAT YOU DON'T MISALIGN THE OS UNITS.**

CHECK ACTION – inspect the system display screen and ensure that OS1 light is GREEN (ON) and all others are off.

REPEAT this for OS2, OS3 and OS4 (see **7.3 e)** below in case of problems).

OS1 OS2 OS3 OS4

FOR PROPER SYSTEM OPERATION IT IS VERY IMPORTANT THAT THE OS UNITS ARE SET AT THE HEIGHTS SPECIFIED AND THAT THEY ARE ORIENTED CORRECTLY SO THIS TEST MUST BE PERFORMED CAREFULLY.

ONCE THE OPTICAL SENSORS ARE VERIFIED TO WORK CORRECTLY AND THEIR PLACEMENT IS AS SPECIFIED – IT IS HIGHLY RECOMMENDED THAT USERS LABEL THE OS RX AND TX UNITS TO MAKE FUTURE FAULT ANALYSIS EASIER TO LOCATE THE CORRECT UNIT. SINCE THE OS ARE YELLOW – A PERMANENT BLACK MARKER IS RECOMMENDED FOR USE. EXAMPLES OF RECOMMENDED MARKING IS "OS#1, RX" AND "OS#4 TX" ETC.

7.3 OS Problems

OS problems are usually caused by one or more of the following factors:

a) Poor alignment of the sensors

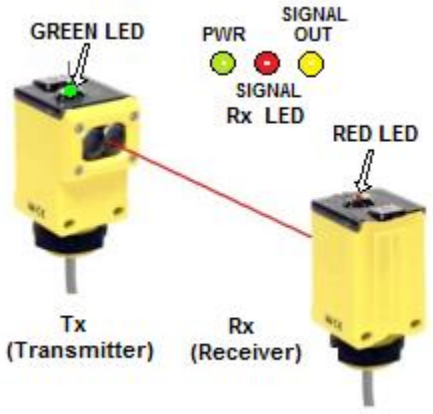
b) Mechanically loose OS units causing misalignment

c) Snow or dirt covering the lens

d) Hardware failures

e) Wiring errors

f) VPM module failures



Resolution of these problems is as follows:

a) Poor alignment of the sensors:

1. Inspect the RED LED on the OS receiver for OS1 and identify which Tx unit it is coupled to from the diagrams above (label for future use).
2. Rotate the Emitter (Transmitter) up or down and right or left and align receiver to the transmitter sensor. As the sensors become better aligned, the Red LED strobes at a faster rate as shown in the figure to the right.
3. Continue rotating the sensor to the point where the Red LED strobes at its fastest rate (approx 2/second). This indicates the best possible alignment.
4. When alignment is achieved, torque bolts attaching the OS bracket to 72 in-lbs.
5. **DON'T OVER TIGHTEN OR THE PLASTIC NUT WILL CRACK.**
6. Repeat for OS2, 3 and 4 as required.

b) Mechanically loose OS units causing misalignment:

Carefully inspect each OS unit and identify the loose one. Align as noted above and tighten properly.

c) Snow or dirt covering the lens:

Carefully inspect each OS unit on a regular basis and clean the lens as required ENSURING YOU DON'T MISALIGN THEM. After all are clean verify that the alignment is OK as noted above.

d) Hardware failures of the Rx/Tx units:

If the unit cannot be aligned (no red light on the Rx unit under any conditions) either the **Rx** or **Tx** unit could be defective. It is difficult to be sure which OS is faulty, but normally the **Rx** unit is more likely to fail (as it has more electronics). A spare set is supplied in the **Spares Kit**. RSI uses OS units with cable disconnects so to replace either unit simply unscrew the connector and replace as required. First of all replace the Rx unit and if not successful replace the Tx unit – then re-align.

e) Wiring errors in the Detector on the VPM Module:

If the OS action is normal at the **OS Rx** units (**RED LED** goes on/off with hand movement) but the action on the STATUS screen is incorrect (e.g. OS1 covered at the detector and OS2 light comes ON on the Status screen) then the OS units are miswired at the VPM module.

The easiest way to "fix" this problem is to switch the OS terminal connections on the VPM module where the **Rx** unit are wired to and verify all is **OK** as in **7.2 b)** above.

Once these are working **OK** – then cover the correct **OS Tx** units on the other detector – if incorrect switch these connection as well.

Refer to Appendix A – for wiring diagrams as a guide to the user.

It is important that the **Rx/Tx** pairs are connected properly as this permits proper system testing in future.

f) Hardware failures of the VPM Module:

If the OS action is normal at the **OS Rx** units (**RED LED** goes on/off with hand movement) but the action on the STATUS screen is incorrect (e.g. OS1 covered at the detector and NO lights come on at the Status screen) then the VPM module may be defective.

Usually the VPM module in the detector that the Rx units are connected to can cause this as the Tx side only supplies power.

Best practice is to open the detector that the **Rx** units are connected to and ensure all terminal strips are properly seated. If all is **OK** change out the VPM unit from the spares kit (marking it to ensure the bad and good don't get mixed up). Then check correct operation as in **7.2 b)** above.

