GR-526/510

Vehicle Monitoring System

SYSTEM MANUAL - Rev 7.1

Part #93516

Software Version 2V16

April 17, 2002

EXPLORANIUM

RADIATION DETECTION SYSTEMS

GR-526/510 Vehicle Radiation Monitor

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for

DYNAMIC VEHICLE RADIATION MONITORING

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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.

EXPLORANIUM 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 GR-526/510 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.

1.1 INTRODUCTION

The GR-526/510 is the state-of-the-art radiation monitoring system for Truck/Rail vehicles in the scrap metal processing and recycling industries. The GR-526/510 has been specifically designed to detect the presence of potentially shielded or un-shielded radioactive sources that are buried in scrap metal.

To prevent these expensive, and potentially dangerous accidents, EXPLORANIUM developed the GR-520 Radiation Detection System in 1988, which was the first system capable of detecting BURIED shielded sources. This system was improved with the introduction of the GR-525 and now, the state-of-the-art GR-526/510. Exploranium has installed over 500 radiation detection systems in steel mills and scrap handling facilities in 17 countries including USA, Canada, Mexico, Germany, Sweden, Finland, Italy, Denmark, UK, Ireland and many countries in Asia.

It is impossible for ANY system to catch ALL potential incoming sources for a variety of technical reasons (see Appendix A). However the technology built into the GR-526/510 together with our previous experience PLUS some recent major technical breakthroughs, make the GR-526/510 THE technical limit in this specialised monitoring technology. The GR-526/510 will detect almost all potential "normal" sources that can be expected to be in the scrap stream and compensate for most logistic limitations commonly seen in scrap handling facilities.

The GR-526/510 offers the highest level of sensitivity, ease of use and system reliability of any scrap metal radiation monitor, through the following features:

- Very large Polyvinyl toluene (PVT) "plastic" detectors.
- Easy user interface via the large Graphics display plus printer output.
- One-button Alarm response for the user
- Continuous automatic system self-diagnosis with user notification
- Redundancy of key system components.
- Tele-Check with full performance data analysis/service support via built-in modem.
- Extensive Exploranium Service Centre support for customer questions.
- FREE software updates to continuously improve performance

1.2 GR-526/510 SYSTEM DESCRIPTION (General)

The GR-526/510 Radiation Detection System consists of a system console and two detector boxes (maximum = 8 detector boxes for special applications). The detectors are usually mounted at the entrance to a truck or rail scale. The system console can be mounted in the scale house or any other convenient indoor monitoring location.

Radioactive sources, both naturally occurring and man-made, emit Gamma-rays that are absorbed by the detectors and produce scintillations, small flashes of light, which are converted to pulses in the detector electronics. The system console collects and monitors the Gamma-ray information from the detectors and displays the data on the front panel Liquid Crystal Display (Console Display) in a "chart recorder" format.

If the system determines that a source of radioactivity is present, an audio alarm is sounded and detailed alarm information is displayed on the Console Display.
The GR-526/510 also performs continuous system diagnosis. If a component failure is detected,

signals can be re-routed to take advantage of back-up systems designed into the GR-526/510. Any system faults that are detected are displayed on the Console Display, enabling Maintenance to be scheduled. The system will continue to operate even if some major components have failed, to give the user the MAXIMUM detection capability during this period.

The GR-526/510 system has been specially designed for ONE-BUTTON operation. The system is designed to monitor all internal components and automatically alert the user to any system malfunctions. ADVANCED SYSTEM DESIGN PERMITS THE SYSTEM TO OPERATE AT MAXIMUM PERFORMANCE LEVELS WITHOUT REQUIRING THE SCALE OPERATOR TO DO ANYTHING UNTIL AN ALARM OCCURS.

1.3 IN CASE OF DIFFICULTY

In the event of a problem, customers can contact the Exploranium Service Centre closest to them

1) Exploranium - Canada (Head office)

Address :	6108 Edwards Blvd., Mississauga, ON L5T 2V7, Canada	
Telephone	:	(905) 670-7071
Fax	:	(905) 670-7072
Pager	:	(416) 614-4551
Service personnel	:	Dan Hoover Fred Walker John Crook

2) Exploranium - Europe- ENVI-2000

Address	:	Vaculikova 1 A, Brno 638 00, Czech Republic
Telephone	:	[033] (420) 5-48-42-6011
Fax	:	[033] (420) 5-48-42-6023
Mobile	:	[033] (420) 602-702-075
Service personnel	:	Ivan Kasparec Jara Matejek

1.4 DOCUMENTATION

Various support documentation is available for the GR-526/510 system:

1) SYSTEM SUMMARY CARD - a 1 page (2 sided) laminated card that summarizes system operation, supplied with all systems. Part #93512

2) OPERATORS MANUAL – part #93516-3
   This manual covers basic system operation, alarm information, alarm responses, basic system maintenance and basic error analysis of system performance.

3) SYSTEM MANUAL – part #93516
   This is an in depth manual that covers system setup, parameter selection as well as normal system use.

4) MAINTENANCE MANUAL – part #93509
   This is a detailed manual specially for Maintenance personnel and covers all required Maintenance functions.

2.0 OPERATION

This section summarizes how the system works and gives some details of special operational parameters that may be selected during system setup. For a full description of each parameter - refer to Section 6.

For easy reference see the laminated 1 page (2 sides) SYSTEM SUMMARY CARD.

2.1 GR-526/510 CONSOLE PRIMARY FEATURES

Primary features are:

Bright graphics Console Display for the display of messages, alarms etc.

RED push-button marked ALARM - used during a Radiation alarm

YELLOW push-button marked STATUS - used for other user functions

Internal AUDIO buzzer referred to as AUDIO BUZZER

CLEAR, ENTER, RUN, STOP - special function keys used in Maintenance and System Set-Up - and a 10 key numeric keyboard - 0 - 9

2 ARROW keys - for parameter selection

Internal PRINTER for hard copy of alarms (external Printer support if required)

Internal MODEM for Remote Maintenance access by telephone line

Special output for control of external TRAFFIC LIGHTS

Special data output (RS-232) permitting external data processing

Note that the system can be operated by ANY user by using ONLY THE RED BUTTON, as the other buttons are primarily for changing system parameters.

2.2 POWER SWITCH

The YELLOW GR-526/510 power switch is located inside the system console and can be reached from the lower right-hand access door. Access to the power switch has deliberately been made difficult to minimize the chance of unauthorized personnel interfering with system operation.

2.3 STARTUP SCREEN

When power to the GR-526/510 is turned on, the following screen appears on the Console Display:

```
************************************
*                                  *
*       EXPLORANIUM GR-526/510     *
*                                  *
*                                  *
*       Radiation Monitor          *
*                                  *
*    Serial # - 1234       2.16.8  *
*                                  *
*     Test in progress - WAIT      *
*                                  *
************************************
```

Fig. 1

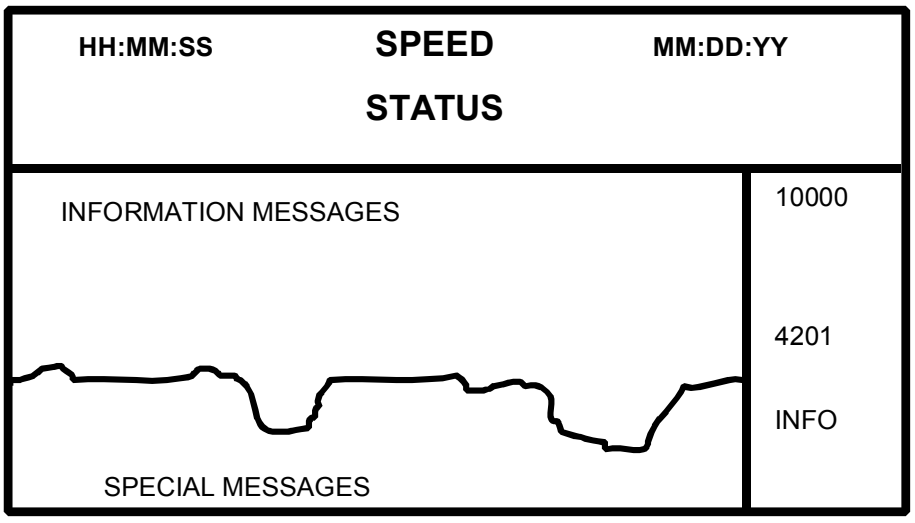
This startup screen is displayed for a few seconds while all components of the system are automatically tested. If all parts of the system are working correctly, the Console Display will change to show the Monitoring Display (Fig 2).

The following message will be printed on the printer

RESXX - 02/14/96 - 14:23:00 -
(date) (time)

XX represents a diagnostic code for performance analysis (See Appendix F for more details)

If any faults ARE detected, the errors are displayed - see Section 2.4 for details.



2.4 DISPLAY MESSAGES

The CONSOLE DISPLAY is used to alert the user to any problem with the system and to display system messages advising the user of the current status of system performance.

In the table below all messages are listed -

STATUS - shows the status of the STATUS (Yellow) button
TRAFFIC - shows the status of the Traffic Light output (if used)
Audio - shows the action of the internal audio buzzer
User action - shows the recommended user actions

Message	STATUS	TRAFFIC	Audio	User action	Comments
SYSTEM WARMUP - WAIT	Flash	YELLOW	None	None	10 second wait on system startup
SYSTEM READY	ON	GREEN	None	None	Ready to monitor
VEHICLE IN	ON	YELLOW	None	None	Vehicle passing
TELE-MAINTENANCE	ON	GREEN	None	None	Modem access occurring
3.7 MPH (or Km/h)	ON	Various	None	None	Speed of the vehicle
3.7, 5.2 MPH (or Km/h)	ON	Various	None	None	Vehicle speed IN and OUT
SPEED ERR	Slow Flash	YELLOW flash	Slow beep	Press STATUS	Super high speed vehicle
SpSpd	ON	Various	None	None	special mode
OS1 ERR (or OS2 ERR)	Fast Flash	Various	Fast beep	Call maintenance	Optical Sensor defective
OS1,2 ERR	Fast Flash	Various	Fast beep	Call maintenance	BOTH OS defective
OS3,4 ERR	Fast Flash	Various	Fast beep	Call Maintenance	OS3, 4 defective (if used)
Detector ERR A1, cntr 123	Fast Flash	Various	Fast beep	Call Maintenance	A detector is defective
COMM FAILURE A	Fast Flash	Various	Fast beep	Call Maintenance	Detector A Comm problem
COMM ERROR A	Fast Flash	Various	Fast beep	Call Maintenance	Detector A Comm problem
SYSTEM INOPERABLE	Fast Flash	RED	ON see Note #1	Stop vehicles call	All detectors are defective - NO monitoring

Message	STATUS	TRAFFIC	Audio	User action	Comments
				Maintenance	possible
??BACKGROUND UPDATE??	Fast flash	YELLOW flash	Fast beep	Remove vehicle and pass again	Excess traffic
SENSITIVITY TEST	ON	RED and flash RED	None	Test the system	Sensitivity test of system
TEST	ON	Various	None	TEST the system	Simple alarm test
PrALA	ON	Various	None	None	Summary alarms being printed
PrtAL	ON	Various	None	None	Alarms being printed
PrSTA	ON	Various	None	None	System parameters being printed
XaSPD	ON	Various	None	None	Alarms only by OS
SpSpd	ON	Various	Various	None	Speed Alert suspended
Modem I/O error	Fast flash	YELLOW flash	Fast beep	Call Maintenance	Defective modem
Remote Monitoring	ON	Various	None	None	System being contacted by modem
Remote Vehicle Log	ON	Various	None	None	System being contacted by modem

Note 1: In this unusual condition the Audio is ON and may not be reset using the STATUS button. The user should switch the system OFF to prevent the audio. Maintenance may disconnect the audio temporarily while awaiting modem support from Exploranium.

2.5 ERRORS DURING INITIALIZATION

When the system goes through SYSTEM INITIALIZATION, a thorough check of all system parameters is made. When these tests are being carried out the screen shown in Fig. 1 is shown. At the conclusion of these tests, if NO errors are found the display changes to the Monitoring display. However if the tests determine that errors exist during these tests then the following sequence occurs:

- the console Audio Buzzer "fast-beeps" at a 3/sec rate
- the STATUS button flashes at a 3/sec rate + Yellow Traffic Light
- the errors are listed on the display for 10 seconds

After 10 seconds the display automatically goes into the Monitoring Mode (see Fig.2) and the errors are displayed - as listed above.

The Audio Buzzer "quick-beep" can only be stopped by pressing STATUS, at which time the user accepts responsibility for ensuring that all errors are corrected.

2.6 TRAFFIC LIGHT SYSTEM (Normal operation)

The GR-526/510 is supplied with a TLC (Traffic Light Controller). Exploranium recommends that users install a complete Traffic Light system as it is very helpful in advising users and drivers of system operation. There are 4 control lines available and are usually connected to : GREEN, YELLOW and RED lights and an external HORN. The following is the detailed explanation of their operation and meaning.

GREEN steady	system operational, proceed
GREEN Flashing -	both primary Optical Sensors are defective, system still alive but sensitivity significantly reduced.
YELLOW steady	EITHER - vehicle is being monitored as it passes - OR system is not ready (user accessing alarms etc) so vehicle must WAIT
YELLOW SLOW Flashing -	Vehicle speed TOO HIGH
YELLOW FAST Flashing -	System errors (bad OS, or bad detectors)
RED steady	RADIATION ALARM OR - SYSTEM INOPERABLE
EXT. HORN steady -	RADIATION ALARM
EXT. HORN SLOW pulsing -	Speed Alert

2.7 SPEED ALERT

To prevent system sensitivity reductions caused by excessive vehicle speed, the GR-526/510 has a built-in SPEED control. The vehicle speed is shown on the Console Display in the "SPEED" location (see Fig. 2). The speed units of measure (mph, Km/h) are selected during Start-Up.

The maximum permissible SPEED of a vehicle passing through the detectors is selectable and is normally set to 3 mph (5 Km/h). Any vehicle passing at a speed above this limit causes a Speed Alert which gives an Audio alert (beeps) as well as Visual (YELLOW Traffic light flashes).

The user should realize that reducing the vehicle speed from a maximum of 6 mph (10 Km/h) to a maximum of 3 mph (5 Km/h) - effectively increases system sensitivity by 40%

2.8 CURRENT PARAMETERS - PRINTOUT

Enter Password <9 - 9 - 9 - 9 - ENTER> to give a printout of current system parameters as shown in Fig. 3.

```
CURRENT PARAMETERS        #3214
 4/26/97                  12:34:19
C= 30      B= 2      N= 5      V= 10
O= N       1= 30  2= 15    3= 9   MOD= 2
ERR = 0   0  0  0       Ver: 2.16.8
D= 4       O= 7      D= N      C= 1
S= D       L= 3      U= U
  Poff:    04/12/97      13:49:15
```

Fig. 3

#3214 - is the Serial Number of the system
Date/Time - is the Date/Time of the printout

The following is a list of the parameter settings:

C =30 -	Background Correction parameter - set to 30
B = 2 -	Background Parameter - set to 2
N = 5 -	Number parameter - set to 5
V = 10 -	Vehicle Parameter- set to 10
O = N -	Alarms ONLY by OS - set to NO
1 = 30 -	LOW Alarm L1 - set to 30 (50 for GR-510)
2 = 15 -	LOW Alarm L2 - set to 15
3 = 9 -	HI - Alarm L3 - set to 9 (4 for GR-510
MOD=2	Alarm Mode parameter - set to 2
ERR=000	Error Code (= current error messages see 6.8 below)
Ver:2.16.8	Software Version (display shows 16.8)
D = 4 -	# of detectors - set to 4
O = 7 -	# of OS - set to 7
D = N -	Dust Parameter - set to NO
C = 1 -	Discriminators = 1 = Normal mode = C mode + set at 10
S = D -	Speed Alert - set to D (Default)
L = 3 -	Speed Limit - set to 3
U = U -	Speed Units + Date Format - U = US Date + mph (E = Euro date + Km/h, X = US Date + Km/h, Y = Euro Date + mph)
Poff	Date/Time of last time system power was switched OFF

2.9 SYSTEM TEST

In order to help the user test the system on a regular basis special test capabilities are built into the GR-526/510. Refer to Appendix N for full details.

