

Gamma Ray Logging System

Installation and Operation Manual



Table of Contents

| | |
|--|----|
| Section 1: System Description | 3 |
| Section 2: System Installation..... | 7 |
| Section 3: System Display Descriptions and Operation | 8 |
| Section 4: System Maintenance | 13 |
| Section 5: System Troubleshooting | 14 |
| Section 6: System Specifications | 15 |
| Section 7: System Schematics | 17 |
| Section 8: Replacement Parts List..... | 19 |
| Warranty and Repair | 20 |

DOCUMENTATION CONVENTIONS

This uses the following conventions to present information:



WARNING

An exclamation point icon indicates a **WARNING** of a situation or condition that could lead to personal injury or death. You should not proceed until you read and thoroughly understand the **WARNING** message.



CAUTION

A raised hand icon indicates **CAUTION** information that relates to a situation or condition that could lead to equipment malfunction or damage. You should not proceed until you read and thoroughly understand the **CAUTION** message.



NOTE

A note icon indicates **NOTE** information. Notes provide additional or supplementary information about an activity or concept.

Section 1: System Description

Function and Theory

The Geotech Gamma Ray Logging System (GR) is a portable, hand-operated geophysical instrument used in exploration for uranium, potash, and base metals, as well as for petroleum and ground water. The GR identifies lithology's and stratigraphic correlations in boreholes (case or uncased), liquid or air filled.

The GR system has three main components: a gamma ray detecting probe, 500 feet (152 m) of four-conductor geophysical logging cable on a cable reel, and a digital counter instrument. Typical capabilities include logging of 2" (5 cm) monitor wells, hollow stem augers, and small diameter boreholes.

The GR logging apparatus is manually lowered, and raised, within the borehole. Readings are taken point by point up the well bore and recorded by the operator. These data points are then plotted on a logging form to obtain the graphical log needed for interpretation.

The instrument at the surface is designed to accept the output of a scintillation detector.

System Components

Gamma Ray Control Panel

The pulse counting circuitry controls the operation of the LCD located in the center of the panel. Use and operation of various controls on the instrument panel control the following:

Power Connector

The power connector is used for attaching an external AC power supply cord or DC power cord to the control panel providing 12 VDC to the panel. A set of cords comes with each GR unit to convert power from an AC source or to provide power from a DC source, such as the provided battery or car battery. The circuit is protected by a 1 Amp Slo-Blo fuse.

ON/OFF Switch

The power switch should only be turned on once all equipment has been checked and properly attached to the control panel (as described in Section 2). Ensure the unit is set to OFF and the power cord disconnected when disassembling the system.





Fuse

The GR control panel is protected by a 1 Amp Slo-Blo fuse. Should the display not appear when turned ON, power OFF the unit and verify the condition of the fuse.



Do not attempt to replace the fuse with a circuit breaker. The response is not fast enough to prevent damage to the circuits.

Navigation Buttons

A key pad with , ,  and  buttons is provided to setup the GR count and logging time and to navigate through the system status displays. See also User Interface Flow Chart in Section 3.

LCD

The LCD displays the operation mode and status of your GR system. When used as a counter, the LCD will display gamma-ray counts per second. It is automatically stopped by count time set by the operator. See Section 3 for more information on the various Gamma Ray status and operational displays.

Battery

A 12 VDC rechargeable battery comes with the GR system. An additional cord is provided for recharging the battery from an AC power source.

Hand Reel

The hand reel and frame are made of steel and PVC. A slip ring is employed to make connection between the probe (logging) cable on the rotating reel and the connector on the Leader Cable. A flexible jumper cable is attached to the side of the reel for connection to the control panel.

Probe (Logging) Cable

The logging cable is used to lower the probe and has four conductors covered with a tough and durable neoprene jacket. The cable is very resistant to abrasion and will provide flexibility at low temperatures. The high breaking strength of the cable, 320 lbs. (145 kg), is made possible by use of “Copperweld” (copper coated steel) for the individual conductors. The cable is marked at 5' (1.5 m) intervals with numbered markers starting at 20' (6 m).