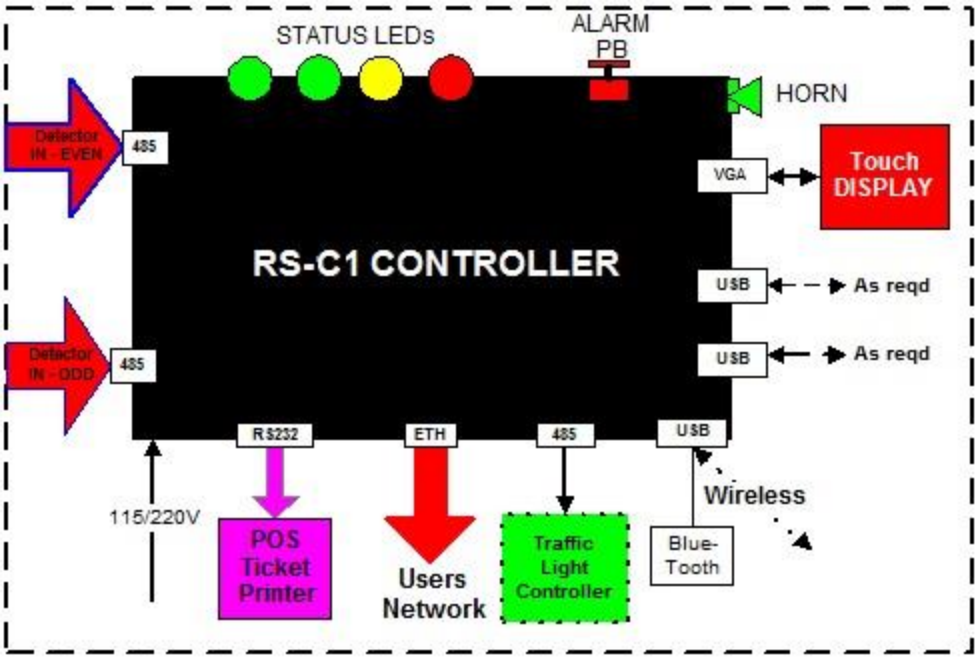
If this does not solve the problem then open the detector that the **Tx** units are connected to and ensure all terminal strips are properly seated. Then check correct operation as in **7.2 b)** above.

8.0 SYSTEM CONTROLLER

8.1 Overview

System design is that the RS-C1 Controller acts like a “black box” which is used for all Connectivity but no user interface or actions are required once the unit is powered on.

The RS Controller is a custom designed industrial fully enclosed unit with IP66 sealing to prevent Dust or minor water ingress. The unit has **no moving parts, no fans and no hard disk** and is based around an Industrial CPU board rated from **-40 to +85 deg C** for high reliability operation.



A removable front panel is used to access the internal Interface board for easy wiring via terminal strips. Five ¾” cable conduits provide dust tight cable entry at the bottom of the unit.

The unit operates from 110/220V AC 50/60Hz for universal usage.

On the side of the unit are 3 x USB ports, 1 x VGA port and 1 x RS232 port for connections of peripherals as required.

The unit also has Ethernet connections to connect to the Plant Network and Ethernet and RS485 for interfacing to an optional Traffic Light Controller if required.

On top of the unit are 4 LEDs and a Push Button used to acknowledge alarms and for local alarm testing.

The remote Touch screen display is connected to the VGA port and is used to interact with the system.

A POS Printer is also supplied for real time alarm printouts as most users need them.

8.2 Compact Flash, Memory Card & CPU Issues

Controller Parts – Compact Flash and Memory Card		
ITEM	**PART NUMBER**	**DESCRIPTION**
	P-1115	Compact Flash, Western Digital 8Gb, SSD-C02G1-4500
	P-1454	Memory Card, WinSystems 1Gb, SODIMM200-2-53-1G to be installed by RSI trained technician

8.2.1 Replace the Compact Flash (CF)

The operating system software and data storage memory are stored on a non-volatile 8GB COMPACT FLASH. Under certain conditions (e.g. a power transient when the system is writing to memory) can cause memory problems.

The typical symptom is the system continuously reboots so on the Display you see various messages repeated each time the system reboots.

This problem can also be caused by hardware failures on the circuit card assemblies in the Controller but sometimes it is caused by a defective or damaged Compact Flash.

The easiest fix is to change the **Compact Flash (CF) Card** so RSI supplies a pre-formatted CF Card taped to the INSIDE of the Controller to permit this “fix”. It is deliberately NOT included in the Spare Parts Kit as it is relatively small and can be easily lost.

To replace the Compact Flash (CF) Card proceed as follows:

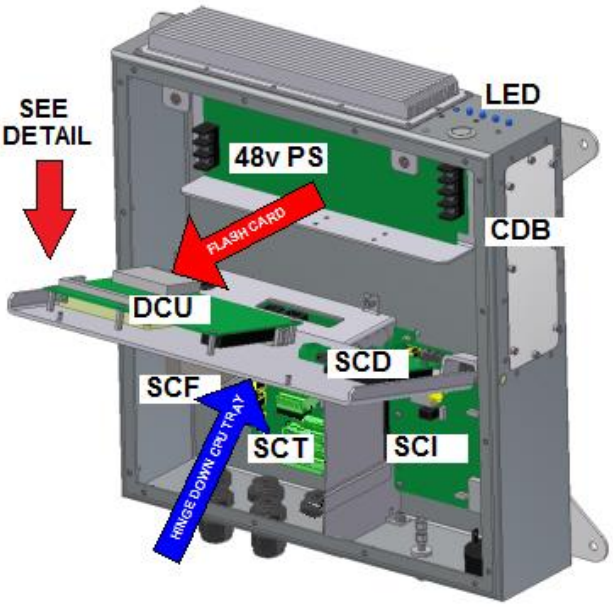
a) Power **OFF** the AC at the UPS and for added safety unplug the Controller from the UPS.

b) Use the 7/64 special socket screw driver (supplied in the Spares Parts Kit) to remove and retain 16 screws that secure the Controller front panel.

c) Remove and retain 1 screw that holds the tray in place, and hinge down the CPU tray (**blue arrow**) to access the DCU CCA.

d) The **CF Card** is now visible (**red arrow**). Press the eject button (**See Figure 1**) to remove the old CF (mark it “**OLD**” to avoid confusion) and replace it with the new 8Gb CF Card (SSD-C02G1-4500) making sure it is properly seated.

e) Replace the CPU tray in position, and secure it with 1 screw.



f) Re-mount the Controller front panel and secure it with the retained 16 screws using the 7/64 special socket screw driver. Then power ON the UPS and wait for the software to initialize.