2.10 TELE-CHECK

The Exploranium Service Department computer can access the system on a regular basis to perform system performance analysis as required without interfering with system performance. In previous versions this access interrupted system monitoring so frequent contact was required to select a "quiet" time for data access - but this is not a problem now.

Exploranium offers optional extensive data analysis of system performance with weekly access and monthly data reports - contact Exploranium for more information and see Appendix M.

3.0 ALARM DISPLAYS AND PROCEDURES

3.1 IF AN ALARM OCCURS

If a RADIATION ALARM occurs, the Audio gives a loud continuous tone and the display changes to show the alarm (Fig 4) and the alarm is automatically printed (Fig 5) (unless this option is disabled). The Audio alarm will continue indefinitely until the red ALARM button is pressed.

In the Alarm Display various data are displayed:

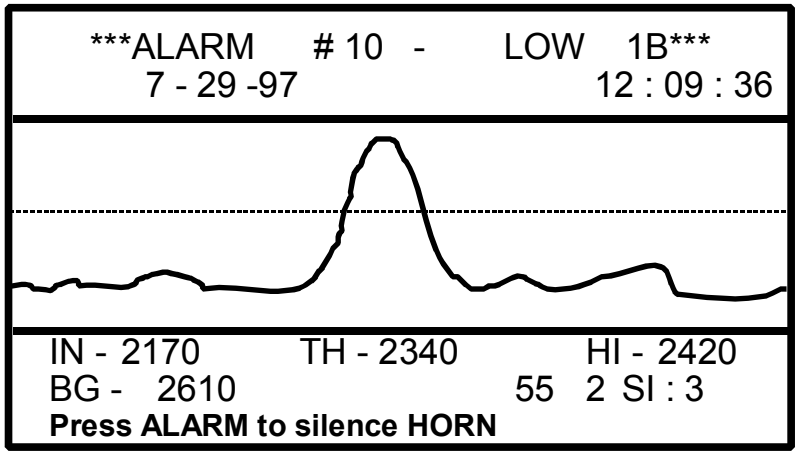


Fig.4

ALARM #10 - a sequential alarm # for record keeping
LOW 1 - Alarm designation - refer to 3.4 below for more details
B - This refers to the detector that the primary (highest) alarm was detected on. (Other labels are A, B, C, D, E, F for different detectors, X = an alarm on A+B and Y = alarm on C+D
IN - 2170 Vehicle Background = 2170 cps
TH - 2340 Computed alarm threshold =2340 cps
HI - 2420 Highest radiation count = 2420 cps
BG - 2610 Local Background = 2610 cps
55-2 Count analysis information.
SI:3 Vehicle speed = 3mph (or 3Km/h)

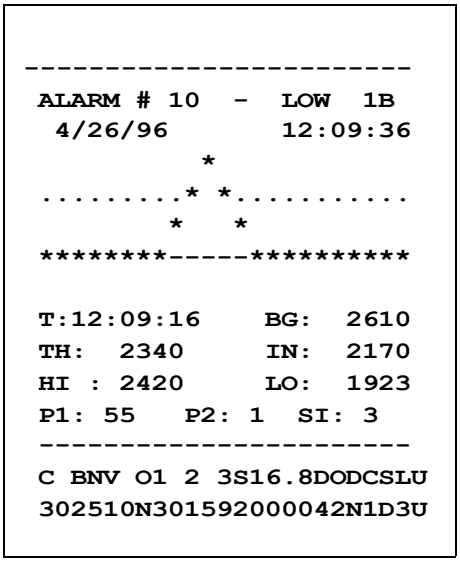


Fig.5

With the Audio alarm stopped, pressing the red ALARM button again (a second time) will cancel the Alarm Display and the system will go back to the normal display screen. The user has 4 minutes from this point to view the alarm before the display reverts to the Monitoring Display.

3.2 LEVEL 5 (DANGER) ALARM

LEVEL 5 is a special Alarm level that could denote hazardous material with a potential personnel exposure hazard. For this reason it has a special display (Fig 6) and printout (Fig 7).

If this screen appears, press ALARM to silence the audio, and the screen will replace the message "Press ALARM to silence HORN" with "proceed with caution".

```
> > > > LEVEL 5 ALARM < < < <

**************************************
*                                    *
*   VERY HIGH LEVEL ALARM!           *
*                                    *
*          PROBABLY                  *
*     HAZARDOUS MATERIAL             *
*                                    *
**************************************
  Press ALARM to silence HORN
```

Fig.6

Correct alarm procedures depends on the plant but normally the vehicle will have passed, so press ALARM again and the message "Press ALARM if ready" will appear and the ALARM light will flash. Pressing ALARM a third time returns the system to Monitoring.

SPECIAL PRINTOUT

A special alarm printout is used to clearly distinguish this alarm from normal alarms - Fig. 7.

```
ALARM # 10  -  DANGER
 4/26/96          12:09:36

> > LEVEL 5 ALARM < < <
VERY HIGH LEVEL ALARM
PROBABLY
HAZARDOUS MATERIAL

 T:    12:09:16   BG:    2610
 TH:   300000     IN:    0
 HI:   325000     LO:    18730
 P1: 5     P2: 0     SO : 1
-------------------------------------
C BNV O1 2 3S16.8 DODCSLU
302 510 N301592 00004 2 N1D3U
```

Fig.7

3.3 ALARM TIMING

LOW ALARM - (labelled L1/L2)

IF A VEHICLE IS PRESENT : The system has determined that the radiation levels from the vehicle that has <u>just left</u> the detectors, are above the alarm threshold. If LOW 1A this means that the source is closer to detector A etc.

IF NO VEHICLE PRESENT : Alarm LOW Alarm L2 can occur with no vehicle present and in this case was caused by whatever was near the detectors at that time.

HIGH ALARM - (labelled H3/H4)

<u>Immediate alarms</u>. Radiation levels have risen VERY significantly above normal background. These alarms are sounded immediately and therefore may relate to the vehicle that is between the detectors <u>at the moment the alarm sounds</u> or has just passed.

3.4 ALARM LEVELS - detailed explanation

LOW 1A - this is the MOST SENSITIVE alarm on the system and is only activated when a vehicle is passing through the detectors. The "A" means that the primary alarm occurred on the A detector.

LOW 2B- this is the next highest level alarm with an Alarm Threshold and can occur EVEN IF NO VEHICLE IS PRESENT, if the local radiation background level significantly changes. The "B" means that the primary alarm occurred on the B detector.

Other sub labels are : C/D = if C/D detectors are used,
X/Y = special combination detector alarms and Z = Danger alarm.

HIGH 3 - this alarm signifies a very significant increase in local radiation level

HIGH 4 - this alarm level signifies that the local radiation level has increased so high that the detectors are registering their maximum count levels. However this is not necessarily hazardous (see below)

DANGER - This Alarm Level is triggered WHEN ALL SELECTED DETECTORS EXHIBIT A HIGH "LEVEL 4" ALARM. Thus a LEVEL 5 alarm indicates that the source is PROBABLY a HIGHLY RADIOACTIVE source in the vehicle and this alarm should be treated with GREAT CAUTION and personnel exposure should be limited.

3.5 ALARM LEVELS AND EXPOSURE LIMITS

Potential radiation levels and employee safety are the main considerations when designing alarm procedures. Alarm levels provide an indication of the amount of radiation emanating from the source that has triggered the alarm.

Typical local background radiation levels are typically 5-10μR/h (0.05-0.1 μSv/h). The following examples assume that the local level IS 5 μR/h (0.05uSv), and that the GR-526/510 is set with the recommended parameters. Note that the levels listed below are actually the Exposure Rate AT THE DETECTOR FACE and should NOT be considered as an EXACT measure of radiation for safety or hazard evaluation. (The actual buried source, if exposed by dumping the vehicle, will have much higher levels when not shielded by the scrap cover).

LOW = 0.5 - 50μR/h (0.005 - 0.5 μSv/h)

HIGH = 50 - 150μR/h (0.5 - 1.5 μSv/h)

DANGER = ALL DETECTORS ABOVE 150 μR/h (1.5 μSv/h)

The GR-526/510 is designed to detect very small changes in radiation levels so all of the system's components and data analysis algorithms have been optimized to meet this design objective. Due to these design requirements, the system "saturates" at radiation levels above 150 μR/h (1.5

μSv/h).

As a result, any radiation level above 300 μR/h produces a HIGH radiation alarm on the detector.

Thus a NOT very dangerous 200 μR/h (2 μSv/h) source positioned close to 1 detector would probably give ONLY a HIGH alarm. However a very dangerous 400,000 μR/h (4 mSv/h) source would give a LEVEL 5 alarm.

3.6 ALARM PROCEDURES

Exploranium strongly recommends that users of the GR-526/510, develop a plant operating procedure that specifies the actions to be taken in the event of an alarm. These procedures should be developed under the guidance of a certified Health Physicist and in co-operation with local and state authorities.

The basic recommendations made in this manual can be used as the starting point for a procedure - however restrictions pertaining to handling, storage and transportation of radioactive materials vary widely.

Exploranium is NOT certified to act as a Health Physics consultant to fully advise users on correct methods of handling and regulation compliance, so it is essential that each user develop procedures that suit their specific circumstances and conform to all applicable laws.

The following simple procedures are recommended for confirming alarms and vehicle handling. Procedures for the investigation of vehicle contents and radioactive material disposal will usually be required, but must be developed independently.

LOW ALARM PROCEDURES - Alarm Level L1 and L2

After silencing the audio alarm, inspect the Alarm display and note the approximate location of the source of radioactivity. (The left edge of the screen is the START of vehicle and the right side is the END).

If the Printer is enabled, the alarm will also be printed. Press the ALARM button to return to normal monitoring mode.

TRUCKS – have the truck circle around and wait at least 15 ft. back from the detectors.

TRAINS – move the suspect car back at least 2 cars from the detectors.

When the vehicle is again positioned prior to the detectors, have it proceed forward slowly (maximum 3 mph) and continuously (no stops), through the detectors to verify that the alarm is

activated a second time.

Review the Console Display and again note the approximate location of the source.

Repeat this test a third time. If the second and third test confirm the initial alarm, isolate the vehicle and follow local procedures for investigating the source of the radioactivity.

HIGH ALARM PROCEDURE - Alarm Level H3 and H4

After silencing the audio alarm, inspect the Alarm display and note the approximate location of the source of radioactivity. (The left edge of the screen is the START of vehicle and the right side is the END). If the Printer is enabled, the alarm will also be printed.

Press the ALARM button to return to normal monitoring mode.

It is recommended that the HIGH alarm vehicle be moved at least 100 feet from the detectors to allow monitoring of other vehicles to continue without interference. Follow local procedures for investigating the source of the radioactivity.

DANGER ALARM PROCEDURE

Proceed on the assumption that a potentially hazardous source is in the vehicle

- move personnel (and driver) at least 100 ft away from the vehicle
- strictly control access to the area
- allow access only to qualified personnel
- immediately advise the RSO to verify the alarm and implement correct procedures

4.0 VIEWING ALARM DATA IN MEMORY

The system will store up to 30 typical alarms in memory, however VERY LONG alarms can limit the number of alarms stored. An alarm access password is built into the system to allow an authorized user to review stored alarms. This password is different from the Maintenance password. (See section 5.28)

The alarm password is: <ENTER - 1 - 4 - 9 - 2 - ENTER>.
Once entered, the following screen appears.

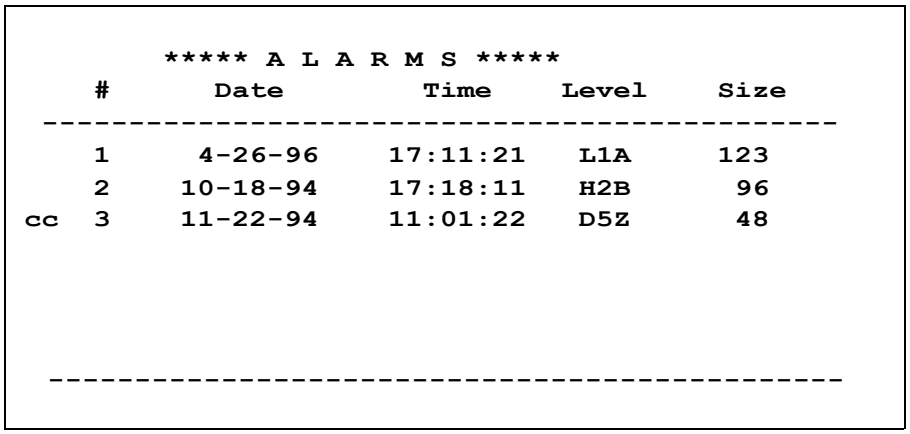


Fig.8

cc - is a cursor used to select an alarm by using the UP and DOWN arrow

\# - is a sequential # starting at 1 to label the alarm. This number increases to 99 then RESETs to 1

Date - is the Date that the alarm occurred

Time - is the TIME that the alarm occurred

Level - is the Alarm LEVEL. There are various data here as follows :
- L2A - L = LOW level alarm - 2 = LOW Alarm L2
  A(B) = primarily on detector A(B)
- H3A - H = HIGH level alarm - 3 = Alarm Level 3
  A = primarily on detector A
- D5Z - D = LEVEL 5 alarm - 5 = Alarm level 5
  Z = ALL detectors

Size - the number of samples for each vehicle analysis. This parameter is usually only useful to Exploranium.

Pressing "1" while viewing this display will print a listing of the alarms in memory on the internal printer. Alarms are printed as follows:

```
      ***** A L A R M S *****
  #    Date      Time      Level   Size

-------------------------------------------------
--
  1   4-26-97   02:11:21  L2A     123
  2   4-26-97   05:18:11  L2A     96
  3   4-26-97   09:01:22  D5Z     48
  4   4-26-97   12:11:21  H3A     78
  5   4-26-97   12:18:11  H3A     199
  6   4-26-97   13:01:22  L1A     22
  7   4-26-97   15:01:22  L1B     57
  8   4-26-97   20:11:21  L1A     94
  9   4-26-97   21:18:11  L1A     27
 10   4-26-97   22:09:36  L1B     55

-------------------------------------------------
```

Fig.9

The ARROW keys are used to select an alarm then pressing <ENTER>, displays the actual data from the Alarm, exactly as the user would have seen it as it occurred (Fig. 4).

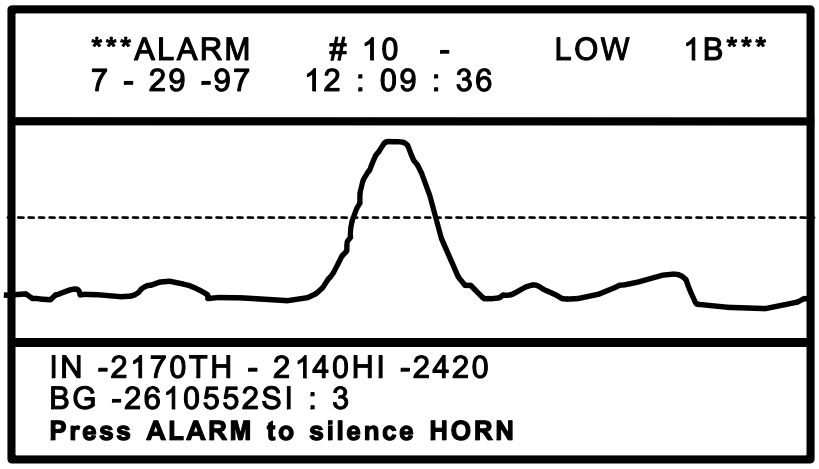


Fig.10

In this display:

IN - 2170	Background of the vehicle "in" between the detectors = 2170 cts/sec(cps)
BG - 2610	Background before the vehicle entered the detectors was 2,610 cps
TH - 2340	Calculated alarm threshold was 2,340 cps
HI - 2420	Highest radiation count was 2,420 cps
55-2-SI : 3	Count analysis information.

NOTE : FOR DANGER = LEVEL 5 ALARM (D5Z) DISPLAY - SEE SECTION 3.2

PRINT ALARMS

Press <1> to print out the selected alarm. The following are the explanation of the alarm printout parameters shown in Fig 11.