Even though the cable is durable, it is important that you use the supplied Cable (Tubing) Guard on well heads with abrasive edges.

Leader Cable

The leader cable is an extension to the logging cable and must be attached to the end of the probe (logging) cable prior to attaching the probe. The leader cable is manufactured to a specific length to place the Gamma probe detector at 20' (6 m) from the first marker on the reel cable. All cable connections between the reel and probe use a slip ring connector for a waterproof fit.



The reel assembly that comes with the Gamma Ray system is also used with the Geotech Resistivity probe, which is physically longer. The Leader Cable replaces this missing length.

Flexible Jumper Cable with Connector

A flexible jumper cable is permanently attached to the reel side and is used to connect the reel assembly with probe to the control panel.

Well Probe

The scintillation detector is housed in a stainless steel body that is approximately 1.5" (3.8 cm) diameter. Located with the scintillator are the high voltage power supply and the pulse preamplifier, shaper, and amplifier circuitry.

The probe requires approximately 9 VDC for proper operation. Voltage below this level may result in erratic output or a no output condition. The bottom plug on the probe is drilled so that an additional weight may be added, if needed, to carry it to the bottom of the well.

The well probe is attached to 500 feet (152 m) of geophysical cable by means of waterproof, slip ring connectors. See Section 2 for installation instructions.



Care must be exercised in handling the probes, since they will not tolerate rough or abusive treatment. Never bang the probe against any surface in any position.

It is not recommended that the probe be disassembled. If any problems are encountered with the probe, it should be sent to Geotech for repairs and/or adjustments.

Cable & Tubing Guard

The Cable and Tubing Guard (Figure 1-1) is made of PVC and can be used on 2" (5 cm) and 4" (10 cm) wellheads. The cable guard prevents the edge of the well casing from damaging the probe cable. It is highly recommended that it be used during system deployment to prevent cuts to the cable. The guard easily attaches by placing the rectangular opening on the rim of the well.

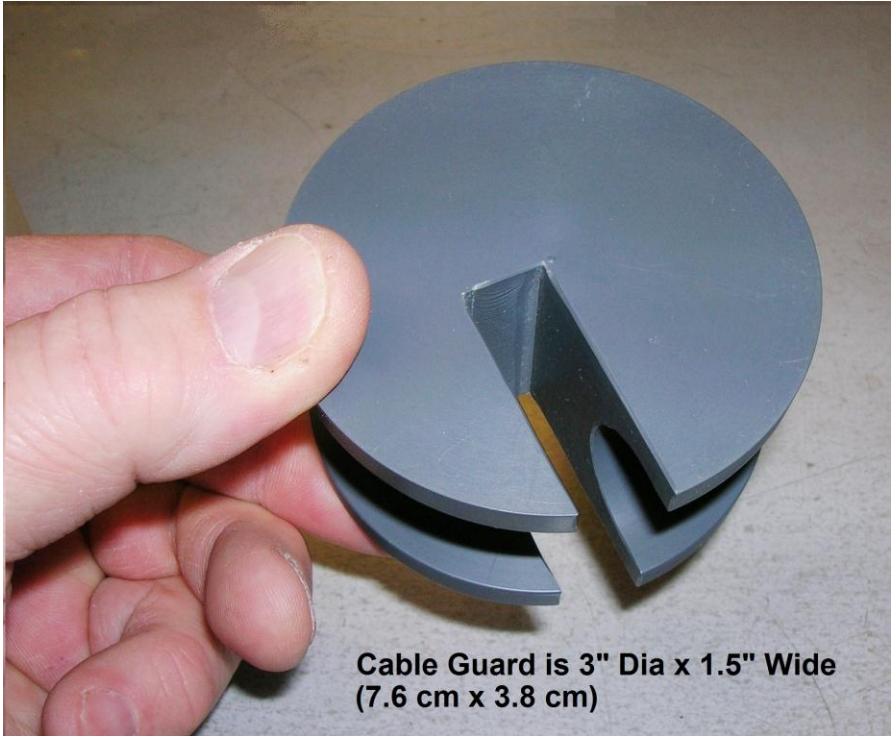


Figure 1-1 – Cable and Tubing Guard

Section 2: System Installation

The GR system will need access to either a 110 VAC or 12 VDC power source. Place the GR case with control panel in a location where it will not be exposed to water. Examine the contents of the GR system and verify that the following equipment is with the unit:

- Pelican case with GR control panel
- Hand reel with probe cable and flexible control panel cable
- Leader Cable (for use with Gamma Ray probe)
- Gamma Ray probe
- AC power cord
- DC power cord with battery clips
- DC rechargeable battery with AC power supply
- Cable Guard

With the control panel switch set to OFF, connect the appropriate power cord to the connector on the control panel labeled “12 VDC”.

Connect the flexible cable from the hand reel to the control panel connector labeled “PROBE”.



Connect one end of the Leader Cable to the end of the probe (logging) cable on the reel.



One pin on all of the probe (logging) cable connections is larger than the other three, ensure it is lined up with the correct hole on the other connector.

Connect the probe to the remaining end of the Leader Cable.

Power ON the unit and check for the Main Menu display to appear (as described in Section 3). If the display does not appear, turn OFF the unit and re-check all power cord connections. Verify that power is coming from your power source. Verify that a good 1 amp fuse is installed. Then power up the unit again.

Once the Main Menu appears, use the  and  buttons to move to the Battery Voltage display and verify that sufficient DC voltage is coming to the unit.



Contact your Geotech Sales Representative if any part of your GR system is missing, damaged, or is not functioning.

Install the cable guard accessory to the well head (as needed) prior to deploying the unit.

Section 3: System Display Descriptions and Operation

This section describes the display functions and operation of the Gamma Ray System. Each controller comes with a User Interface Flowchart (as shown in Figure 3-1) inside the enclosure lid. The flowchart, used in conjunction with the arrow buttons on the control panel (shown in Figure 3-2) is designed to provide the following operator functions:

- Set up and initiating of the run time for the GR system.
- Accessing system status and diagnostic displays.