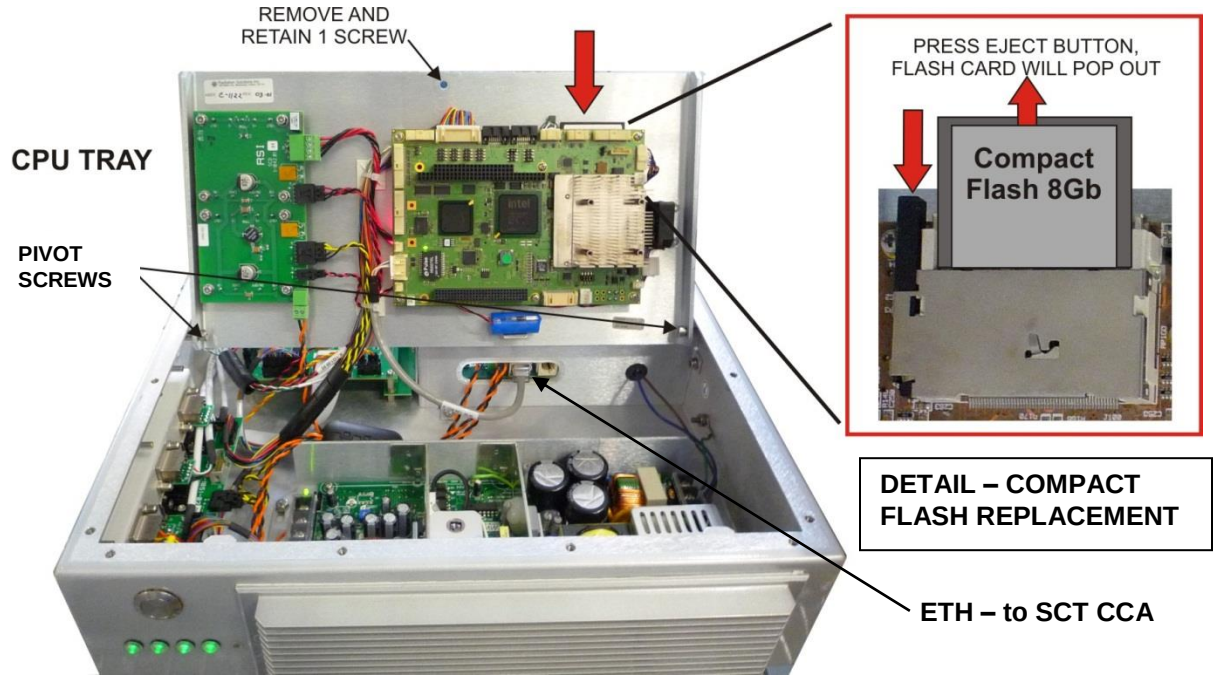


Figure 1 – Compact Flash Replacement

8.2.2 Replace the Memory Card

To Replace the Memory Card proceed as follows:

CAUTION: Make a backup of your System Parameters onto a USB memory stick prior to removing the DCU Circuit Card Assembly (CCA). Insert the USB Memory stick into the console, a button will then appear on the right hand side of the Status Screen. Push the button and it will describe the steps required.

NOTE: The Memory Card is installed on the back of the DCU Circuit Card Assembly (CCA). The DCU CCA must first be removed to gain access to the memory card. For this reason it is recommended that a licensed RSI technician makes this repair, or contact RSI for a replacement CPU Tray Assembly (Refer to **Section 8.2.3 to replace the CPU Tray Assy**). See **Appendix Z** for Contact Information.

8.2.3 Replace the CPU (CPU Tray Assembly)

To Replace the CPU proceed as follows:

CAUTION: Make a backup of your System Parameters onto a USB memory stick prior to removing the DCU Circuit Card Assembly (CCA).

NOTE: The CPU is installed on the back of the DCU Circuit Card Assembly (CCA). The DCU CCA must first be removed to gain access to the CPU. For this reason it is recommended that you contact RSI for a replacement CPU Tray Assembly. See **Appendix Z** for Contact Information.

To Replace the CPU Tray Assembly do the following:

1. Power **OFF** the AC at the UPS and for added security unplug the Controller from the UPS.
2. Use the 7/64 special socket screw driver (supplied in the Spares Parts Kit) to remove and retain 16 screws that secure the Controller front panel.
3. Remove and retain 1 screw that holds the tray in place, and hinge down the CPU tray.
4. Remove the cable connector from the +48VDC connection on the SCD CCA.
5. Remove the ETH connector from the SCT CCA.