ALARM (#10) Numerical Alarm number (1-99)

LOW 1B LOW level (type 1) alarm primarily on the B detector

4/26/96 Date that the Alarm occurred

12:09:36 Time that the alarm occurred

Graphics depiction of the alarm

T: 12:09:16 The time that the Vehicle OUT background was last updated

BG : 2610 The current local background (cps)

TH - 2340 Calculated alarm threshold (cps)

HI - 2420 Highest radiation count (cps)

IN - 2170 Average vehicle background (cps)

P1 Number of samples for Vehicle IN (in 1/10 sec units so 55 = 5.5 seconds)

P2 Segment number - this advises the user which part of the truck the alarm occurred in, usually 1=Cab, 2=Truck trailer, 3=Pup

SI 21 Speed of the vehicle, in this case Speed IN = 2.1mph. Other data could be SO (Speed OUT) or SP 1 = no OS activated so speed not computed.

```
----------------------
ALARM # 10 - LOW 1B
 4/26/96     12:09:36
      *
.....* *.....
     *  *
********-----**********

T:12:09:16   BG: 2610
TH: 2340    IN: 2170
HI : 2420    LO: 1923
P1: 55  P2: 1  SI: 21
----------------------
C BNV O1 2 3S16.0DODCSLU

302510N301592000042N1D3U
```

Fig.11

The lower data is encoded to define current system operational parameters, see Section 6.6 for more information.

After reviewing or printing the desired alarms, press <STOP> to return to normal monitoring mode.

5.0 PARAMETER SETTINGS

System Parameters are set during installation, and under normal operating conditions do not require adjustments. Modification to these parameters may result in seriously degrading system performance. To restrict access to the system parameters, they are Password protected. The system parameters Password is set at installation, and is provided to the user at that time. The password can be changed at any time by entering the system parameters menu. (1234 is used as an example of a system parameters password below) :

FIRST PARAMETER SCREEN

To enter the system parameters menu, press <ENTER - 1 - 2 - 3 - 4 - ENTER> and the following display appears :

```
BG  Parameter                    2
```

Fig.12

Enter the required value using the keyboard and press <ENTER> to continue to the next line. Continue this sequence until all parameters are set.

```
BG  Parameter                    2
BG  Correction                   30
Number Parameter                 5
Segment Parameter                3
Vehicle Parameter                30
Analog Scale                     10000
Number Detectors                 4
Number Opt. Sens.                2
Alarm Mode                       2
Low Alarm   L1   AB              30/50 for 510
Low Alarm   L2                   15
High Alarm  H3                   9 /4 for 510
OS level                         10
Modem used                       YES
Print alarms                     YES
CONTRAST 50 - UP/DOWN,     STOP
```

Fig.13

5.1 BG PARAMETER - (DEFAULT=2) - Range 1-10

This parameter is selected to prevent erroneous short term local effects from polluting the Local Radiation Background measurements.

NOTE : On the Alarm Printout - if the 2 real-time clock times are more than a 30 seconds different, increase this parameter as this indicates that the background correction system is not functioning correctly.

5.2 BG CORRECTION - (DEFAULT=30) - Range 1-99

This parameter is used to set a special edge-alarm threshold to enhance edge-alarm detection capability under special conditions. Under special local logistic conditions, this enhancement can cause edge-alarm problems. If an excessive number of alarms are noted please advise Exploranium and this parameter can be optimised.

NOTE : This parameter primarily controls the special edge-enhanced alarm level. The user can assess whether this feature is causing incorrect alarms by computing ((BG-LO)/2). If this value equals the TH value (within 10 because of round off errors) then the alarm WAS caused by this enhancement and therefore if it is judged to be an incorrect alarm, increasing this level to 40 may be appropriate.

A setting of 10 disables this feature and then only "normal" edge sensitivity is achieved.

5.3 NUMBER PARAMETER - (DEFAULT=5) - Range 3-9

Special parameter to limit interfering alarms and prevent False Alarms - must be set to 5 under normal conditions.

NOTE : Under special conditions (such as very high speed vehicles) reducing this parameter can be beneficial in improving the system alarm capability, however the down side is that reducing this parameter can have a serious effect on the False Alarm rate so consult with Exploranium before experimenting with this feature

---

5.4 SEGMENT PARAMETER - (DEFAULT=3) - Range 3-9

This parameter is used to determine the minimum vehicle size (referred to as a SEGMENT) that should be analysed by the system. In combination with the Number Parameter the system can be "tuned" to ignore very small OS actuations that under special circumstances could cause potential system errors.

NOTE : The minimum vehicle size analysed = Seg. Par. + Num. Par. So if default values are used this equals 5+3=8, so the minimum vehicle size for alarm analysis is 8 data samples = 0.8 secs. The actual minimum vehicle size also uses the OS spacing parameter (see 5.22) and the actual computation is as follows :

Speed	OS spacing	Num Param	Seg Param	Min Veh size
3mph (5Km/h)	41	5	3	6.9ft/2.1m
	59	5	3	8.5ft/2.6m
	41	5	9	9.5ft/2.9m
5mph (8Km/h)	41	5	3	9.1ft/2.7m
	59	5	3	10.5ft/3.2m
	41	5	9	13.5ft/4.1m

So in a yard that has NO small vehicles, this parameter can be used to only analyse LARGE trucks.

The MINIMUM VEHICLE SIZE is the truck body and excludes the length of the cab. However in the special case where the OS units cannot see a gap between the cab and the truck body, then this dimension applies to the whole vehicle.

5.5 VEHICLE PARAMETER - (DEFAULT=10) - Range 8-53

This parameter is used to eliminate the majority of "incorrect" alarms for LOW Alarm L1 analysis (most sensitive) caused by material in the cab of a vehicle. This may be voids, special material in the cab, radioactive debris picked up in the radiator or a "radioactive" driver from recent Medical treatment (see Appendix A). In most cases the cab is relatively small and through a complex set of interactive parameters can be clearly identified as a cab.

The Vehicle Parameter determines the cab MINIMUM SIZE and uses 1 ft. units. The normal setting of 10 = 10 ft = 3m. The following conditions apply to analysis assuming a 10ft setting.

The following table determines the analysis carried out :

Veh. Param	Min. seg. from (5.4)	# of seg.	Seg #1 length	Seg #2 length	Result
10	8ft	1	9ft	---------	Seg.#1="non-vehicle"= no Level 1 analysis
10	9ft	1	15ft	---------	Seg.#1 = vehicle= normal Level 1 analysis
10	15ft	2	9ft	20ft	Seg.#1 = a CAB so no Level 1 analysis. Seg. #2 = Level 1 analysis
10	15ft	2	15ft	20ft	Seg. #1, #2 = Level 1 analysis
20	12ft	2	15ft	20ft	Seg.#1 ignored, Seg.#2 = Level 1 analysis

NOTE : Set to 20 OK if NO small vehicles for analysis.
Set to 30 OK if no small vehicles and ALL long trucks (minimum 40ft/12m).

5.6 ANALOG SCALE - (DEFAULT=10000)

This parameter sets the maximum vertical scale of the front panel "chart-recorder" display. May be set at 5000, 1000, 20000, 50000 or 100000 counts/second FULL SCALE. If this scale is set incorrectly the system will still function correctly but the "chart-recorder" may be difficult to view.

5.7 NUMBER DETECTORS - (DEFAULT=4) - Range 1-17

This parameter sets the system to match the supplied detectors. The GR-526/510 can support from 1 to 8 detector sets in multiple combinations for special applications. Normally this is set to 4 for a 2 detector Vehicle monitoring system.

#Detector	Detector Code	Detectors
1	1	A1+A2
2	2	A2+B2
3	3	A2
4	4	A1+A2+B1+B2
5	5	A1+A2+B2
6	6	A1+A2+B1+B2+C1+C2
7	7	A2+B2+C2
8	8	A1+A2+B1+B2+C1+C2+D1+D2
9	9	A1+A2+B1+B2+C2
10	A	A2+B2+C2+D2
11	B	A1+A2+B1+B2+C2+D2
12	C	A1+A2+B1+B2+C1+C2+D2
13	D	A1+A2+B1+B2+C1+C2+D1+D2+E1+E2
14	E	A1+A2+B1+B2+C1+C2+D2+E2+F2
15	F	A1+A2+B1+B2+C1+C2+D1+D2+E2
16	G	A1+A2+B1+B2+C1+C2+D1+D2+E1+E2+F1+F2
17	H	A1+A2+B1+B2+C1+C2+D2+E1+E2+F2

"Detector Code" is the code used on various printouts for # of Detectors.

5.8 NUMBER OPT. SENSORS - (DEFAULT=7) (selections 0, 2, 4, 7, 9)

This parameter sets the number of OS units in the system.

2 - Speed is computed and displayed only from the 2 PRIMARY OS units mounted below the detectors and defined as OS1 and OS2

3 - A third OS designated OS3 is added - note OS2-OS3 spacing must be 15ft. The PRIMARY speed is computed between OS1 and OS2, and the SECONDARY speed is computed between OS2 and OS3.

4 - 2 additional OS are added designated OS3 and OS4 - this pair of OS may be located at any distance from OS1/2 but OS3-4 spacing must be 59". The PRIMARY speed is computed between OS1 and OS2 and the SECONDARY speed between OS3 and OS4.

7 - This is the DEFAULT. Used for 2 OS units, this setting computes the actual speed of EACH segment of the vehicle and gives a Speed Alert if ANY segment exceeds the preset limit

9 - Similar to the 2 OS selection except that the PRIMARY Speed is computed at the FRONT of the vehicle but a SECONDARY Speed is computed at the END of vehicle. This provides a check that the vehicle did not speed up through the system. Note that this SECONDARY speed computation is NOT as precise as speeds computed using additional OS sensors (as in 3,4 above) but reasonable speed accuracy is achieved.

The 2 speeds are displayed on the screen as 3.7 4.7 (for example) with the 3.7 = PRIMARY and 4.7 = SECONDARY. The SPEED LIMIT is applied to EITHER set of Speed data so if the PRIMARY is below the Speed Limit and the SECONDARY above the Limit = Speed Alert.

When a new vehicle enters the scale the 2 speeds are erased and the new vehicle speed displayed, but the SECONDARY Speed FROM THE PREVIOUS VEHICLE (if computed) is displayed on the lower right box on the display as 4.7.

The purpose of this display is in case trucks are running close together and the OUTGOING vehicle causes a Speed Alert. In this case the Speed Audio etc. would be sounding/flashing etc. but the INCOMING vehicle speed is now being displayed in the SPEED location of the display and users may be confused over which truck caused the Speed Alert.

In this case the OUTGOING vehicle data is visible on the lower right of the display and the INCOMING vehicle speed is displayed on the SPEED location, so it is very obvious which vehicle caused the problem!

5.9 ALARM MODE - (DEFAULT=2)

Special parameter that essentially removes most Nuisance alarms that can occur in scrap vehicles with variable scrap loading. The selection is 0, 1, 2 or 3 as follows :

0 - A, B (C, D)
1 - A, B, A+B (C, D, C+D)
2 - A, B enhanced (C, D) = DEFAULT
3 - A, B (C, D) enhanced

For normal system detector operation, set to "2"

NOTE : If any detector is classified as defective "Detector ERR message", the system automatically changes this parameter to "0" to optimize performance.

5.10 LOW ALARM L1

This parameter has now been segregated into separate settings for systems that use 2, 3 or 4 detectors.

5.10.1 L1 settings for a 2 Detector system - DEFAULT = 30 (50 FOR gr-510) Range - 10-99 (1.0-9.9 SD)

This alarm level has no relationship to local Background levels and the Alarm Threshold is individually computed for each vehicle. This parameter is set in Standard Deviation units (based on the 0.1sec data NOT cps) with 30 = 3.0SD. This parameter setting has a direct effect on system sensitivity, in most application 30 (3.0SD) is the correct setting.

This parameter setting is combined with other system parameters for special applications as follows :

a) If the system sensitivity must be decreased because it is Nuisance-Alarming in the CENTRE of the vehicle only, then change from 30 to 31, 32 then 34, 35, 37, 38 etc

b) If the system sensitivity must be changed because of Nuisance-Alarming on the EDGES of the vehicle then changing from 30 to 33, 36, 39, 42 etc may be appropriate. However if the Nuisance-Alarm is caused by the Enhanced edge analysis method (as determined in 5.2 above) then changing this level will have no effect.

This level will be shown on the Parameter Screen as L1 AB to confirm that it is for a 2 DETECTOR system with detectors designated as A and B.

5.10.2 L1 settings for a 3 Detector system - DEFAULT = 35

If the # OF DETECTORS parameter shows that an UPPER detector is being used, this is designated as a C detector. Once the L1 AB setting is entered and ENTER pressed then a new line on the screen will appear L1 C. Enter 35 for this detector.

5.10.3 L1 settings for a 4 Detector system - DEFAULT = 45

If the # OF DETECTORS parameter shows that an UPPER (C) and LOWER (D) detectors are being used. Once the L1 AB and L1 C settings are entered and ENTER pressed then a new line on the screen will appear L1 D. Enter 45 for this detector.

5.10.4 L1 settings for 5/6 Detector systems

If number of detectors is greater than 13 (more than 4 detector boxes) then the L1 setting format changes as follows (N.B. "detector" = detector boxes):

Parameter	1 detector	2 detector	3 detector	4 detector	5 detector	6 detector
L1 - first selection	A	A, B	A, B	A, B	A, B	A, B

L1 - next selection	-----	------	C	C	C, D	C, D
L1 - last selection	-----	------	-------	D	E	E, F

5.11 LOW ALARM L2 (- DEFAULT=15) Range 3-30.

This Alarm Level is based on the local Radiation Background measured when there is no vehicle present. It is a very sensitive alarm level and is specifically designed to catch "difficult" alarms including Homogenous Load alarms and some alarms that occur near the extremities of a vehicle which under special conditions could be missed by LOW Alarm L1 analysis. However normally INSIDE the vehicle, the LOW Alarm L1 Alarm will have a much more sensitive Alarm Threshold.

These alarms may occur WHEN NO VEHICLE IS PRESENT in which case the alarm could be caused by a vehicle PASSING the scale, personnel with internal radiation levels increased by recent medical treatment (see Appendix A) etc.

This Alarm level is set in Standard Deviation units based on the 1/sec (cps) Vehicle Out Background computed level, and normally set at 15 SD units

---

5.12 HIGH Alarm H3 - (DEFAULT=9) (4 FOR GR-510)

This Alarm Level is set as a multiple of the local Vehicle Out Background and is normally set to 9 = 9 x Local background. This Alarm Level is quite high so if an alarm occurs here it is usually not necessary to retest the vehicle.

5.13 HIGH ALARM H4 - PRESET=75000

The HIGH (H4) alarm is preset at the maximum level that an individual detector can reliably measure. This Alarm Level is a warning that probably the source is VERY CLOSE to one side of the vehicle, but not necessarily hazardous to personnel.

This alarm level acts the same as LOW (L1/L2) and HIGH (H3) alarms as regards display and printout but the TIMING of the H4 alarm is handled the same as the LEVEL 5 ALARM (see below).

The alarm level is set at 75000 counts/sec/scintillator - so since the "A" and "B" detectors have 2 scintillators each, they would each alarm at 150000 cts/sec. So the ALARM THRESHOLD (TH) on the alarm data display should show 150000 for detector A (or B). However if (for example) one of the scintillators in the A detector (e.g. A1) is defective, then the Threshold changes automatically to 75000 as in this case only 1 scintillator is alive.

5.14 LEVEL 5 ALARM - PRESET=300000

This Alarm Level is triggered WHEN ALL SELECTED DETECTORS ARE ABOVE LEVEL H4. Thus a LEVEL 5 ALARM indicates that there is PROBABLY a HIGHLY RADIOACTIVE source in the vehicle and this alarm should be treated with GREAT CAUTION and personnel exposure limited.

A special display and printout is used to emphasize the potential hazard of this alarm level (see Section 3.4 and 3.6).

5.15 OS LEVEL - (DEFAULT=5) Adjustable from 1-20 in 0.1 sec steps

Special parameter that can be used in special cases to improve system performance for small vehicles. This parameter defines the MINIMUM time that EACH OS is covered before a SPEED measurement is enabled.

If essentially NO SMALL TRUCKS (PICKUP TRUCKS) USE THE SCALE set this value to 20. If a large number of Pickup trucks use the scale set this parameter at 5 to start with and Exploranium will help adjust this parameter to be optimum for your location.