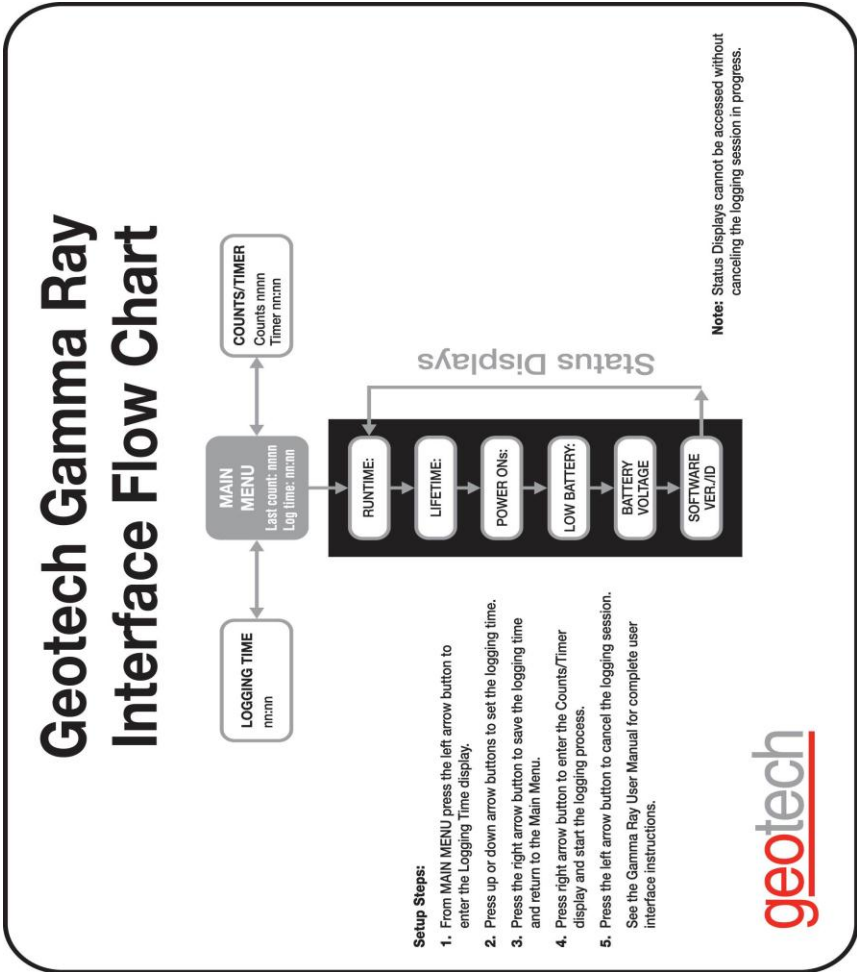


Figure 3-1 – User Interface Flow Chart

The following pages show examples of all GR displays and a brief description of their function. Contact Geotech Technical Sales for any assistance in operating your GR system.

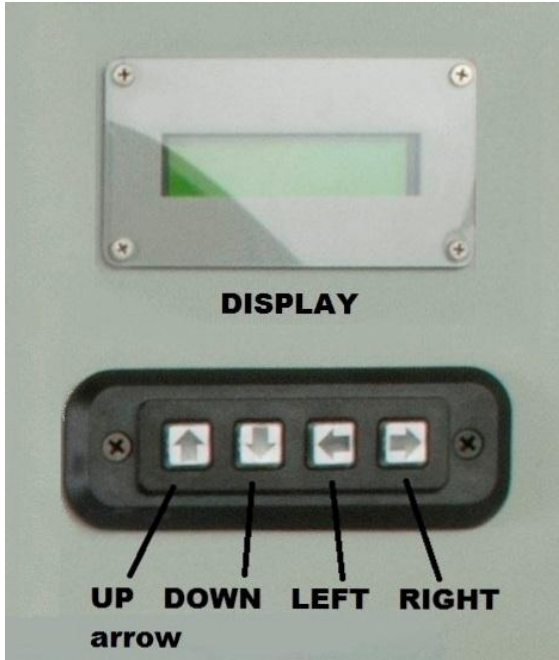


Figure 3-2 – GR display and push button panel.

Main Menu

Once the GR system has been installed and all wiring to the controller is complete, turn on the main power switch to the GR controller. The unit will perform a quick internal self check and memory configuration, after which the following Main Menu will appear:




```
Last count: nnnn  
Log time: xx:xx
```


After the first and subsequent logging events, the Main Menu will show the last count value and logging interval timer setting. The GR system will automatically return to the Main Menu after the logging timer has expired. The unit will also automatically return to the Main Menu after 20 seconds of inactivity while viewing the Status Displays.

Logging Timer

From the Main Menu press the  button to enter the Logging Timer display:



```
Logging time  
mm:ss
```

The Logging Timer is in intervals of 0 minutes and 0 seconds, going up to 59 minutes and 59 seconds. Use the  and  keys to change the timer value. Once a value has been selected, press the  key to save the new Logging Timer interval and to return to the Main Menu.



From the Main Menu press the  button to start logging. The following display will appear:


```
Counts nnnn  
Timer mm:ss
```

The logging interval timer, shown on the bottom line, will immediately begin counting down from the time you set. The number of gamma ray detection counts will count increment to the counts shown on the top line of the display.

Pressing the  button will cancel the current logging session and return you to the Main Menu. The Main Menu will then display the gamma ray detection counts and logging interval timer value at the time of cancelation. That is, the same values that were shown when the logging session was canceled are now shown on the Main Menu screen. To start another session, press the  button once more to enter a new logging time.

System Status and Diagnostic Displays

System Status Displays can be viewed at any time by pressing the  and  buttons. These displays contain a variety of information which can be used to record important activity to your GR system. The system status displays can also be viewed during the systems run time. After viewing a status display, you can leave the system as is. Within 20 seconds the Main Menu will reappear.