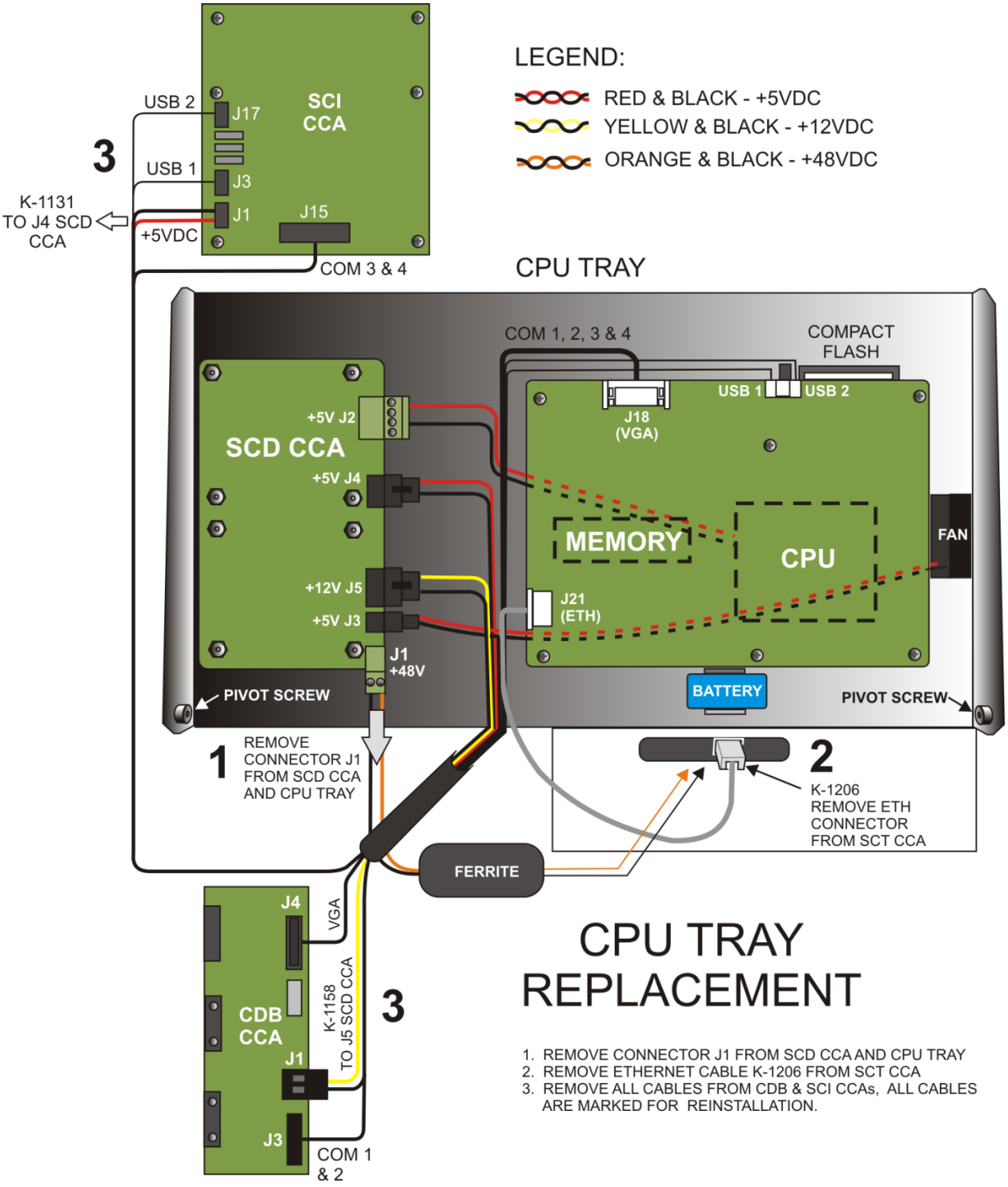


Figure 2 – CPU Tray Replacement

6. Remove all the cable connections from the SCI and CDB CCA in the Console that connect to the CPU Tray.

   Note: Leave cables attached to the CPU Tray and return the CPU Tray with the attached cables. The replacement will be sent with these cables attached and marked for reinstallation.

7. Use the 3/32 special socket screw driver to remove and retain the two pivot screws that hold the CPU Tray to the Controller Box.

8. Replace the CPU Tray with the new one and use the 3/32 special socket screw driver to attach it with the two pivot screws. Make all the cable connections to the SCI and CDB CCAs in the Console and also make the connection to the +48VDC connector on the SCD CCA.
9. Close the CPU tray and secure it with 1 screw.
10. Reconnect the ETH connector to the SCT CCA.
11. Re-mount the Controller front panel and secure it with the retained 16 screws using the 7/64 special socket screw driver. Then power ON the UPS and wait for the software to initialize.

IF PROBLEMS PERSIST, CONTACT RSI-SERVICE (THE CONTROLLER MAY NEED TO BE EXCHANGED). See Appendix Z for Contact Information.

8.3 Changing the SCT Circuit Card Assembly (CCA)

Controller Parts – SCT CCA and Fuses			
ITEM	**PART NUMBER**	**QTY**	**DESCRIPTION**
	P-1025	1	SCT Interface Assembly (Controller)
	XP-1203	1	Set of Controller Fuses (Qty 2) 4A – 250V IEC-Slo-Blo Fuses

The SCT CCA is included in your Spare Parts Kit. This is a rugged card and may be replaced as per the procedure outlined below:

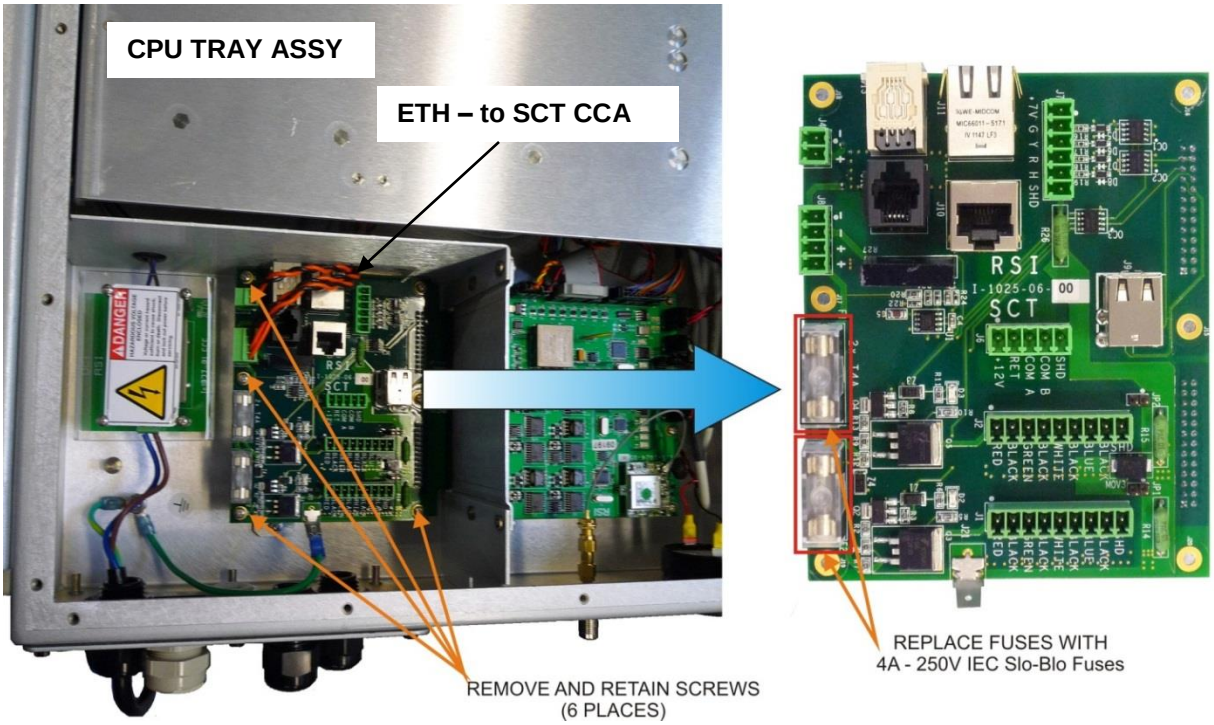
1. Power **OFF** the AC at the UPS and for added safety unplug the Controller from the UPS.
2. Use the 7/64 special socket screw driver (supplied in the Spares Parts Kit) to remove and retain 16 screws that secure the Controller front panel.
3. Once the Front Panel is removed access to the SCT CCA is just below the CPU Tray. Temporarily remove the screw holding the CPU tray in position.
4. Hinge the CPU tray down and unplug the Ethernet connection from the SCT CCA. Close the CPU tray by loosely attaching the retained screw.
5. Remove all the cables from the connections on the SCT CCA, including the Ethernet cables.
6. Remove the Ground Wire from the SCT CCA.
7. Remove and retain 6 screws that hold the SCT CCA to the controller.
8. The SCT CCA is also connected to the Interconnect Board (ICB). Take care when pulling up on the SCT CCA to separate it from the ICB. To prevent bending the pins pull the card straight OUT.
9. Mark the faulty SCT CCA as **"OLD"** and replace it with the new card. Also make sure that the thermal pad is replaced on the heatsink.
10. Align the SCT CCA connections with the ICB and push straight down. Make sure that the SCT CCA is properly seated.
11. Secure the SCT CCA with 6 screws, tighten the screws.

12. Replace the cables including the Ethernet cables. Plug in the grounding wire.

    Note: Make sure that **Detector A** goes into **J1** and **Detector B** into **J2**.

13. Re-mount the Controller front panel and secure it with the retained 16 screws using the 7/64 special socket screw driver. Then power ON the UPS and wait for the software to initialize.

14. Return the faulty SCT CCA to **RSI-Service** and ask them to check for system operation and advise local maintenance that all is **OK** or discuss other repairs as required. Request a replacement for your Spare Parts Kit.



Replace SCT Fuses:

1. The controller software will indicate a faulty fuse.
2. Power **OFF** the AC at the UPS and for added safety unplug the Controller from the UPS.
3. Use the 7/64 special socket screw driver (supplied in the Spares Parts Kit) to remove and retain 16 screws that secure the Controller front panel.
4. Once the Front Panel is removed access to the SCT CCA is just below the CPU Tray.
5. Reach in and pop off the fuse covers.
6. Pull out the faulty fuses and mark them as "**OLD**", replace them with the fuses from the Spare Parts Kit (4A – 250V IEC-Slo-Blo Fuses).
7. Re-mount the Controller front panel and secure it with the retained 16 screws using the 7/64 special socket screw driver. Then power ON the UPS and wait for the software to initialize.
8. The Controller software should indicate that the fuses are **OK**.
9. Request replacements for your Spare Parts Kit.

8.4 Changing the Controller

EXPERIENCE HAS SHOWN THAT CHANGING OUT THE CCAs INSIDE THE CONTROLLER TENDS TO CAUSE ADDITIONAL PROBLEMS BECAUSE OF BOARD HANDLING etc – FOR THIS REASON IF A CCA WITHIN THE CONTROLLER IS DIAGNOSED AS THE PROBLEM, THE ENTIRE CONTROLLER SHOULD BE EXCHANGED.

NOTE – FOR COST REASONS THE CONTROLLER IS NOT NORMALLY SUPPLIED IN THE SPARES KIT HOWEVER RSI KEEPS THESE UNITS IN SERVICE-STOCK SO WE CAN USUALLY REPLACE IT ON-SITE WITHIN 1 BUSINESS DAY.

The following procedure outlines how to change out a Controller:

1) Power OFF the AC at the UPS and for safety also unplug the Controller from the UPS.

2) Use the 7/64 special socket screw driver (supplied in the Spares kit) to remove and retain 16 screws that secure the Controller Top panel.