LARGE TRUCKS ONLY - set to 20
SMALL "PICKUP" TRUCKS - set to 10
SPEED REQUIRED ON EACH SEGMENT = set to 5 (see Section 5.8)

5.16 MODEM - (DEFAULT=YES)

If the system is to be connected to a telephone line to permit remote access (highly recommended), set to YES. If the user cannot supply even limited access to a line, set to NO. Note that if set to NO, then NO access is possible via Modem. Recommended setting = YES.

5.17 PRINT ALARMS - (DEFAULT=YES)

User may select :

YES : Alarms are displayed, stored in memory and printed as they occur. Note that while an alarm is printing the GR-526/510 is in the FULL MONITORING MODE so if another alarm occurs it will also be displayed and printed (see note below).

NO : Alarms are displayed, stored in memory and may be printed later from the alarm memory

Once ENTER is pressed to accept this selection a second selection is required :

INT : system uses the INTERNAL system printer

EXT : system uses an EXTERNAL printer. This selection permits data output to an external printer (HP LaserJet compatible) for full page printing. Note that for external printer use the user must :

- disconnect the Internal Printer
- remove the +5V Printer fuse from the console CPU board
- use an extender cable to connect the internal printer cable out of the console (supplied by Exploranium)
- use a specially terminated parallel printer cable connector to achieve compatibility with the external printer.

5.17.1 ALARM WHILE PRINTING - if PRINT ALARMS = YES

In previous versions of system software - an alarm display or alarm printing temporarily disabled system monitoring - but now the GR-526/510 SYSTEM RETURNS IMMEDIATELY TO THE MONITORING MODE AFTER ALARM ANALYSIS. Thus the system GOES BACK into the MONITOR MODE and is capable of alarming on another vehicle, but the RED light and AUDIO stay ON as a warning to the user until silenced by pressing ALARM twice. If another alarm occurs before the ALARM button is pressed, the display changes to the NEW alarm display and the new alarm goes into memory. Some users have un-attended scales or semi-attended scales. By the time they find that the system has alarmed sometimes an entire string has passed. In the past they had to run the string BACK through the system and note which car sounds the alarm.

If for example there are 3 alarms on a string of cars (e.g. Alarm #21, 22 and 23) - then when someone finally presses the ALARM button to cancel the alarm then :

- the AUDIO stops and the LATEST alarm (#23) is shown.
- after another press of ALARM the system changes to display Alarm #22. Note that when these previous alarms are displayed they are slower and appear "hesitant". This is because the alarms display is updated on a NON-INTERFERENCE basis with alarm analysis as the systems priority is NEW alarms.

- after pressing ALARM again, Alarm #21 is displayed. Since this is the LAST of the alarms that were "missed", pressing ALARM again changes the display back to the normal Monitoring display. Since #21 was the last alarm to be displayed, the user has 5 minutes to observe this display before the system automatically reverts to the Monitoring Display.

  NOTE #1 : to avoid confusion the system displays the last alarm (in this case #23) indefinitely until the user presses ALARM. Thus user action (pressing ALARM) steps the user through the alarms. Since the user had to press ALARM a few times to get to the LAST alarm, this ensures that the user HAS VIEWED these alarms and is aware that there were more than 1 alarm in this sequence. Thus the automatic timeout ONLY occurs on the last alarm display as by then the user MUST have seen ALL of the previous alarms, so automatically reverting to Monitoring is correct.

  NOTE #2 - the system also PRINTS in real time so as soon as the alarm is stored in memory the printer AUTOMATICALLY starts printing the alarm.

  NOTE #3 - During printing of alarms in real-time, the system IGNORES any other Password command

- the user can inspect all these alarms in memory (using <1 - 4 - 9 - 2 - ENTER> at any time.

5.18 CONTRAST

At this parameter the display contrast can be changed using the Cursor keys

5.19 DISCRIMINATOR SETTINGS

```
Line |              Discriminator/Mode setting
 2   |        16 : 11 : 28                    16 : 11 : 28
 3   | ------------A-------------------------C-----------------
 4   |        C              C                              OS12
 5   |    10    10       10    10                            00
 6   |      2652           2726                             39
 7   |      2659           2710
     |
 8   |        C              C
 9   |    10    10       10    10
10   |      2127           2525
11   |      2113           2501                             30
12   | ------------B-------------------------D---------------
13   | M o d e    1 - A,  2 - B,  3 - C
14   | Discrim    CLEAR - left, ENTER - right
15   |            UP +,  DOWN -, STOP - END
```

Fig.14 (sample GR-526 Display)

The Discriminator Settings screen is described below. (As an aid to the user we have shown a Line Number, but this does not appear on the actual screen). To change any parameters the CURSOR (blinking square) must be positioned at the parameter. As lines 14 and 15 indicate, press <ENTER> to move the cursor to the right or press <CLEAR> to move it to the left.

Line 2 — the two times of day shown here are the INTERNAL clock and the DERIVED clock. These should be the same.

Line 3 and 12 — is the detector label - A/B are the ones either side of the vehicle (A is normally the closest to the console)

Line 4 and 8 — is the mode of operation - should be C. The cursor indicates which detector is being worked on (<ENTER> moves you to a new detector). When at the selected detector, line 13 indicates action - press key <1> to get A only, key <2> for B and key <3> for C.

Line 5 and 9 — is the discriminator setting for the A/B photo tubes, should be set to 10 for GR-526 or 50 for GR-510 each using the keys indicated in line 15.

Line 6 and 10 — is the 1 second reading from that detector in counts/sec.

Line 7 and 11 — is the 30 second average from the selected detector. The 30 second average may be restarted by pressing 9 on the keyboard.

Press <STOP> to exit this screen.

OTHER PARAMETERS

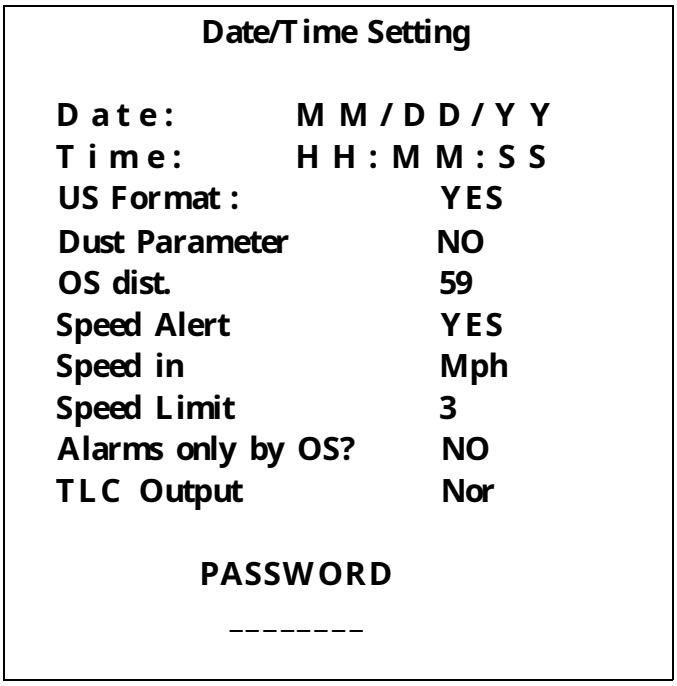


Fig.15

5.20 DATE/TIME

Date/Time Enter the Date and TIME using the numeric keys and press ENTER

USA Format Normally the system is operated with the USA Format = YES so that the Data is in the MM/DD/YY mode. (<1> sets this parameter to YES and <0> sets it to NO). If NO is selected then the date is in the DD/MM/YY mode as used in Europe.

5.21 DUST PARAMETER - (DEFAULT = NO)

YES - should be used to minimise DUST truck marginal alarms. Some users report very low level alarms on Dust trucks when the dust is WARM. This is usually due to the presence of trapped slightly radioactive gas in the dust which quickly dissipates as it has a short half-life.

NO - should be used to slightly enhance system performance where Dust Truck alarms are not a problem.

Also see Appendix A (e) and Appendix J for further information

---

5.22 OS DIST - (DEFAULT = 41)

This parameter has 3 selections - refer to Fig. 16

59 - this is the setting if the OS spacing is the normal 59" separation. This selection requires that the detectors are installed in a "mirror image" format

41 - this is the default setting for all new systems for an OS spacing of 41" and it is recommended as a means of slightly enhancing system performance IF IN MIRROR FORMAT

59C - This setting is recommended for older installations with NON-MIRROR installations. If unsure of this setting - consult Exploranium for guidance.

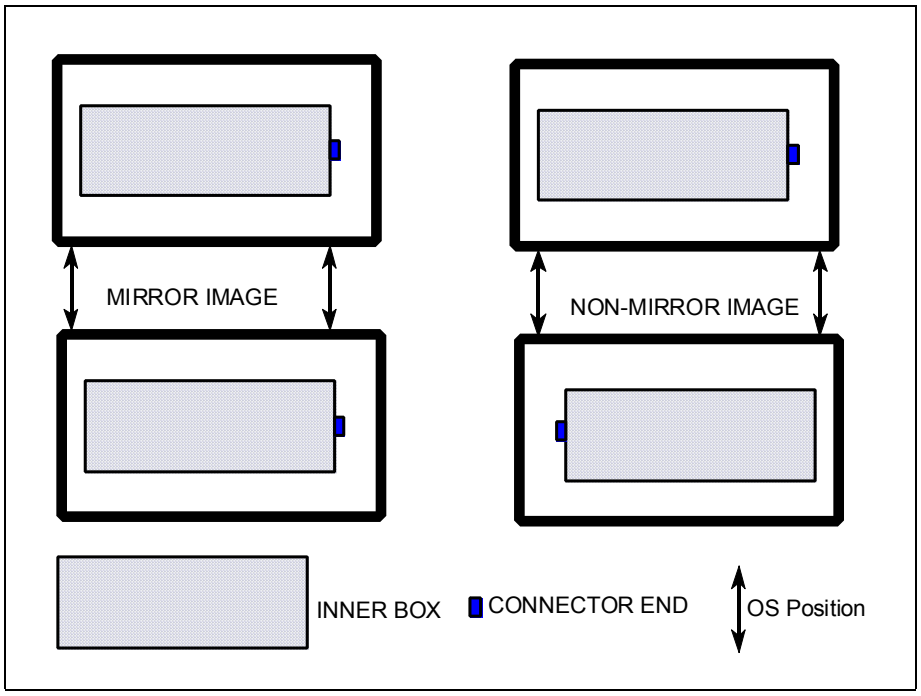


Fig.16

5.23 SPEED ALERT - (DEFAULT=DEF)

The SPEED ALERT parameter selection is DEF, YES, or NO

DEF - In the event of excessive vehicle speed, the console Audio beeps and the console STATUS light and YELLOW Traffic Light flash INDEFINITELY until someone presses STATUS.

YES - In the event of excessive vehicle speed, the console Audio beeps and the console STATUS light and YELLOW Traffic Light flash FOR 60 SECS until someone presses STATUS.

NO - Same as YES except NO Audio action

The default setting DEF is automatically set when new software is loaded.

To change press 1 = YES selection

---

press 0 = NO selection

Once 1 or 0 is pressed, the system will then only permit YES or NO selection.

For special selections consult Appendix H

5.24 SPEED IN - (DEFAULT=Mph)

This is the selector for Speed Units and may be set to MPH or KPH as required.

1 = Mph
0 = Kph.

5.25 SPEED LIMIT - (DEFAULT=3)

This is the actual speed limit that the system uses to generate a SPEED ALERT. Normally set at 3 Mph (5 Kph).

5.26 TLC OUTPUT - (DEFAULT = NOR)

Selections are 1 - NOR 2=SP1 3=SP2 4=SP3

Some users with unattended scales want to limit the alarm response activity of the system. Normally the Alarm stays displayed and the Traffic Light display and the Audio alarms stay activated - until the user MANUALLY reset the ALARM button.

In the SPECIAL selection (as shown below) - after 60 seconds all the Alarm and speed Alert displays are cancelled. Users should be absolutely sure that the SPECIAL mode is protected by other user procedures to ensure that the ALARMS are responded to correctly.

SELECTION of both these special features is as follows :

TLC Setting	Name	Lights	Reset scheme
0	NOR	Normal	Normal
1	SP1	Special	Normal
2	SP2	Normal	60 sec Speed + Alarm reset
3	SP3	Special	60 sec Speed + Alarm reset

See tables below for details

---

1) NOR setting -meaning of each light as defined below. Timing of each sequence defined in

Appendix H setting. Additional details as described in Section 2.6.

LIGHT	if ON	if OFF
GREEN	System operational - trucks may enter	system in operation (another light is on)
YELLOW	Vehicle is passing	no vehicle is passing
RED	Alarm	No alarm
HORN	Alarm	No alarm

---

2) SP1 setting - light sequence as defined below - timing as per Appendix H setting.

LIGHT	if ON	if OFF
GREEN	System OK - OK to enter	DO NOT ENTER
YELLOW	Speed Alert - note - if user pressed STATUS then this light will go OFF as the user has acknowledged the alert.	NO Speed Alert
RED	Radiation Alarm note - if user presses ALARM button - twice - the light goes OFF as the user has acknowledged the alarm.	NO RAD ALARM
HORN	System Error	NO System error

---

3) SP2 setting - light sequence as follows. Timing as shown.

LIGHT	if ON	Timing	if OFF
GREEN	System operational - trucks may enter		system in operation (another light is on)
YELLOW	Vehicle is passing	If an speed alert - times out after 60 secs	no vehicle is passing
RED	Radiation alarm	If an alarm - times out after 60 secs	No alarm
HORN	Radiation alarm	If an alarm - times out after 60 secs	No alarm

Console alarm DISPLAY, Internal AUDIO and ALARM button - time out after 60 secs

c) SP3 setting - light sequence as follows, timing as shown.

LIGHT	if ON	Timing	if OFF
GREEN	System OK - OK to enter		DO NOT ENTER
YELLOW	Speed Alert - note - if user pressed STATUS then this light will go OFF as the user has acknowledged the alert.	if ON - times out after 60 secs	NO Speed Alert
RED	Radiation Alarm note - if user presses ALARM button - twice - the light goes OFF as the user has acknowledged the alarm.	if ON - times out after 60 secs	NO RAD ALARM
HORN	System Error	if ON - times out after 60 secs	NO System error

---

NOTE : Exploranium has an optional TLC controller that has cold-contact relays in parallel with the normal AC switching of the TRIAC. This permits users to activate other non-AC activity to follow TLC action. Contact Exploranium for further details.

NOTE : When ENTER is pressed to accept the selection, another parameter selection is enabled as in 5.27 below.

5.27 ALARMS ONLY BY OS - (DEFAULT=NO)

Selections are :

NO Normal operation (Default), thus LOW (L1) alarms ONLY occur if the OS are functioning. However all other alarms levels can alarm anytime that local radiation levels exceed the computed alarm threshold.

YES if this is selected then NO ALARMS - EXCEPT LEVEL 4 and LEVEL 5 LEVEL - will occur if the OS are not activated. If an OS fails, system reverts to NO. This will permit some users who have no interest in alarms not related to vehicles to ignore such interfering alarms. This is particularly useful at sites where there are a lot of alarms caused by local X-ray activity.

X this selection sets normal operation to NO (so OS activation is NOT required to alarm the system). Then between 6PM and 6AM the parameter is automatically set to YES. Thus between 6PM and 6AM - OS activation is required for alarm analysis to occur.

ALL if this is selected then NO ALARMS (INCLUDING H4 and LEVEL 5 LEVEL) will occur if the OS are not activated. If an OS fails, system reverts to NO. This will permit some users

who have no interest in alarms not related to vehicles to ignore such interfering alarms. This is particularly useful at sites where there are a lot of alarms caused by local X-ray activity. Note that in this case the detectors are totally inactive if NO vehicle is present, so users will have NO warning of excessive radiation levels from other (non truck) sources. For personnel safety reasons, users should be sure that they have some other level of Personnel radiation hazard monitoring if this mode is selected.

5.27.1 If YES, X or ALL is selected - then this means that a vehicle must be present to permit an alarm to occur - this feature is used to minimise X-ray alarms if no vehicles are being monitored.

EXPLORANIUM WARNS USERS TO BE VERY CAREFUL IN SELECTING THIS PARAMETER AS X-RAY ALARMS COULD INDICATE A LOCAL HEALTH HAZARD AND SHOULD NOT BE WILFULLY IGNORED.

5.28 PASSWORD - (DEFAULT = 1234)

Users may select a special system Password (up to 4 digits) to prevent unauthorized users from changing system parameters.