The following status displays (as shown in figure 3-1) will appear with each press of the  button. The following pages show you an example of each status display (as they appear) followed by a definition and use of the display.

```
Runtime: nn  
0000:00:00:00  
dddd:hh:mm:ss
```

The Runtime display shows the current power on cycle runtime.

```
Lifetime: nn  
0000:00:00:00  
dddd:hh:nn:ss
```

The Lifetime display provides diagnostic information showing the unit's total runtime since original factory shipment.

```
Power Ons: nn  
0000:00:00:00
```

The Power Ons display shows the total number of times the unit has been powered ON/OFF (since being put into service) along with a time record of when the unit was last powered on.

```
Low Batts: nn  
0000:00:00:00  
dddd:hh:mm:ss
```

The Low Batts display shows the total number of times the unit has experienced a low battery condition (since being put into service) along with a time record of when the unit last had a low battery condition. This display can help in evaluating battery usage and can help to determine if the battery is losing its ability to maintain a charge.

```
Battery Voltage:  
nn.nV xxxx
```

The Battery Voltage display shows the actual battery voltage. It will also display the power supply's output voltage when not using a battery.

The Battery Voltage display shows the current battery voltage for the GR system followed by a diagnostic number.

```
Ver: v.v Wls: n  
ID: iii
```

The Software Version/ID display provides information on the unit's current software version and individual ID number.

```
Where v.v = software version  
      iii = controller ID
```

PCB Damage



On rare occasions the following display may appear:

```
Bad display val:
```

The Bad Display Value message will only appear when damage has occurred to the PCB within the GR controller. Should this display appear, contact Geotech

about the fault. Inform the Geotech Technical Sales Representative of all conditions (weather, temperature, vibration, etc.) and when the fault occurred. A fault message of this kind will usually require the unit be sent to Geotech for diagnostics and repair.

Logging a well with the Gamma Ray system

1. Control unit in Main Menu.
2. Check that there is no moisture on the probe connector surfaces, then connect the probe to the logging cable. Be sure the threaded connector on the cable is securely attached to the probe. **Do not force the connectors together.** If the two parts do not join easily, spread a little silicone on the outside of the male plug. A pop should be heard when the connectors are joined properly.
3. Connect the instrument to the logging cable via the jumper cable.
4. Set the timer value to 30 seconds.
5. Set deploy probe into well bore. Set to desired level using foot markers on cable.
6. Press  button to start. The counter will start counting. The counter will count to the user set point then stop.
7. Record counts value in field notebook.
8. Place the probe at the next level to be logged.
9. Press  button to start. The counter will start counting.
10. When the counter stops, it registers the number of gamma-ray counts per user set time interval. Record the depth and the number of counts.
11. Move the probe to a new depth and repeat Steps 7 through 9.



Background counts should be taken prior to and after the well logging operation to verify that no malfunction exists. A number of background checks should be taken at the beginning of the logging operation and the counts averaged. Repeat again at the end of the logging operation. The average number of counts should not differ significantly.

Section 4: System Maintenance

Maintenance and Adjustments

The only maintenance required other than cleaning is charging the battery. The Battery Voltage display will indicate when this is necessary.

The battery should be recharged when:

1. The voltage becomes less than 9 VDC.
2. The counter becomes unreliable.
3. The counting rate is erratic and rapid.

To recharge the battery

1. Connect the DC recharging cord to the battery.
2. Plug the other end of the cord into a 110 VAC outlet.
3. Allow 16 to 24 hours for the battery to charge. Use the Battery voltage status display to verify the voltage and how long the charge is kept.

To operate the GR from a 12 volt DC source, such as a car battery:

1. Connect the DC power cable to the receptacle labeled POWER, on the upper left side of the instrument panel.
2. Plug the other end into an appropriate DC power source or use the adapter to connect the battery clips to their proper battery terminals – black to negative, red to positive.



Should an improper connection be made, the protective fuse will blow. The power should be disconnected and the error corrected prior to replacing the fuse.

Section 5: System Troubleshooting

Problem: Unit will not turn on or LCD display will not come on.

Solutions:

No power to control panel

- Power cord is incorrectly installed.
- Battery is below 9 VDC and needs to be charged.
- Fuse has blown.