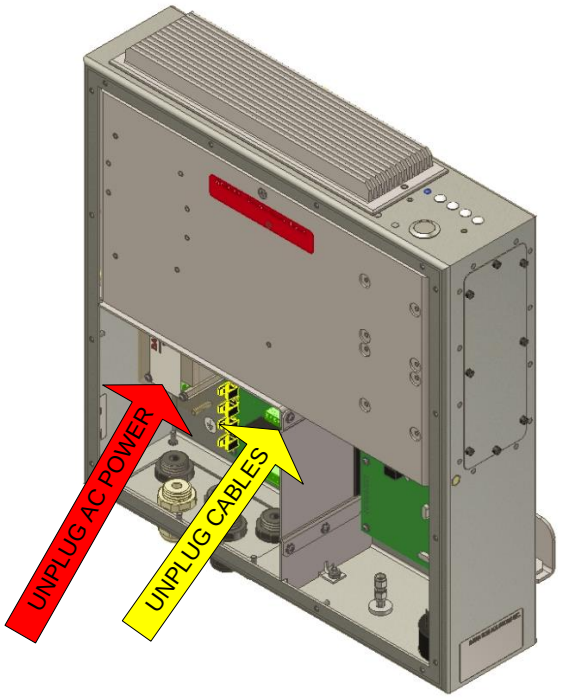
3) Unplug all the cables connected to the Conduit clamps (mark them as required).

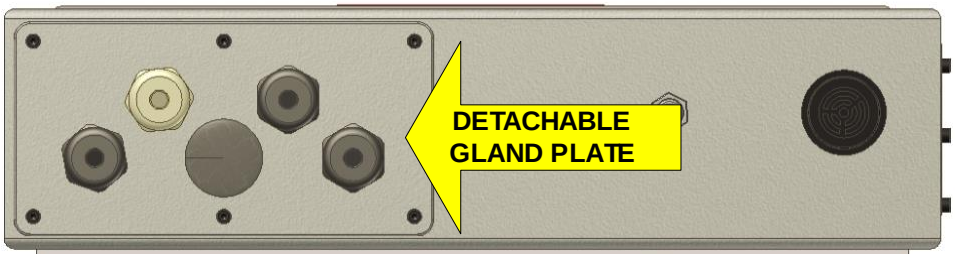
   NOTE: Refer to Figure 3 – Controller Cable Location

4) Use the 7/64 special socket screw driver to remove the 6 screws securing the detachable gland plate to the base of the Controller and carefully remove the gland-plate and its' attached cables.

5) Now the Controller can be detached from its wall mount. Return to RSI Service.

6) Reverse the process to install the new RS-C1 Controller.





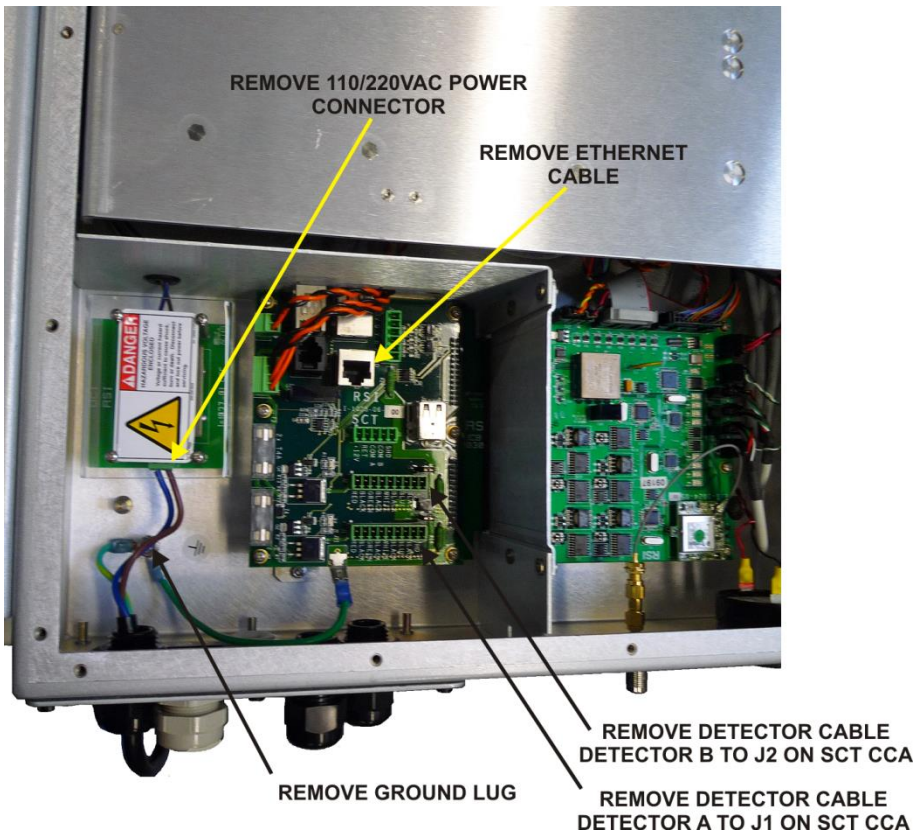
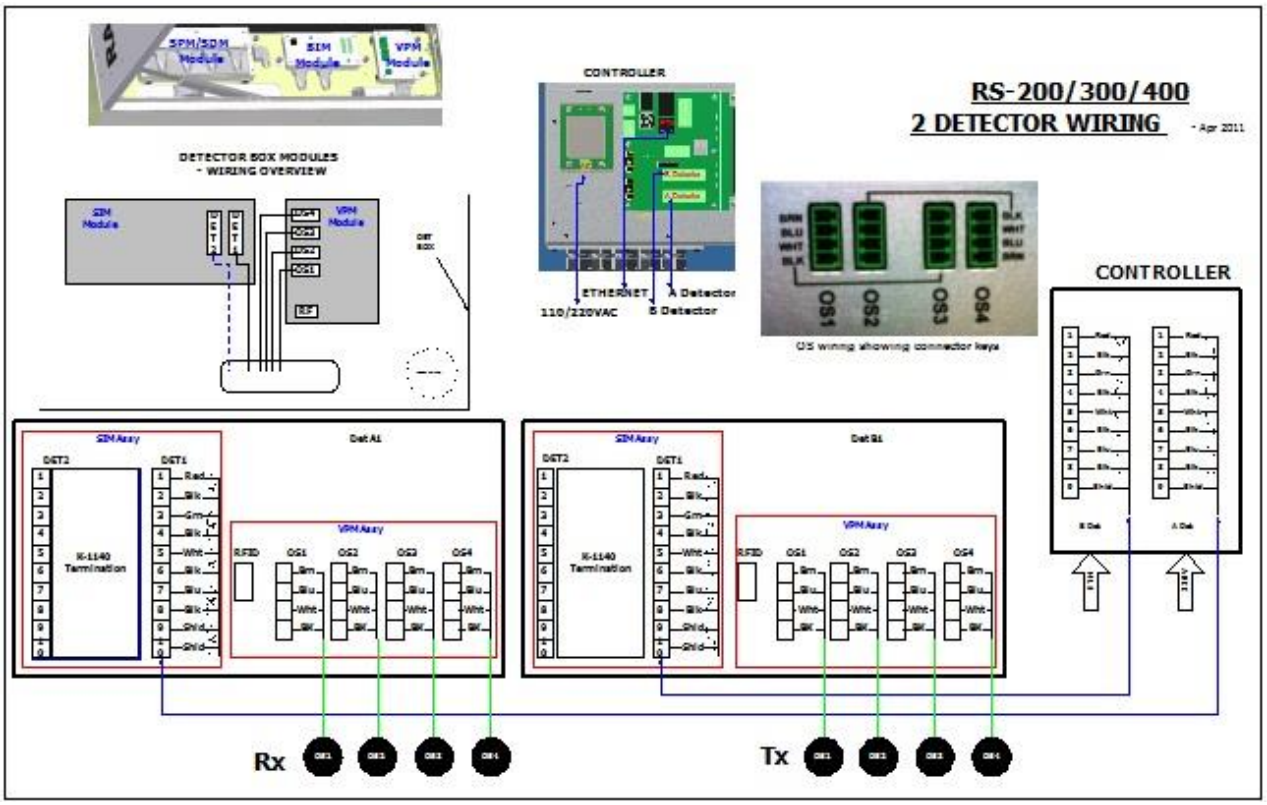