It is highly recommended that users set some non-obvious Password to prevent unauthorized access to system parameters - it must be emphasized that unauthorized adjustment of parameters CAN COMPLETELY DISABLE THE SYSTEM!

SPECIAL NOTE: ALL PARAMETERS WILL BE SET BY AN EXPLORANIUM ENGINEER AT THE TIME OF INSTALLATION. ANY CHANGE TO THESE COULD HAVE SERIOUS CONSEQUENCES ON SYSTEM OPERATION. PLEASE CONTACT EXPLORANIUM BEFORE CHANGING ANY SETTING ON THE SYSTEM.

6.0 SYSTEM FEATURES

6.1 SPEED LIMIT TEMPORARY SUSPENSION

If the SPEED AUDIO is set to DEF on a mixed scale, Speed Alerts from NON-SCRAP trucks will keep setting off the Speed Alert warning.

A special function permits a TEMPORARY override of the SPEED ALERT selection. As an example if the SPEED ALERT setting is DEF (alarm on all speeding vehicles) then if Password < 8 7 4 1 > is entered, the SPEED AUDIO automatically changes to OFF (a special TEMPORARY mode that totally disables the Speed Alert and NO speed data is entered into the History File). Thus if Scrap trucks all enter before 10AM, then after the last truck has passed, if Password 8741 is entered then the rest of the vehicles have NO Speed Alert TEST.

At 6 AM, this parameter is automatically reset to the previous setting (in this case DEF). In the History file will be a message "SpSPD" (Speed Suspended) as a record of this change and the Console Display will show SpSPD in the lower right corner.

This mode may be REVERSED, by re-entering the <8741> password, in this case the History File will show SpUNS as a record of this action.

6.2 VEHICLE "LOG"

The GR-526/510 has the ability to log all passing vehicles to record the fact that they were monitored. This feature can be used to ensure that all vehicles passed through the radiation detection system. In the past this data was output on the Internal printer but most users found the limited data format of little benefit.

Vehicle logging is now carried out on an external PC using special software supplied by Exploranium - see Appendix L.

6.3 HISTORY FILE

The GR-526/510 has a special internal record of system action as an aid to Maintenance and proper system operation. This "History File" is accessible by pressing a special Password and the data may be displayed and/or printed. However the data CANNOT be erased as it is primarily intended to permit detailed system analysis and to prevent incorrect procedures. The file is limited to 100 records and to avoid any potential confusion the DATE FORMAT is fixed as US format and cannot be changed.

The user is permitted to mark the START and the END of the section of interest, and then the selected section can be printed. The END point selected is stored and the next time the user enters this screen the previous END is now automatically set as the new START ,and the current end is marked as END. Thus it permits users to print out the current data very simply. Users can then use this information as a control on # of speed alarms etc.

When the password <9 - 1 - 9 -1 - ENTER> is entered the History File appears as follows:

a) CONSOLE DISPLAY

The display permits marking of selected text and printing blocks of data as follows :

<UP/DOWN> permits users to use the UP/DOWN arrow keys to select Start and End points to define a data block

<1> once the cursor is positioned at the selected position, press 1 on the keyboard to mark this point. The screen shows BEG (Beginning).

```
********* HISTORY FILE *********
 #        Event    Date    Time
 BEG   D2.16  4/26/96   12:00:02
 2     RES36  4/26/96   12:05:22
 3     STAT     4/26/96   12:08:22
 4     302510N301592000042N1D3U
 5     SO103  4/26/96   14:02:11
 6     AL 22    4/26/96   14:15:22
 7     SI029    4/26/96   14:44:02
 8     SO056  4/26/96   15:02:22
 9     SI055    4/26/96   14:44:02
 END   SO022  4/26/96   15:02:22
-------------------------------------------------
< UP/DOWN>  Move  < 1>  Mark begin
< ENTER>  Confirm  < STOP>  exit
```

Fig.17

<ENTER> accepts this mark as the BEG point.

NOTE : that if the user wants the History File data FROM THE LAST TIME IT WAS PRINTED, pressing ENTER immediately on entering this screen marks only the current data.

The screen now changes and other info is displayed.

<2> the arrows keys should be used to mark the end point of the data and when 2 is pressed, this point is marked as END = the end point of the data block.

<CLEAR> will clear the selected points and you can start again

<9> prints this selected data block

<STOP> return to Monitoring

For a description of the data displayed, see the explanation below.

---

b) PRINTOUT

A typical printout of a selected block is shown in Fig. 18.

D2V16 - this means that the DEFAULT parameters were loaded, an indication that some very serious error occurred. The indicated data is the DATE OF THE RELEASE and not the current date.

This message also appears in the file when the software is FIRST installed.

DUUUU - Default parameters were loaded under special conditions.

RES36 - the GR-526/510 has many automatic RESETs that restore the system in the event of various system faults or special conditions. These RESETs can give a very clear idea of a potential problem so they are numbered for analysis. See Appendix F for a full list.

302510N301592000042N1D3U is the current list of system parameters as detailed in Section 6.6.

```
*** HISTORY FILE ***

D2V16  4/08/96  12:00:00
RES36  4/26/96  12:05:22
STAT   4/26/96  12:08:22
302510N301592000042N1D3U
SO103  4/26/96  14:02:11
AL 22  4/26/96  14:15:22
SI029  4/26/96  14:44:02
SO056  4/26/96  15:02:22
SI055  4/26/96  14:44:02
SO022  4/26/96  15:02:22
---------------------------------------
EOF  SN: 1234  S/W 2.16.8
```

Fig.18

SPEED Speed was in excess of 23.2mph (or 37.5 Km/h as selected)

IF "2" OS SELECTED (normal)

SO xx - every time a vehicle exceeds the Speed Alert, a record is made and the actual speed AND direction are recorded - e.g. SO xx = Speed Alert - Outbound vehicle = xx mph (or kph).

The user can easily realise that TOO MANY speed alarms is an indication of faulty system procedures, so checking the History File on a regular basis gives valuable system control.

Note that in the History Display - speeds up to the maximum of 16.6mph can be displayed, however in the Printout, the maximum speed displayed is 9.9mph due to space limitations.

SI xx Would have been an INCOMING vehicle speed record

SP xx Speed analysis is correct but Direction is ambiguous

IF 3,4 or 9 OS selected

xxIyy Speed of an INCOMING vehicle - xx is the PRIMARY Speed, yy is the SECONDARY Speed.

xxOyy Speed of an OUTGOING vehicle - xx is PRIMARY and yy is SECONDARY

xxPyy DIRECTION is ambiguous, xx is PRIMARY and yy is SECONDARY speed

Alarm Records

AL 22 - This is a record that an alarm occurred and this is sequential Alarm # 22.

Other labels

SETUP - a record that a user has accessed the system to change system parameters. Any changes of parameter must be very carefully regulated or system performance could easily be compromised.

REMOT - this record shows that the system was accessed remotely by an external computer OR system automatically notified the Exploranium Service computer of errors.

STAT shows that the user selected the Current Parameters printout

SpSPD shows that the Speed Alert has been temporarily suspended

SpUNS shows that the Speed Alert temporary suspension was reversed -at Midnight it will automatically be reversed.

XaSPD shows that the user activated the special Password that only permits alarm analysis if the OS beams are activated

XaUNS a record when XaSPD is reversed

OSTEST - shows that the user activated the special TEST mode

COMFx - (x=A,B,C,D) - COMM.FAILURE in indicated detector

COMEx - (x=A,B,C,D) - COMM.ERROR in indicated detector

SETDT - date/time changed by user

PwOFF - Power OFF event - this normally indicates that the power to the unit was switched OFF.

PwDOG - A special series of RESETs actions caused by special protection circuitry to prevent the system being kept in a non-monitoring mode for an excessive period of time.

6.4 POWER OFF DURING AN ALARM

If the power goes OFF when an alarm is being displayed - when power is restored the system goes back to the EXACT POINT at which the power failure occurred.

As an example, if the Alarm sounds but the user does NOT press ALARM to silence the Audio before the power fails - when power is restored the Audio will again start and the console will return to the alarm display at the point that the power was lost.

SPECIAL CASE : If the user HAS silenced the audio and is viewing the alarm display screen when power is lost, when power is restored the system knows that the user has been advised of this alarm so on power up the system returns to the monitoring mode and display. At any time the user can view the alarms in memory by using the < 1 4 9 2 > password for entry.

6.5 PRINT CURRENT ALARMS

Some users like to disable the system printer during normal use, in this case if an alarm occurs the Audio and Display are used to advise the user - no alarm printout is created. In this mode the System Monitor only wants to print the alarms when they visit the system for an inspection. This mode is activated by setting the parameter PRINT ALARMS = NO.

In this case, if Password <5 - 5 - 5 - 5 - ENTER> is pressed then the system will print all the alarms that have occurred SINCE THE LAST ALARM WAS PRINTED. A status message (PrALA) will appear on the display lower right box as a reminder that this feature has been activated. This printout may take some time as it is done on a NON-INTERFERENCE basis with normal system operation. Thus this printout DOES NOT STOP THE NORMAL SYSTEM MONITORING ACTIVITY.

If while this printing was occurring, a Radiation alarm occurs - then the Alarm takes priority and the current printing job is cancelled, and will have to be repeated later. However all alarms that have been completely printed have been "flagged" in the system so they will not be repeated again.

NOTE : If PRINT ALARMS=YES, if this password is entered, all alarms are printed.

6.6 CURRENT PARAMETERS - PRINTOUT

Press <9 - 9 - 9 - 9 - ENTER> is entered as a Password, then the current parameters + system status are output as follows on the printer. When this feature is activated, a special message PrSTA appears on the lower right box of the main display as a reminder.

CURRENT PARAMETERS #3214
4/26/97 12:34:19
C= 30 B= 2 N= 5 V= 10
O= N 1= 30 2= 15 3= 9 MOD= 2

Fig.19

#3214 - is the Serial Number of the system
Date/Time - is the Date/Time of the printout

For the following data, a more detailed explanation of each parameter is given in Section 5.

C =30 -	BACKGROUND Correction parameter - set to 30
B = 2 -	BACKGROUND Parameter - set to 2
N = 5 -	Number parameter - set to 5
V = 10 -	Vehicle Parameter- set to 10
O = N -	Alarms ONLY by OS - set to NO
1 = 30 -	LOW Alarm L1 - set to 30
2 = 15 -	LOW Alarm L2 - set to 15
3 = 9 -	HI - Alarm L3 - set to 9
MOD=2	Alarm Mode parameter - set to 2
ERR 000	Error Code (= current error messages see 6.8 below)
Ver:2.16.8	Software Version - set to 2V16.8
D = 4 -	# of detectors - set to 4
O = 2 -	# of OS - set to 2
D = N -	Dust Parameter - set to NO
C = 1 -	Discriminators = 1 = Normal mode = C mode + set at 10
S = D -	Speed Alert - set to D = Default
L = 3 -	Speed Limit - set to 3
U = U -	Speed Units + Date Format - U = US Date + mph
	E = Euro date + kph, X = US Date + kph, Y = Euro Date + mph
Poff	Date/Time of last time system power was switched OFF

6.7 "ALARM" PARAMETER PRINTOUT

On the Alarm Printout (and the History File) the system parameters are listed in an encoded format, similar to when Current Parameters are printed. For clarity these codes are listed below.

Typical printout :

C	B	N	V	0	1	2	3	S	16.8	D	O	D	C	S	L	U
30	2	5	10	N	30	15	9	2	0000	4	2	N	1	D	3	U

The top row is the PARAMETER CODE and the bottom row is the PARAMETER SETTING. The data is interpreted using same codes as described in Section 6.6.

6.8 ERROR CODES

Error codes are shown on the various printouts as a 4 digit code printed below the software version label (16.8).

1st Character = OS STATUS

Code	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
OS bad	0	1	2	1+2	3	3+1	3+2	3+2+1	4	4+1	4+2	1+2+4				
							3+4	3+4+1	3+4+2		1+2+3+4					

2nd Character = A or C detector Error

Code	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
Detector A	0	A1	A2	A1+A2		A1	A2		A1+A2			A1	A2	A1+A2	A1	A2
										A1+A2						
Detector C	0				C1	C1	C1		C1	C2	C2	C2	C2	C1+C2	C1+C2	
C1+C2	C1+C2															

3rd Character = B or D detector Error

Code	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
Detector B	0	B1	B2	B1+B2		B1	B2		B1+B2			B1	B2	B1+B2	B1	B2
										B1+B2						
Detector D	0				D1	D1	D1		D1	D2	D2	D2	D2	D1+D2	D1+D2	
D1+D2	D1+D2															

4th Character = E or F detector Error

Code	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
Detector B	0	E1	E2	E1+E2		E1	E2		E1+E2			E1	E2	E1+E2	E1	E2
										E1+E2						
Detector D	0				F1	F1	F1		F1	F2	F2	F2	F2	F1+F2	F1+F2	
F1+F2	F1+F2															

As an example, 004 means OS are OK, Detector A & C are OK but D1 is defective.

6.9 TIMEOUT

Most vehicles pass through the detectors in 5-10 seconds for TRUCKS and 15 secs for a RAILCAR (Weigh-in-motion-scale). However for a variety of logistic reasons the vehicle sometimes stops on the scale for a very extended period of time - 1-2 minutes frequently and 30+ mins if the vehicle

is parked.

Under normal circumstances these very long "vehicle lengths" could disable the system or MISS A BURIED SOURCE under certain conditions. To prevent this occurring the system imposes a time limit of 20 secs on vehicle duration.
At the end of this time it is assumed that the vehicle has stopped, so a complete Radiation analysis of the 20 sec. data is made.

If NO ALARM IS FOUND, the system AUTOMATICALLY starts monitoring again with special math correction to ensure no data is missed. Thus from the users viewpoint since this process is automatic, no data is missed and a complete analysis is made.

If this TIMEOUT occurs and a Radiation Alarm IS detected, the ALARM DISPLAY and ALARM PRINTOUT are flagged with the label Timeout to advise the user what has occurred. To prevent any loss of data, after a Timeout some old data is re-analysed.

NOTE : to avoid confusion - only 1 alarm is recorded/displayed for each vehicle. If a TIMEOUT occurs and the system alarms, then if a second source is detected AFTER the timeout, the system will NOT give a second alarm on this source.

The recommended alarm procedure if an alarm is tagged "timeout" - is to ensure that the vehicle passes through the system without stopping, in which case a timeout will not occur so if 2 sources are present they can be clearly identified from the alarm display.

Users are advised that stopping vehicles in front of the detectors can result in some slight reduction in performance, so if possible vehicles should not be permitted to stop in front of the detectors. Also see Section 2.3.e.

6.10 DEFAULT PARAMETERS

The GR-526/510 has a selected optimised set of parameters in memory. When the Software is loaded these DEFAULT PARAMETERS are automatically loaded and unless changed by the user they are the parameters that the system uses for analysis. The set of DEFAULT PARAMETERS listed below have been carefully selected by Exploranium to optimise system performance in a TYPICAL INSTALLATION.

The GR-526/510 has many parameter option but users are advised THAT ANY PARAMETERS OTHER THAN THE DEFAULT PARAMETERS THAT ARE SELECTED BY THE USER - MAY SERIOUSLY LIMIT SYSTEM PERFORMANCE. FOR THIS REASON USERS ARE STRONGLY ADVISED TO DISCUSS ANY SYSTEM "PROBLEMS" (THAT MAY BE RESOLVED BY PARAMETER CHANGE) WITH EXPLORANIUM BEFORE THEY ARE CHANGED TO PREVENT POTENTIAL SYSTEM PERFORMANCE PROBLEMS.

A full description of each Parameter can be found in Section 5.

BG parameter =	2
BG Correction =	30
Number parameter =	5

Segment parameter =	3
Vehicle Parameter =	10
Analog scale =	10000
Number Detectors =	4
Number Opt. Sens. =	7
Alarm Mode =	2
LOW Alarm L1 =	30 (L1C = 35, L1D=45) (50 on GR-510)
LOW Alarm L2 =	15
High Alarm H3 =	9 (4 on GR-510)
OS level =	5
Modem =	YES
Print Alarms =	YES
Printer =	INT
Disc =	10
C mode =	C
US Format =	YES
Dust parameter =	NO
OS dist =	41
Speed Alert =	DEF
Speed in =	Mph
Speed Limit =	3
Alarms only by OS =	NO
TLC =	NOR
PASSWORD =	1234

6.11 MODEM SUPPORT

Users are strongly recommended to connect a DEDICATED telephone line to the system. This permits the Exploranium Service Department to access the system to aid users in system problem analysis. Many users get "strange" alarms from time to time (see Appendix A for examples). It is often a great help to request Exploranium to access the system and "view" these "strange" alarms so as to give an opinion on correct interpretation.