Short circuit in the geophysical cable or moisture entering the cable or the probe causing the battery to be drained at an excessive rate.

- Be sure to check the lower female connector for moisture or metal shavings first. Clean thoroughly and dry.

Problem: The count does not operate normally.

Solutions:

Connection problem, or problem in the cable

- Be sure to check that all cord and cable connections are properly made.
- Contact Geotech for service.

Failure of circuit or detector in probe.

- Contact Geotech for service.

Section 6: System Specifications

Pelican case with Control Panel

| | |
|---------------------------|---|
| Dimensions: | 17"W x 7"H x 14"D (43.2 cm x 17.8 cm x 35.6 cm) |
| Power: | 12 VDC |
| Display: | LCD |
| Operating Temperature: | 32° to 122° F (0° to 50° C) |
| Weight (with accessories) | 17.1 lbs. (7.8 kg) |

Scintillation Probe

| | |
|------------------------|---|
| Dimensions: | 27.5"L x 1.5"OD (70 cm x 3.8 cm) |
| Counting rate: | User set – from 0 min : 0 sec to 59 min :59 sec |
| Operating Temperature: | 32° to 122° F (0° to 50° C) |
| Weight: | 6.4 lbs. (2.9 kg) |

Cable and Reel

| | |
|-------------|---|
| Dimensions: | 15"H x 11.5"W x 12"D (38.1 cm x 29.2 cm x 30.5 cm) |
| Cable: | 4-conductor polyethylene sheathed, .25" (6.4 mm) diameter, 500' (152 m). 500' (152 m) extension cable available. |
| Reel: | Steel and PVC. Reel turns on bronze bearings w/continuous electrical contacts. |
| Weight: | 31.3 lbs. (14.2 kg) |

Power

| | |
|-----------|--|
| External: | 110 VAC to 12 VDC power supply cord. 12 VDC cord with battery clip adapter. Rechargeable 12 VDC battery with cord. |
|-----------|--|