Figure 3 – RS-C1 Controller Cable Location

NOTE: When replacing the Detector Cables make sure that you connect **Detector A** to the **J1** connector and **Detector B** on the **J2** connector on the SCT CCA.

Appendix A – Wiring Diagrams

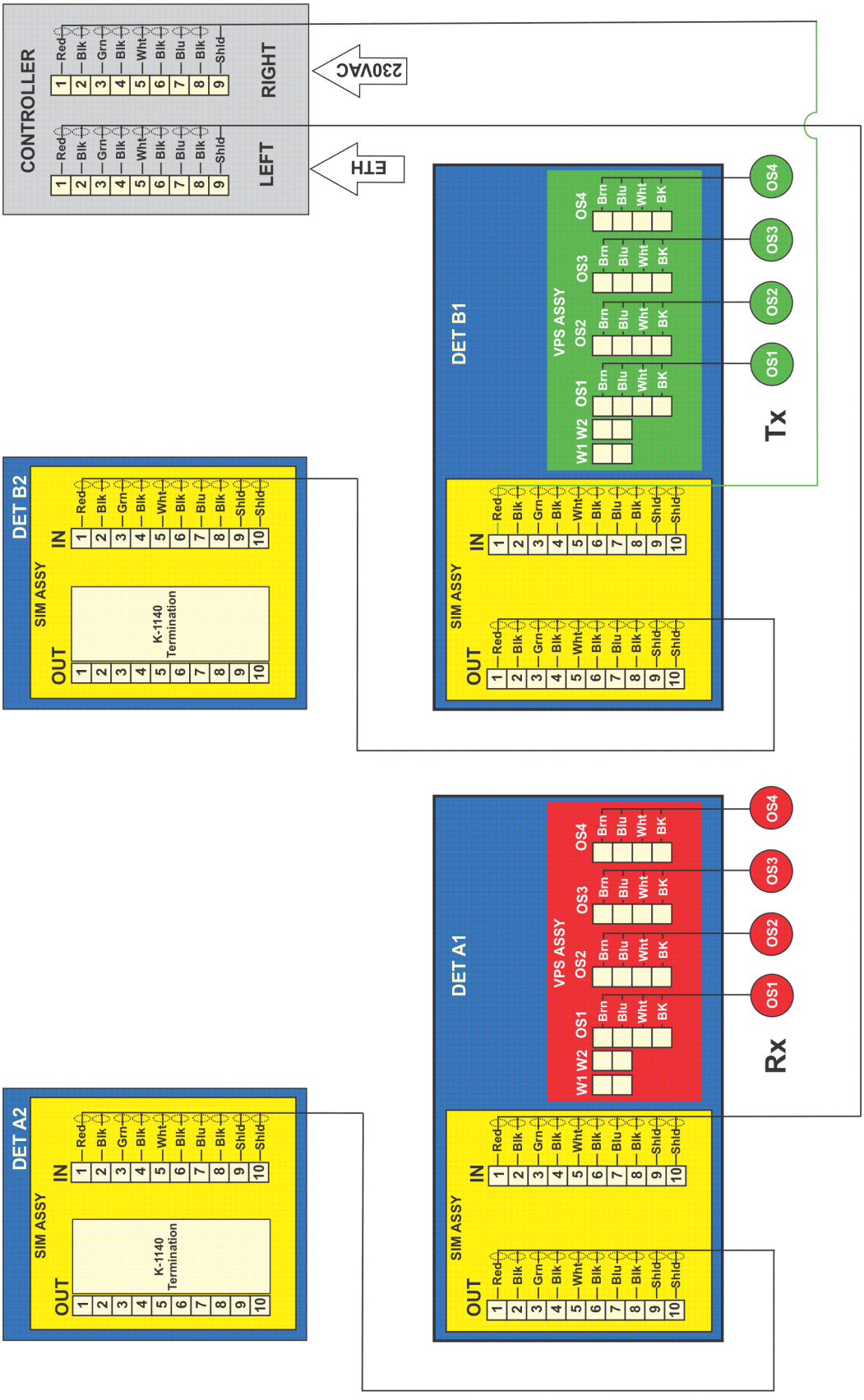
A.1 RS-200/300/400 – 2 Detector Wiring Schematic