Another major use of the telephone access is that the GR-526/510 has the capability of AUTOMATICALLY calling the Exploranium Service computer in case it diagnoses an internal system problem. In this case Exploranium can often contact the system, analyse the problem and advise the user - often before they are aware a problem exists (at least in a semi-unattended location).

Exploranium also offers users Service contracts using TELE-CHECK that require Exploranium to test the system weekly via the telephone line, to check system operation (and provide monthly written reports). This procedure is only available to systems with DEDICATED telephone lines.

Also see Appendix M for details on Tele-Check.

6.12 AUTO ERROR REPORT

If requested by the user, any GR-526/510 that has a DEDICATED telephone line connected can be enabled to automatically call the Exploranium Service Department computer system in the event of system malfunctions.

This feature can only be enabled from Exploranium by Modem access. The user must define the appropriate telephone dial codes for the installed system to contact the factory.

When this feature is enabled, if an error is detected in the system, the console will wait 1 HOUR to confirm the problem then dial the embedded telephone number. If this call gets a BUSY signal the call is repeated every hour until the error message is transmitted successfully.
When this Error Report is received by the factory computer, the DATE-TIME-Serial #-and Error Code is displayed and the Service Department will then call the system and follow up on this problem. After investigation the Service Department will then contact the customer to advise them of system status.

6.13 SEGMENT ANALYSIS

System software uses special analysis methods to separate the various parts of a vehicle into their appropriate parts prior to data analysis.

TRUCKS : normally comprise a CAB and a TRUCK body. If the CAB is normal size and separated from the truck body, then the truck body is analysed as Segment #1.
If a "pup" trailer is attached to the truck then this is Segment #2. The Alarm printout shows the SEGMENT NUMBER as P2 so the user can ascertain which vehicle component caused the alarm. This "segment numbering" system can sometimes be interfered with by hanging scrap or OS alignment problems, but it is usually a good guide to alarm location in case a vehicle has multiple components.

TRAINS : the engine is counted as SEGMENT #1 and the first car is SEGMENT #2 etc IF THE ENGINE PASSES FIRST. If the train comes in backwards then the engine is of course the last segment.

The segment counter has been improved to provide more reliable information as under some conditions of OS movement incorrect incrementing of the Segment Counter could occur.

Normally the first segment = first vehicle = #1. However recent field testing shows that alarms can occur outside the segment and cause location confusion. For this reason the counting system has been changed as follows :

Segment #	Description
0	an alarm occurred BEFORE segment #1
1 (2,3 etc)	segment #1 or 2,3, etc. as previously
-1 (-2,-3 etc)	alarm occurred after segment #1 but before segment #2 (in the gap)

6.14 DATA OUTPUT

A special RS-232 Serial Data port in the console is used to permit recording on an external PC of ALL the data from OS and all individual detectors using a special program on the external PC. This capability permits the development of custom software for special applications and also permits ARCHIVING of data if required.

Exploranium has developed support software to run on an external PC for those users who require that the radiation levels of ALL vehicles be recorded for archive purposes. Please contact Exploranium if you require this type of software support. If an existing application program can be readily adapted to your application this can often be done on a NO CHARGE BASIS.

However if extensive software development is required for special applications, Exploranium can provide a fixed-price quote on such a project.

Also see Appendix L - Vehicle Logging.

6.15 DUMP ALARM & HISTORY FILES

Some users have requested the ability to easily dump the ENTIRE History and Alarm files. This is an unusual requirement but since this is a necessary feature if new software is installed. This feature has been implemented by Password access.

If the Password < 4 - 6 - 9 - 7 - ENTER > is entered into the system, the entire History and Alarm files are printed on the printer. During this printout the display shows :

```
Printing HISTORY file
Please wait ...
```

and

```
Printing ALARM file
Please wait ...
```

If these files are extensive this can take some time (typically 30 secs/Alarm and 2 minutes for a complete History File) so in a typical situation a complete dump takes about 5 minutes. Since during this time SYSTEM MONITORING IS DISABLED, users should ensure that they choose an appropriate "quiet" time on the scale. During the total printout, the YELLOW traffic light is ON to stop vehicles entering the detectors to prevent any vehicles missing analysis.

6.16 CHANGING SOFTWARE

WHEN NEW SOFTWARE IS LOADED, THE HISTORY AND ALARM FILES ARE AUTOMATICALLY ERASED! USERS SHOULD CAREFULLY FOLLOW INSTALLATION INSTRUCTIONS ACCOMPANYING THE SOFTWARE UPDATE WHICH PERMITS A PERMANENT RECORD OF CURRENT DATA.

If these procedures are followed a complete printout of the current ALARM and HISTORY files is

made as a permanent record of the system up to that point.

6.17 SENSITIVITY TEST

In order to help the user test the system on a regular basis various test capabilities are built into the GR-526/510. Refer to Appendix N for full details.

6.18 SPECIAL "X-ray" MODE

Some installations have local X-ray sources creating frequent alarms. Even though the users can be trained to ignore these usually clearly identifiable X-ray alarms, this is sometimes a problem as they may be too quick to classify ANY alarms as an X-ray alarm - and thus miss a REAL alarm. Another problem is that an excess of these alarms not only desensitizes the user to reacting to alarms it also fills up all the existing alarm storage space in memory. Normally if Alarms only by OS is set to YES then such X-ray radiation activity will not cause the system to alarm (as explained in Section 5.27.) However if the user has small trucks/vehicles that are so low that they DO NOT INTERRUPT THE OS BEAMS, then a source in such a vehicle WILL PROBABLY NOT BE DETECTED. To minimise these problems the system now permits selecting X as a parameter selection as described above.

However some users may want more rigid control over this parameter so a special Password has been added. When < 2 5 8 0 Enter > is entered, the display shows XaSPD to show that the system is in this special mode. This Password acts as a toggle so until it is activated again, the system remains in the Alarms only by OS = YES mode. (At 6:00am this is switched AUTOMATICALLY to whatever is the current setting for the ALARMS ONLY BY OS parameter.

6.19 TELE-CHECK

The Exploranium Service Department computer can now access the system on a regular basis to perform system performance analysis as required without interfering with system performance.

In previous versions this access interrupted system monitoring so frequent contact was required to select a "quiet" time for data access - but this is now not a problem.

Exploranium offers optional extensive data analysis of system performance with weekly access and monthly data reports - see Appendix M for more details.

APPENDIX A - "NUISANCE" Alarms

From practical experience, as the acknowledged leader in vehicle monitoring technology with an installed base of more than 500 units, over the last 8 years a large variety of practical problems have been experienced. The GR-526/510 systems have been extensively modified over the years to "solve" most of these problems but it is impossible to prevent certain spurious alarms. These alarms are not FALSE ALARMS because they are REAL alarms as far as the system is concerned, however to the user they are NOT the big shielded source that is the REAL danger. However in most cases they have the same characteristics as a REAL alarm, so for this reason they are defined as NUISANCE alarms. Any monitoring system with enough sensitivity to detect deeply buried

shielded sources will suffer from these NUISANCE alarms, as there is no technological way to prevent them occurring (however sophisticated data processing in the GR-526/510 limits many of these effects) - because such a system sees the REAL and NUISANCE alarms as the same. Thus any serious attempt to prevent these NUISANCE alarms will impair the systems ability to detect REAL alarms, so they must be lived with. As a guide to users the following types of NUISANCE alarms are common :

(a) CONTAMINATED PIPE

Contaminated Pipe - is usually steel pipe that has been used in the Oil or Potash industries and has a "scale" on the inside of the pipe that contains radioactive material - usually Radium or Thorium. This scale is usually of a low enough radiation level to be safe to handle, and if melted in the furnace would "disappear" WITH NO MEASURABLE EFFECT ON THE ENVIRONMENT or STEEL PLANT. Unfortunately this pipe typically has a RADIOACTIVE SIGNATURE that is often identical to a REAL shielded source. The MAJORITY of material detected by the GR-526/510 will usually be this pipe material BUT IF THIS IS NOT DETECTABLE, NEITHER IS A REAL SOURCE. Some users have agreed to sort a rejected vehicle load to isolate such pipe and some jurisdictions permit the melting of controlled amounts of this contaminated pipe. However the majority of users prefer to reject the load and "make it somebody else's problem", an understandable sentiment.

(b) "MEDICAL" ALARMS

Some plant personnel may receive special medical treatment involving radioactive tracers (Barium enema etc). For the next few days after this treatment they act as a radiation "source" to the system. Even though such radiation is low level it can often be enough to set the alarms off. This particular type of alarm is very aggravating as it is so variable. For example if such a human "source" passed near the detectors WHEN A VEHICLE WAS PASSING, the system user would assume that the vehicle was the alarm.

If the vehicle is retested and NO alarm occurs the user could assume that a FALSE ALARM had been generated.

These "medical" alarms can only be isolated by common sense procedures such as restricting personnel near the system during retesting etc.

(c) PARTIALLY LOADED VEHICLES

If a vehicle contains a variable density load of scrap then another type of NUISANCE alarm can occur. For emphasis, the following is an exaggerated example of this problem to permit the user to clearly understand this problem.
The GR-526/510 system will identify and suppress the vast majority of such "nuisance alarms" but very occasionally such "strange" alarms may occur.

(d) X-Ray GAUGING SERVICES

In the last few years we have seen many alarms caused by an X-ray crew who are crack testing

steel and concrete pipes. This is a common service and involves shooting a high intensity narrow beam of radiation FOR A VERY SHORT PERIOD at the material and illuminating an X-ray plate looking for cracks.

Unfortunately if such a beam is bore-sighted at one of the GR-526/510 radiation detectors - even though such a source may be more than ONE MILE away the system CAN ALARM. These alarms can also occur WHEN NO VEHICLE IS PRESENT, unless parameters are adjusted to prevent this.

Normally such alarms are easy to identify as they are quite narrow (typically 1 second) and will of course NOT re-occur when the vehicle is re-tested (unless by an incredible coincidence). This problem is often solved by arranging with local X-ray service groups, that they will notify GR-526/510 users when they are in the vicinity!

(e) MISCELLANEOUS MATERIAL ALARMS

FIREBRICK used to line furnaces has a significant Thorium content and a vehicle loaded with firebrick will usually cause the system to alarm.

CALUMITE is a powder material made by grinding slag etc. This material contains trace amounts of Uranium, Potassium and Thorium and if a large volume is loaded into a vehicle will probably alarm the system.

CONCRETE - concrete usually contains trace amounts of Potassium and if in significant volume in a load can cause the system to alarm.

DUST - some users have reported alarms on hot baghouse dust. If the load is allowed to cool then the system will not alarm as they pass. This is a result of a short lived isotope THORON which is derived from Thorium material.

Furnace Dust often contains low levels of URANIUM and THORIUM from various sources and if these levels are high enough an alarm can occur. Spectrometer sampling can be used to confirm this situation. Note new Dust Parameter to improve system response.

OTHER MATERIALS - that can cause alarms:

Alum (Aluminum sulfide)
Bonding Mortar
Bonding pour tile
Ceramics
Corrosive solids
Fiberboards
Fire brick
Fire clay
Fluidox 141
Industrial ceramics (such as nozzles and sleeves)

Insulation
Ladle brick
Oxytherm R1
Potassium Permanganate
Pyro block
Refractories
Liquid Petroleum Gas (often contains Radon)

NOTE - some of these materials can contain naturally occurring radioactive material but in volume may create enough of a "radioactive source" to cause a sensitive system to alarm. However it is CORRECT that the system should alarm as in these cases it IS radioactive material.

APPENDIX B - "Problem" Sources

The GR-526/510 has VERY high levels of sensitivity and is the state-of-the-art in vehicle detection technology. However there are various radiation "targets" that may be undetectable under normal operating conditions. Such "undetectable" sources will of course be invisible to ANY similar system except as noted in the text.

(a) SMALL SOURCE - BIG SHIELD

A "normal" source may be typically a 1 Curie (1 Ci) of CESIUM-137 size approximately 10" diameter by 10" high, weighing 100 lbs. Such a source has a radiation level (expressed in the common Exposure Rate units) on the OUTSIDE of the shield of 1-5 mR/h. If this source is buried ANYWHERE in a scrap vehicle containing randomly loaded scrap of the size that could hide such a source, the GR-526/510 will detect it's presence EVERY TIME.

However some manufacturers have "standard" safety shield sizes of 1Ci, 10Ci and 100Ci. Thus if the user purchases a 100mCi (0.1 Ci) source and specified that it be in a 10Ci shield - the Exposure rate on the outside of the source would be typically 0.02-0.05μR/h. Such a source if DEEPLY buried in HEAVY scrap is UNDETECTABLE by any current technology (except perhaps Neutron-activation). Neutron-activation is a very specialised method which involves RADIATING the vehicle with a high intensity radioactive source and looking for secondary emissions. No scrap user that Exploranium has discussed this matter with is willing to consider having such technology on site, as the benefit of locating such an unlikely source is heavily offset by the cost/logistic limitations of deploying such a system. Since the probability of such a source being the target are low, the risk/benefit ratio of such technology are very difficult to justify.

(b) "NORMAL" SOURCE - BURIED IN SOLID STEEL

If a vehicle is loaded with solid steel bars (or bundles) - and these bars are carefully loaded so as to form essentially a "solid" block of steel, and somehow a "normal" source is buried exactly at the centre - the solid steel shielding would probably make the source undetectable. However in real life scrap material is loaded RANDOMLY into a vehicle so this is probably a completely improbable scenario, unless done DELIBERATELY!

(c) AMERICIUM

Americium is a source used quite commonly in gauging operations and probably comprises 5% of all sources in use. Unfortunately Americium emits radiation at SUCH A LOW LEVEL, that if DEEPLY BURIED in heavy scrap, is undetectable by any practical technique. Most Americium sources above 1Ci are enclosed in special containers and this combination causes the source to emit NEUTRONS, which the GR-526/510 can easily detect. In fact Exploranium systems have detected such sources in the past at the weigh scale!

The GR-526/510 has been specially sensitized to maximize it's response to Americium EVEN IF NOT EMITTING NEUTRONS, and if an Americium source is only lightly buried in scrap (1-2 ft) it is probably detectable by the GR-526/510.

(d) HIGH SPEED VEHICLES

If a source is deeply buried in heavy scrap, the signal that is measurable on the OUTSIDE of the vehicle is VERY LOW (typically less than 1 μR/h. If a vehicle passes through the GR-526/510 at speeds in excess of 8-10 mph, such a source may be undetectable.

For this reason the GR-526/510 incorporates a Speed Alert and users are strongly urged to ensure that Operating Procedures are closely followed to prevent any vehicle passing at speeds in excess of the systems capability!

(e) OPERATING PROCEDURES

While the GR-526/510 incorporates the technical experience gained in more than 400 installations and 8 years of on-site testing, the instrument requires that users COOPERATE in taking system operations seriously. It is essential that the following steps be covered in Plant procedures in such a way as to make the procedures as "foolproof" as possible:

Speed Alert - plant procedures should ensure that any vehicle that causes a speed alarm - be RETESTED before the vehicle passes into the plant. Experience shows that such rigidity quickly encourages the driver to slow down.

LOG BOOK - Users are strongly encouraged to have a log-book that is religiously kept and where EVERY alarm is noted together with the appropriate resolution (re-test, reject, inspect etc). The designated Safety officer should check the system alarms at least weekly and ensure that EVERY alarm in memory is correctly noted in the log book and that correct procedures were followed. Such a log assures the user that full attention is being paid to alarm procedures and minimises missing an incoming source due to improper operation.

TEST SYSTEM -Exploranium provides a small Test source and at Start-up users are clearly instructed in a simple procedure to test the system. Such a test takes only 1 minute if carried out correctly and should be carried out at least weekly and entered in the log.

WARNING MESSAGES - Users are advised to ensure that proper procedures are in place to correctly respond to any WARNING MESSAGES that the GR-526/510 gives out. These are covered in section 2 together with the appropriate response. For users who want to minimise the possibility of local personnel ignoring system WARNING MESSAGES, a special option is provided. If the MODEM is set to YES in the setup, then any WARNING MESSAGES will also be transmitted automatically to the Exploranium Service Department computer and Service personnel will follow up quickly to resolve the problem.

Also see Appendix K - for recommended Maintenance procedures.

If PROPER procedures are in place, then with the GR-526/510 system properly installed, the plant is assured of MAXIMUM INCOMING SCRAP LOAD MONITORING PROTECTION.

APPENDIX C - SPECIAL SYSTEM PASSWORDS

The system has a variety of reserved Passwords as listed below. If the user selects one of these as their Maintenance password, the system will not accept the data and a different Password must be selected.

1492 to access stored ALARM DATA - see Section 4

1590 reserved

2580 to set system to Alarms only by OS = YES - see Section 6.18 (label = XaSPD)

3214 to select special TEST mode - see Section 6.17 and Appendix N

4697 to printout the COMPLETE History File and Alarm File - see Section 6.15

5555 to print CURRENT ALARMS - see Section 6.5

7171 controls data output format - see Section 6.14

8741 to temporarily suspend the Speed Alert AUDIO - see Section 6.1 (label = SpSPD)

9191 to access the HISTORY FILE - see Section 6.3

9999 to print CURRENT PARAMETERS - see Section 6.6

APPENDIX D - MULTI-DETECTOR ANALYSIS

FOUR-DETECTOR analysis - typically A,B are the side detectors, C the above detector and D the below detector.

Alarm analysis order is as follows :
for Level I = A, B, C, D (A+B and C+D if selected)

Alarms are labelled :

LOW L1X	an alarm from detectors A+B
LOW L1B	an alarm from detector B only (also A, C and D)
LOW L1Y	an alarm from C+D only

APPENDIX E - SYSTEM RESETS

The system has many special codes for internal fault analysis. These RESET codes are an aid in fault diagnosis and appear on some printouts. The following is a complete list of current RESETS. All codes will be RESxx where xx is as listed below:

00	Reset if power off in ACI board	PwOFF
01	Restart after setting Parameter Screen	
02	Restart after setting Discriminator Screen	
03	Restart after setting Date/Time Screen	
04	Restart after viewing Alarm File	
05	Restart after viewing History File	
06	Restart after Remote access by Modem	
07	Restart after Dumping History/Alarm File	
08	Restart after Sensitivity Test	
21	Reset during setting Parameter screen	all PwDOG
22	Reset during setting Discriminator screen	all PwDOG
23	Reset during setting Date/Time screen	all PwDOG
24	Reset during view Alarm file	all PwDOG
25	Reset during view History file	all PwDOG
26	Reset during Remote access by modem	all PwDOG
27	Reset after Dumping Alarm/History file	all PwDOG
28	Reset during Sensitivity Test (test interrupted)	all PwDOG
34	Reset during Alarm display	PwDOG
36	Reset Power ON	PwOFF
37	Reset after Auto Error report	PwDOG
38	Other RESETs	PwOFF

PwOFF - Power OFF event - this normally indicates that the power to the unit was switched OFF.

PwDOG - A special series of RESETs actions caused by special protection circuitry to prevent the system being kept in a non-monitoring mode for an excessive period of time.

APPENDIX F - SPECIAL SPEED ALERT SELECTIONS

The current software release has a variety of options accessible as follows. Enter the Parameter screen using the appropriate Password and advance the cursor until Speed Alert is reached. Now press key "3". Each time it is pressed a new selection appears as described below :

Selection	Audio	Status	YELLOW T.L	History
DEF	Indef	Indef	Indef	All
YES	60	60	60	All
IN -	IN=60	IN=60	IN=60	IN only
OUT -	OUT=60	OUT=60	OUT=60	OUT only
MIN -	4	4	4	All
OFF -	none	none	none	none
NO -	none	60	60	All

Indef = Audio/visual flashes/beeps INDEFINITELY until STATUS is pressed/

Audio - 60 = Front panel audio "slow-beeps" for 60 seconds

Status - 60 = STATUS light "slow-flashes" for 60 secs

History - All = All Speed data IN and OUT are recorded in the History File

Audio IN=60 - ONLY a vehicle passing in the IN direction will give a speed alert. Any OUT trucks will NOT have any action.

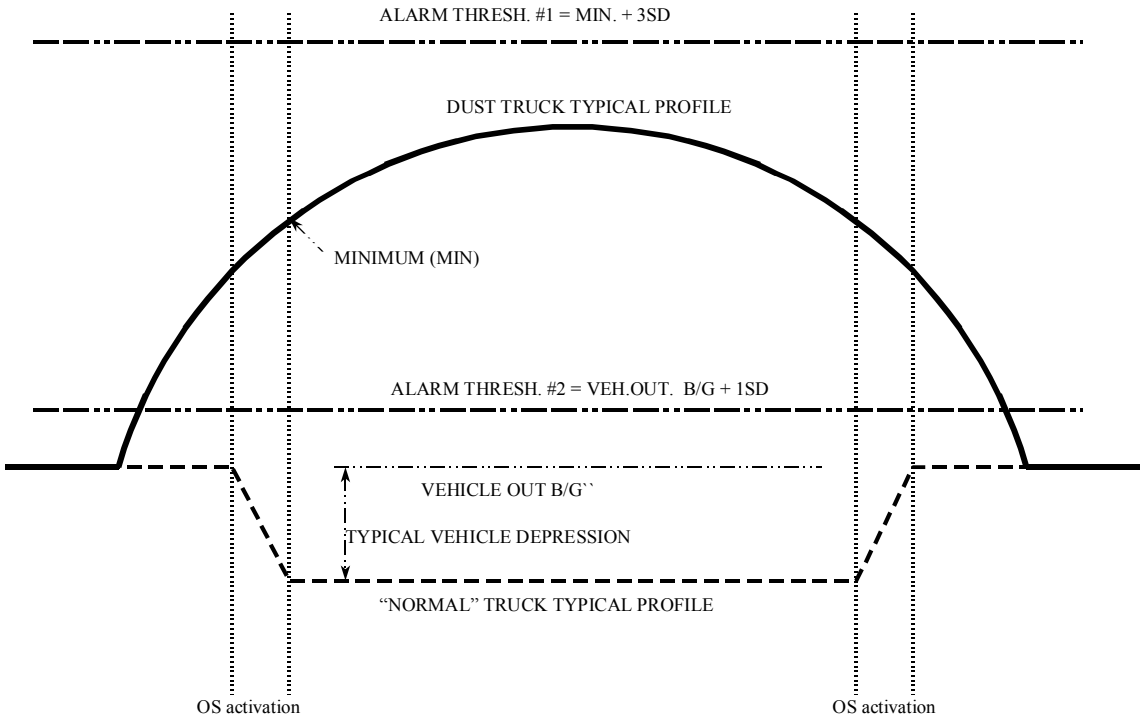
Audio - 4 = beeps for only 4 secs as an Speed alert.

Status - 4 = flashes for only 4 secs as an Speed alert.

Thus IN = any INCOMING vehicle that exceeds the Speed Limit will give a 60 second Audio Alert, a 60 sec STATUS and YELLOW Traffic light flashing and storing in the History File. All speed data from OUTGOING vehicles are ignored.

APPENDIX G - DUST PARAMETER additional information

There are 2 possible selections of this parameter - YES and NO



a) Dust Parameter = YES
In this case the Alarm Threshold is set at the ALARM THRESHOLD #1 shown in the figure and is computed as the MINIMUM signal (MIN) plus the setting for Level 1 alarm in the system (MIN + 3SD)

b) Dust Parameter = NO
In this case the Alarm Threshold is set at the ALARM THRESHOLD #2 shown in the figure and is computed as Vehicle Out Background plus 1 Standard Deviation (VEH. OUT + 1SD)

RECOMMENDATIONS :

Dust Parameter = YES

This is the recommended setting FOR USERS WHO WANT TO TRY AND MINIMISE DUST ALARMS. It is a reasonable technical assumption that the type of "Radiation Profile" created by a typical Dust Truck (shown in the figure) is highly unlikely to be a buried shielded source and so "missing" or ignoring these alarms is not unreasonable. However it must be emphasized that this technique SLIGHTLY reduces system sensitivity and perhaps local logistics in unusual situations could create a Radiation profile similar to a Dust Alarm and so there is a faint chance that such a source could be missed.

For this reason we normally recommend that this parameter be set to NO.

Dust Parameter = NO

THIS IS THE RECOMMENDED SETTING OF THE SYSTEM TO DETECT ALL SIGNIFICANT CHANGES IN LOCAL RADIATION LEVELS.

COMMENT

Some plants report that with DUST PARAMETER = NO, that if a dust vehicle trips the alarm, then parking the truck for approximately 6 hours will often permit the vehicle to pass without tripping the Alarm. This has had some level of investigation at a few plants and it appears that the phenomena of the "disappearing" radiation is probably due to the decay of Thoron or Radon gas generated in the furnace by thermal action on either a Thorium/Uranium rich furnace lining or some minor contamination in the scrap material. Both these gases are very short lived so after a few hours they decay below the system Alarm Threshold and thus the alarm is not tripped. This requires further investigation to fully clarify this effect as it is most pronounced in plants that move their dust while it is still "warm" from the furnace.

APPENDIX H - RECOMMENDED MAINTENANCE PROCEDURES

The following operational procedures are applicable to any Exploranium Radiation Monitoring system but Manual references are for Manual 2V16.

4. SET UP A SCALE LOG BOOK for each system and mark Serial # then specify that the Scale Operator record (at a MINIMUM) the following data for EACH alarm and any system errors :

Date	Time	Alarm#	Alarm level	User actions	Signed
5/9	11:05	21	1A	Ran truck through again	
5/9	11:08	22	1A	Ran truck through again	
5/9	11:11	23	1A	3 alarms confirmed - Notified Mr. ..... that truck rejected	
5/11	13:25	25	1b	Test Alarm - Maintenance	
5/12	14:22	Error		OS error, notified Maintenance	
etc					

Such a log permits :

- the Radiation Safety Officer (RSO) to have a record of all actions taken. Using a regular full Alarm printout (see below) they can ensure that ALL alarms were handled correctly - and investigate errors
- show that the user is responding correctly to system errors and notifying Maintenance as required
- show that someone (Maintenance?) Is carrying out regular Test alarms to ensure that the system is functioning correctly

---

5. SET UP A MAINTENANCE LOG BOOK for each system - mark each with the appropriate SERIAL #.

   Enter in the LOG BOOK - the date of installation and after the installation is OK, printout Current Parameters (STANDARD) - and glue/tape into the book

   It is highly recommended that as the various tests are carried out on the system, that sequential (dated) notes are kept in the logbook. Also regular Test Alarms - Parameter + History printouts etc. should be glued into this logbook thus providing an invaluable record of system performance and a reference guide to track persistent problems.

6. DAILY SYSTEM CHECK - MINIMUM actions by SCALE personnel

1	Inspect the display and ensure that the Yellow STATUS button is NOT flashing. If it IS flashing note the Errors on the display and call Maintenance
2	Inspect the display and ensure that Date and Time are correct - if Date/Time have changed significantly - notify Maintenance

7. WEEKLY SYSTEM CHECK - MINIMUM actions by MAINTENANCE

1	Check OS alignment - ensure that all OS Receivers have a "fast pulsing" light (2 flashes/sec - slower is bad) - mark in log as a record
2	Check that Date/Time are set correctly - a significant change could indicate that DEFAULT parameters have been loaded due to RAM error
3	Print out Current Parameters and compare to normal parameters printed in the LOG BOOK - glue in log as a record
4	Carry out a SENSITIVITY CHECK - as per Appendix N. Inspect and glue in logbook as a record

APPENDIX J - VEHICLE LOGGING

1. GENERAL

Many users want to log vehicle data to create a reference archive or record of all vehicle monitoring activity. The GR-526/510 system supports various output options :

a) Direct printout of basic data on an external printer
b) Basic Data Logging/ Storage/ Printout on an external PC
c) Total Data Logging/ Archive on an external PC with Network capability

---

a) DIRECT PRINTOUT

The system has an RS-232 data output that can be directly connected to a SERIAL data printer (or to an external computer running Windows Terminal or similar program) - with a special cable from Exploranium (2m long).

This data format is the default value - if this mode is selected there should be a flashing white dot at the top right of the display. If there is select Password < 7 1 7 1 > to set the correct data output format. The data for each vehicle is printed in the following format :

Date	Time	T	dir	V/Sg	Len	Spd	Alrt	BG	IN	TH	HI	Alarm	Al#
01/10/96	12:01:09	T	in	1/1	84	2.3	NO	585	380	516	419	NO	-
01/10/96	12:02:24	T	in	2/1	127	3.2	NO	592	382	516	405	NO	-
01/10/96	12:03:18	T	out	3/1	20	8.5	YES	582	386	513	401	NO	-
01/10/96	12:03:22	T	out	3/2	62	6.7	YES	582	381	513	392	LOW 1A	30

The data is interpreted as follows (using the second line of data as an example):

Date/Time = Date/Time of vehicle passing
T = fixed parameter
in = direction of the vehicle - in = into the plant, out = out of the plant
2/1 = Vehicle # and Segment # (Cab+Truck+Trailer = 3 segments)
127 = vehicle sample time in 0.1 secs units (127 = 12.7 secs)
3.2 = speed in selected units (3.2kph or 3.2mph)
NO (YES) = NO = No Speed Alert, Yes = Speed Alert
592 = System radiation Background BEFORE the vehicle entered the detectors(cts)
382 = Vehicle IN Background data (cts)
516 = Computed system Alarm Threshold (cts)
405 = Highest radiation level of the vehicle (cts)
NO(Level)= NO radiation alarm (if yes then the type of alarm)
30 = The current Alarm # (sequentially incremented)

Thus the user has a full record of ALL data analysis for all vehicles.

b) BASIC DATA LOGGING

This option requires the user to supply an external dedicated PC connected to the RS-232 output of the GR-526/510 (2m cable supplied by Exploranium). This data mode is activated by Password <7 1 7 1 > and if this mode is selected there should be a white dot at the top right of the display.

Exploranium can supply a special program 526LOG.EXE that runs on a PC under DOS. The program accepts data from the console on the RS-232 port and permits logging Display, Printing and archiving of the logging data on the PC. A data file is created for each day and at the end of the day the complete data file listing is printed. A collection of 30 data files (1/day) is maintained automatically by the program. On the 31st day the oldest data file is deleted. At any time the program can be used to re-print any of the last 30 data files.

The data printout is identical to that described in item (2) above except that a title block is printed. Note that in this mode the data is also archived and may be printed at any time whereas in option (2 above) the data once transferred from the GR-526/510, is printed then eliminated.

Date	Time	T	dir	V/Sg	Len	Spd	Alrt	BG	IN	TH	HI	Alarm	Al#
01/10/96	12:01:09	T	in	1/1	84	2.3	NO	585	380	516	419	NO	–
01/10/96	12:02:24	T	in	2/1	127	3.2	NO	592	382	516	405	NO	–
01/10/96	12:03:18	T	out	3/1	20	8.5	YES	582	386	513	401	NO	–
01/10/96	12:03:22	T	out	3/2	62	6.7	YES	582	381	513	392	LOW 1A	30

c) TOTAL DATA LOGGING

Some users need to archive ALL data (including the raw data from the detectors) from the system for Archive purposes. In this mode a different output data format from the GR-526/510 is selected by Password - press <Enter 7 1 7 1 Enter> - and a special mark "," appears at the top right of the display to show that the correct format was selected. The user connects a dedicated PC to the RS-232 data output and runs a special Exploranium software program named VLOG.EXE. In addition to the CRT display of the logging data (as above) EVERY VEHICLE that passes has it's raw data stored in memory on the PC in separate files using filenames automatically generated by the program. These data can be "collected" for archiving by connecting the plant Network computer to the PC (Ethernet etc.). With this option the user can DISPLAY the data log on the CRT display of the logging PC (as in (b) above), PRINT the logging data display and ARCHIVE each vehicle on disk for subsequent re-processing or archiving as required

APPENDIX K - TELE-CHECK

GENERAL:

See attached brochure.

APPENDIX L - SYSTEM TESTING

GENERAL - Many users want to test their systems on a regular basis. Exploranium strongly recommends this practice as a means of ensuring system performance is being maintained correctly. The following procedures are recommended for correct performance monitoring.