CAUTION:

WHEN WIRING IS COMPLETE, IT IS ESSENTIAL TO CHECK AND VERIFY THAT THE SHIELD OF THE DETECTOR CABLE IN THE DETECTOR AND CONTROLLER IS PROPERLY INSULATED - SO IT CANNOT CAUSE A GROUND CONNECTION. IF THERE IS A GROUND CONNECTION BETWEEN THE SHIELD OF THE CABLE AND THE DETECTOR OR CONTROLLER BOXES, A SERIOUS EM BREACH WILL OCCUR AND MAKE THE SYSTEM VERY SUSCEPTIBLE TO LIGHTNING DAMAGE.

A.2 RS-200/300/400 – 4 Detector Wiring Schematic



Appendix B Service Mode

B.1 General

In special cases it is necessary to temporarily disable the system to perform special functions. These functions typically fall into 2 categories: SERVICE or TEMPORARILY DISABLE

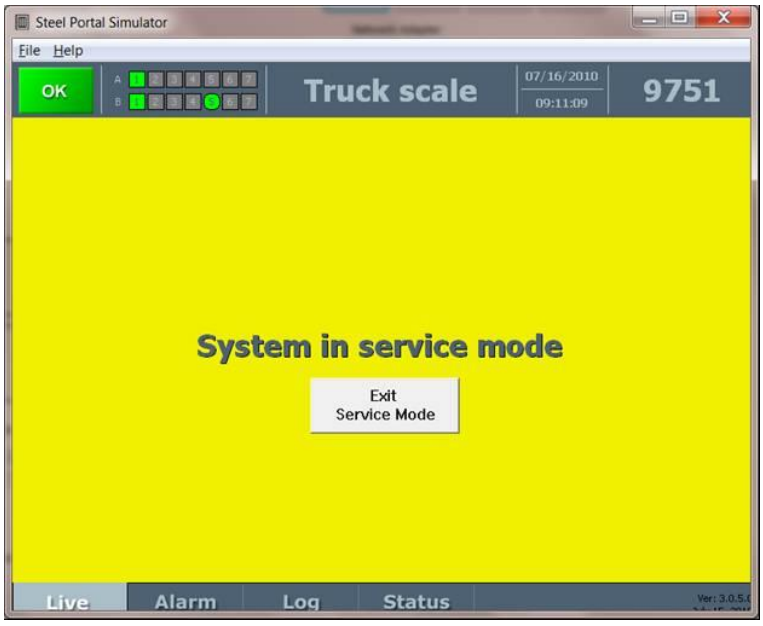
SERVICE – in this mode the system is temporarily disabled to perform service adjustment or repairs without switching the power off. Servicing the unit with power ON is often necessary to setup OS units and enable/disable parameters etc. In this mode system errors are suppressed to avoid polluting the systems' data records with unnecessary error messages.

TEMPORARILY DISABLE – in some applications, vehicles are parked in front of the detector for a long time which disables system operation and causes many error messages. Since the user is CHOOSING to do this, these error messages cause operational problems Service Mode will suppress these unnecessary messages.

B.2 Service Mode

Service mode **CAN ONLY BE SET** by the RSO utilizing RSI's proprietary software RadInspect but can be disabled by the local user on the systems Touch panel.

Once in the **SERVICE MODE** all display screens have a Yellow background to be totally visible to the user that the system is not functioning normally.



If a vehicle passes then the unit will "beep" as a reminder that the system is disabled but NO ANALYSIS will occur.

Once the required function is complete, press the "**EXIT Service Mode**" and the unit will revert to normal operation.

NOTE: When the system returns to normal operation it takes typically 2 minutes to establish proper parameters before it is ready for normal operation – during this time the traffic lights will flash as a warning and the Controller display will show an error condition which will automatically clear once the system initializes.

Appendix Z – WARRANTY

RSI RADIATION SOLUTIONS INC

Radiation Solutions Inc. Warranty

RSI products are provided with a two (2) year return to factory limited warranty against defects in materials and workmanship from the date the Products are placed at the disposal of the Buyer at the named place of delivery. The warranty does not cover damage caused by improper use or unauthorized repairs.

Repairs of defects will be performed by RSI at no charge to the Buyer, subject to the limitations when the unit is returned to the factory. To request warranty service, the Buyer must call RSI's service coordinator for a return material authorization (RMA) number.

The Buyer is responsible for all the shipping, customs clearance costs and risk of loss of returning the repaired or replaced Products to the Buyer. RSI will own all parts removed from repaired Products or all Products replaced.

RSI's warranty does not include mechanical damage to the detector from handling or abuse. RSI does warrant the detectors to be complete and fully operational to their published specifications at the time of delivery and to maintain the minimum resolution and performance for a period of two years under normal operating condition.

The radiation monitoring system is warranted by RSI to perform correctly if it is installed and operated according to RSO directions. However system operation is limited by basic physics so RSI does NOT warrant 100% detection capability but does warrant that if the system is installed and operated correctly then these systems are technically more advanced than any other similar system on the market and has the highest probability of alarming.

Complete details of the "***Standard Terms and Conditions***" may be obtained by contacting RSI.

For more information or to make a warranty claim contact RSI.

Contact Information

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