The basic testing method involves placing a Test Source on the face of the detector and then noting the change in count rate on the console. The system provides a data printout of the results that can be used to check system performance on a regular basis.

SYSTEM TESTING - (Minimum MONTHLY - recommend Daily or Weekly)
In this procedure a special test source is used in a fixed location on each detector. A 30 second reading is taken for each detector with and without the test source. This process is semi-automatic and requires only 1 person to carry out the test. At the conclusion of these tests the SOURCE data is corrected for background and the system printer is used to provide a hard copy. This test procedure should take only 2-3 minutes for a 2 detector system and provide very repeatable data for system performance analysis.

SPECIAL SOURCE MOUNTS
After various requests from users for a SIMPLE, REPEATABLE test, Exploranium has constructed a special "source holder" that must be glued in place at the required place on the detector face. These holders are made of steel and the supplied special Test Source has magnets in it so it will stay in place in the source holder. The reason for this holder is that for repeatable results, at least a 30 second sample must be made at each source location and it is extremely difficult to hold the source at a fixed location manually for this period of time.

New GR-526/510 (510) units are supplied with these source holders installed but older systems can be upgraded using the SOURCE-HOLDER KIT (PN 93610) available as an optional item from Exploranium and this kit usually includes: 2 source holders (1/ detector), 1 - magnet equipped Test Source. (Note that the Exploranium Service department should be consulted regarding upgrades to ensure the correct items are supplied)

NOTE : IF THIS TEST IS CARRIED OUT WITHOUT USING THE SOURCE HOLDERS FOR PRECISE POSITIONING - THE TEST WILL WORK CORRECTLY BUT THE DATA MAY NOT BE REPEATABLE FROM TEST TO TEST DUE TO CHANGES IN THE SOURCE POSITION.

SOURCE
To get repeatable data it is very important that the SAME source be used for each test and that the source is placed the SAME way up every time. (The test source has a slightly different performance if placed face-up or face-down on the detector). Note the "magnet-equipped" Test Source is colour marked to ensure it is not confused with the "normal" Test Source.

SOURCE POSITION
It is important that the test source be positioned on the detector at the same place each time. If the source position is very repeatable then the test data results can also be used to assess system performance over the long term.
The optimum Test Source location is shown at point Y in Fig. 22.

Each detector box actually has 2 detectors inside it and for best results the external source should be positioned to give approximately the same response from each detector. The GEOMETRIC centre of the detectors is usually the correct location but in some cases due to internal mechanical variations in the detector, this centre position is a poor choice. The recommended method is to temporarily attach the source mount and carry out the following Test Procedures, then inspect the results to determine if the selected location is OK. The best performance is if the Test Source signal (SIG in Fig. 23) is approximately equal on the 2 detectors in each box (+/- typically 10%). This is easily checked by repeating the procedure for various source holder locations until the best location is determined. Once the correct location is found the source ring should be glued in place.

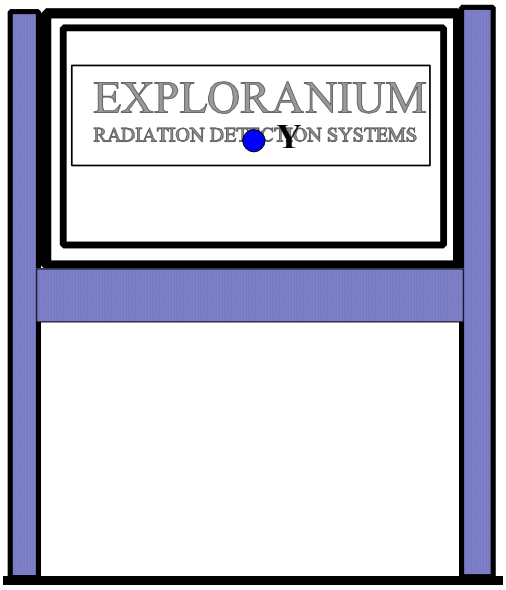


Fig.22

2.5 TEST PROCEDURE

1. Ensure that no vehicles will pass through the system in the 4-5 minutes normally required to test the system as this procedure disables system monitoring.

2. Ensure that there are no vehicles parked in front of the detectors and preferably none within 30 ft (10m). These test results are often used for comparative system analysis and so it is important not to distort the data by passing vehicles influencing local background results.

3. Enter Password 3214 (best method is <Enter 3 2 1 4 Enter> - slowly) :
   NOTE : a 3 minute timer is started once this Password is entered, if 3 minutes pass with no user action this test procedure will automatically terminate to ensure that the system cannot be left in the test state.

ACTION :	System is ready to start the Test
DISPLAY	SENSITIVITY TEST (at the top) RUN = start STOP=exit
TRAFFIC LIGHT :	RED = ON - all others OFF

4. The user should ensure no vehicles are nearby and no one is walking between the detectors - then press RUN

ACTION :	30 second background average is being computed
DISPLAY	Background meas xx (xx starts at 30 secs and counts down)
TRAFFIC LIGHT :	RED = FLASH - all others OFF

5. At the end of this time the audio will "beep" 3 times and :

ACTION :	System has stored background and is ready for source tests.

DISPLAY SENSITIVITY TEST (at the top)
RUN = start STOP=exit
TRAFFIC LIGHT : RED = ON - all others OFF

6. Locate the magnet test source - and press RUN :
ACTION : System is waiting for a test source - user has 3 minutes to place the source on any detector
DISPLAY SENSITIVITY TEST (at the top)
A B (also C,D etc. if installed)
TRAFFIC LIGHT : RED = ON - all others OFF

7. The user must now take the special magnetic Test Source and place it on ANY detector in its special holder, then stand back clear of the detectors. The program can recognize which detector has the source in place and as soon as this identification is complete, the test of that detector begins.

As an example place it on the B detector first :
ACTION : B detector data is being analysed.
DISPLAY Source B
xx (xx = 30 secs and counting down)
TRAFFIC LIGHT : RED = FLASH - all others OFF

8. When the Traffic Light goes from FLASHING to STEADY, move the source to the next detector.

If NO Traffic Lights are installed - use a watch and wait 45 seconds after the source is firmly in place before retrieving it and moving it to the next detector.

NOTE : If somehow the source is removed by accident before the 30 second accumulation is complete, just place it back in place and the test will be restarted on that detector.
If you moved it to the A detector :
ACTION : A detector data is being analysed.
DISPLAY Source A
xx (xx = 30 secs and counting down)
TRAFFIC LIGHT : RED = FLASH - all others OFF

9. When all detectors have been tested the Traffic light will change briefly to RED.

Remove the source and return to the console.

NOTE : As each detector test is complete, its label will be erased from the console display screen. If somehow the user did not test a detector - it will still be displayed on the screen and it can be immediately retested.

10. The system printer should produce a printout in a few seconds, then the Test is complete. During this time :
TRAFFIC LIGHT : YELLOW = ON all others OFF
11. When all is complete (a few seconds) :
TRAFFIC LIGHT : GREEN = ON all others OFF

12. The test printout appears as shown in Fig. 23. Users should use the SIG data only as this is the data from the SOURCE after BACKGROUND has been removed (SIG=Src-BACKGROUND).

    The SIG data should be accurate typically better than +/-10% or better from test-to-test, but this depends on local conditions. When this testing system is first implemented Exploranium suggest that it be repeated 4 times in 1 week and the data discussed with Exploranium to select a reasonable estimate of probable repeatability.

```
------------------------
SENSITIVITY TEST    #9999
3/26/97             12:09:13
----------------------------------------
Detector    BG      6122
   A        Src    23848
            A1/A2     96
            SIG    17726

Detector    BG      5352
   B        Src    18199
            B1/B2     97
            SIG    12847
----------------------------------------
```

Fig. 23

THE SYSTEM IS NOW READY FOR NORMAL OPERATION.

NOTES :

a. Discuss the data with the Service Department if any strange effects are noted.

b. Careful recording of these data on a regular basis will provide a reasonable estimate of system long term performance. Some ageing of the system with time will probably be seen but this should typically be less than 5-10%/year. Data changes significantly greater than this would suggest premature failure of some components - please discuss with the Service department if this occurs.

APPENDIX M - DATA RECORDING

In some installations, strange alarms can sometimes be caused by unusual shaped vehicles. The GR-526/510 has a variety of special parameters that are used to adjust the system to accept these vehicles without causing problems. However sometimes it is difficult to assess exactly what is causing the problem. The GR-526/510 has a special data recording output capability that permits the use of an external laptop computer to record RAW data for subsequent detailed analysis.

This software comprises 2 programs : REC03.EXE
and CONV526.EXE
and are available from Exploranium on request. These programs can be used to RECORD and DISPLAY data for specialised requirements. The recorded data requires approx 100K of disk space/hour of recording. Note that the recording system records ALL raw data with or without vehicles.

To use the software proceed as follows :

A: DATA LOGGING

1. Copy the software onto the hard drive into (say) subdirectory C:\526REC
2. Connect the laptop (COM1) to the 9 pin RS-232 port on the console using a standard 9 pin Male to 9 pin Female RS-232 cable
3. On the console - ensure that the display says SYSTEM READY and no vehicles are waiting to be immediately monitored. Then slowly press Enter 7 1 7 1 Enter - if all is OK there should be a white dot in the top right hand corner of the display. If not then re-enter the password until this dot is visible. The data mode is now switched over and it is now OK to permit normal system operation, vehicle monitoring etc.
4. On the PC type REC03 Filename <Enter> to start the program. Use a DOS filename, max 8 characters.
   As an example let's select a DOS filename "TEST1"
   User should type REC03 TEST1 <Enter>
5. Display should say ..... 0 for Start/Stop
6. Press 0 on the PC then <Enter>
7. Display should now say Press space bar to continue...
8. Press <SPACEBAR> on the PC
9. If all is OK, display should say "Synchro OK , Press.....".
   Then after 60 secs (at the most) a line of data should appear on the display with date/Time etc. This means that data is being recorded OK. Every minute this message should appear. If not OK, see Section C below.
10. The PC is now logging all data from the console. The GR-526/510 will operate completely normally handling alarms etc.
11. When logging is complete, press <SPACEBAR> to terminate the program.

B: DATA VERIFICATION

12. A simple test can be carried out to be sure that the recording is OK.
13. Start recording and measure (say) 2 trucks using the above procedure, then terminate the recording (by SPACEBAR) and go back to the DOS prompt.
14. Type CONV526 Filename <Enter.
    So for the above example, type CONV526 TEST1 <Enter>
15. Press <Enter> to bypass the Printer request
16. The display should now show data in Blue, Green and White - this is the actual truck profile for each detector individually and the sum.
17. This means that all is OK, so press Q to Quit.
18. Restart the recording capability as explained in (A) above.

C: ERRORS

19. If when starting the recording program you get an error message, such as :
    Error...No data .....
    and the system goes to the DOS prompt, this usually means that the correct Password was not entered.

    On the system console press <Enter 7 1 7 1 Enter> and restart the REC03 program as detailed above. Since the keyboard is not designed for fast data entry, sometimes the Password entry may need to be carried out a couple of times before all is OK - press the keys SLOWLY!

APPENDIX N - OPTIMISING SYSTEM PERFORMANCE

The GR-526/510 has many specialised features enabling the system to be adjusted to suit essentially any local logistics. However sometimes it is necessary to compromise system performance to suit local unchangeable logistics which in some specialised locations may SLIGHTLY reduce systems performance. In order to OPTIMIZE system performance and achieve the MAXIMUM level of protection possible, the following points are offered :

a) SPEED

It is ESSENTIAL that vehicle transit speed is kept to a minimum. Exploranium recommends setting the SPEED LIMIT to 3mph (5kph). Experience in many plants shows that this limit is easily achievable and is NOT an undue burden on the driver. The difference between 6mph and 3mph results in a 40% performance improvement, and the slower speeds mean only a few extra seconds in transit time.

b) SPEED CONTROL

Once a Speed Alert occurs it is essential that the vehicle REPEAT the pass. Enforcing this speed control very quickly encourages ALL vehicles to slow down. The GR-526/510 has features that permit the user to keep track of how many vehicles exceed the speed limit as a control method.

c) VEHICLE SIZE/SHAPE

The system's performance can be improved (possibly up to 10%+) if all vehicles are of a similar size. This is usually impractical - as an impractical possibility - however any attempt to standardise trucks will improve system performance.

d) TOP/BOTTOM DETECTORS

System performance can be improved (2-15%?) if an overhead detector is used. To be of any benefit the overhead detector must be no more than 3-4ft from the top of the vehicle. If this can be achieved then this extra detector can offer significant benefits. However in many locations this may be impractical.

Additional performance can also be achieved by the use of a Lower detector buried in the ground, this is primarily of benefit if buried sources in ALL kinds of scrap is an operational requirement.

e) VEHICLE CONTROL

The vehicle should NOT be permitted to stop in front of the detectors or for 10-15ft either side of the detectors.

A new vehicle should not be permitted to be located closer than 10-15ft to the entry of the detectors until the traffic light goes GREEN. This can only be achieved reliably by using an INCOMING traffic light. This technique also FORCES a vehicle to pass at an almost constant speed (best for optimum monitoring), and so has some real benefits, but maybe impractical in some applications.

f) MODEM ACCESS

When the GR-526/510 is installed a DEDICATED telephone line should be connected.

a) It is essential that the system is run at its MAXIMUM performance level at all times. If users are unsure of the systems current level of performance, it is a simple matter for them to call the Exploranium Service Department and ask someone to take an in-depth look at the system via Modem. If this Remote Access capability is NOT available, it is often difficult to detect subtle performance problems by verbal telephone communication.

b) Experience has shown that users who have this auto access capability are quick to request this service "just to be sure". Whereas without this link there is the possibility that users may "live with a small problem" without realising that it could be a symptom of a serious problem coming.

c) Some users want an INDEPENDENT method of assuring themselves that the system IS functioning correctly. This can be achieved by Remote Access as follows :

1) Requesting that the "AUTO ERROR REPORT" feature in the GR-526/510 is activated which will automatically contact Exploranium if an internal error is detected. This is an excellent method but it cannot protect the users system if someone turns the power OFF!

2) WEEKLY MAINTENANCE "TELE-CHECK" - Optionally, Exploranium can contact the system on a weekly basis and check system performance. This weekly check is summarized monthly and a report mailed to the customer.

During this weekly access Exploranium also accesses internal parameters to be sure the system IS in continuous operation and no one is interfering with optimum system performance.

g) ALARM CONTROL

This is covered in more detail in Section 3 and 4 - but users must enforce some rigid control mechanisms to ensure that :

(a) ALL the scrap vehicles are monitored
(b) ALL vehicles causing Speed Alerts are repeated
(c) ALL Radiation alarms are correctly investigated
(d) The system is properly maintained

h) REGULAR MAINTENANCE

Ensure that the system is checked on a regular (weekly) basis to be sure that there are NO error messages and that all parameters are correctly set etc.

See Appendix - K for more detailed recommendations of Maintenance procedures.

APPENDIX Z - SYSTEM SOFTWARE CHANGES in 2V16

Z.1 Changes in 2V16

1. Enhanced filtering and data analysis improvements results in a very significant increase in system performance. System detectability approximately 25% above previous levels.

2. SENSITIVITY TEST capability added making it very simple for users to accurately measure system performance on a regular basis. Upgrade kits available for older systems.

3. Originally the Alarm test sequence was A, B, C etc - thus if an alarm was detected on A, NO FURTHER ANALYSIS WAS PERFORMED. In 2V16 all detectors are tested and the system displays the alarm from the detector that gave the LARGEST alarm only.

4. Speed measured for each segment. Thus in trains, each railcar speed is analysed separately.

5. SPEED display - some users now require speed display of up to 35kph. Only 2 digits are available so the decimal point has been dropped on all printouts - but is still visible on the actual display. So display may be 3.7, 7.2 but the printouts will show only 37 and 72.

6. Outgoing vehicle speed accuracy improved.

7. Segment counting now extremely accurate. Special notification for alarms that occur between segments for special situations.

8. Truck counter now extremely accurate.

9. Special TLC output added for special applications

10. OS permitted to be zero for special applications

11. Alarm analysis is NOT halted if a Level 4 or 5 alarm occurs. Previous software versions halted analysis to ensure that action was taken. However remote detectors with no operating personnel make this procedure unuseable.

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