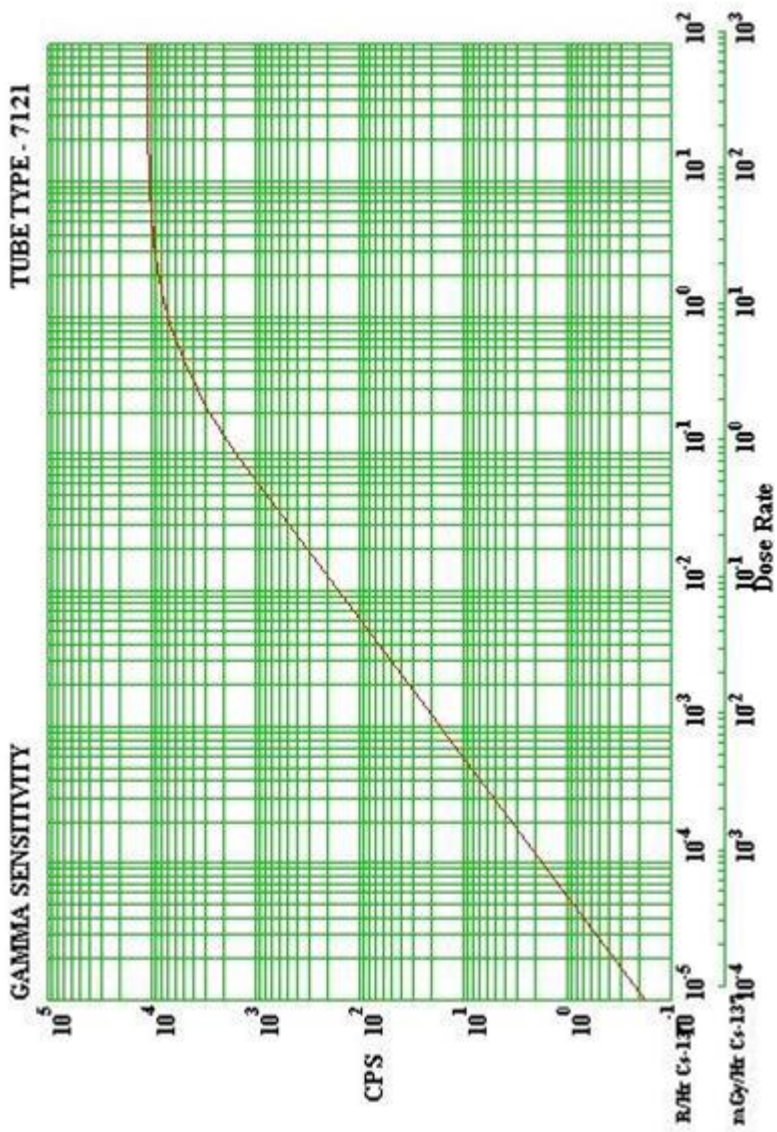


Figure 6-1 – Gamma Sensitivity Graph

Section 7: System Schematic

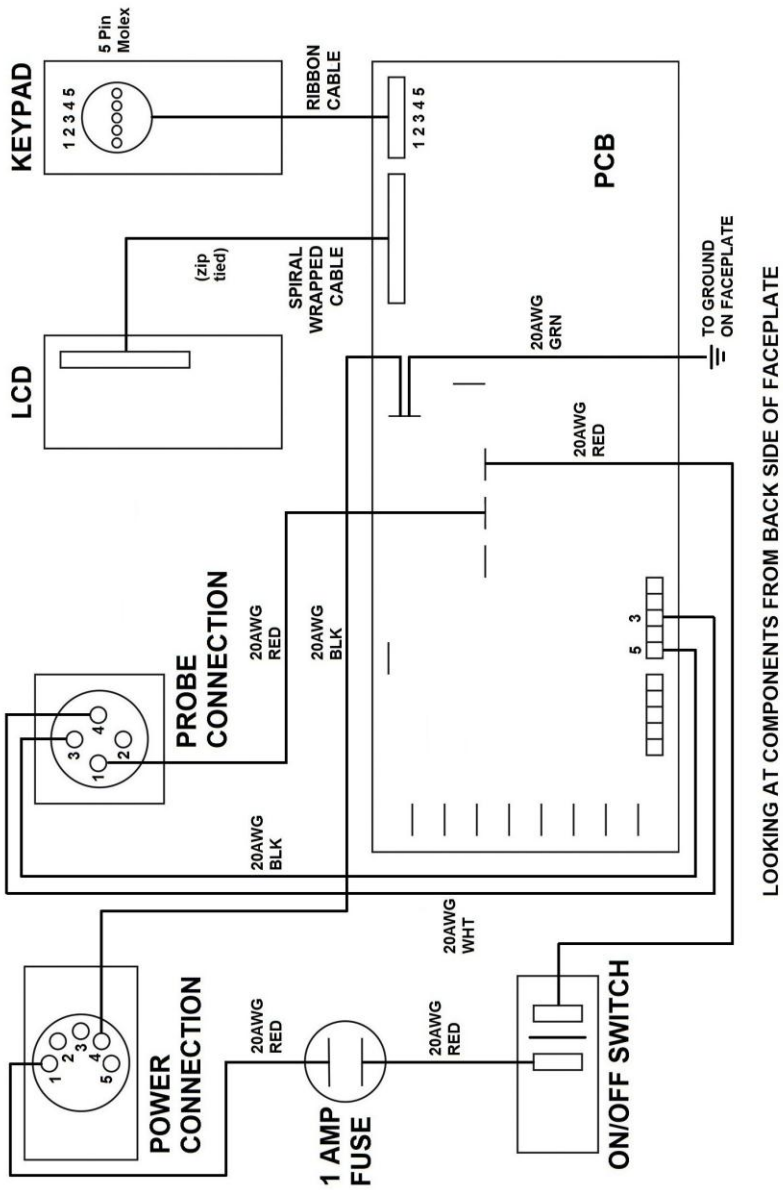


Figure 7-1 – Wiring Diagram for the Gamma Ray Controller.

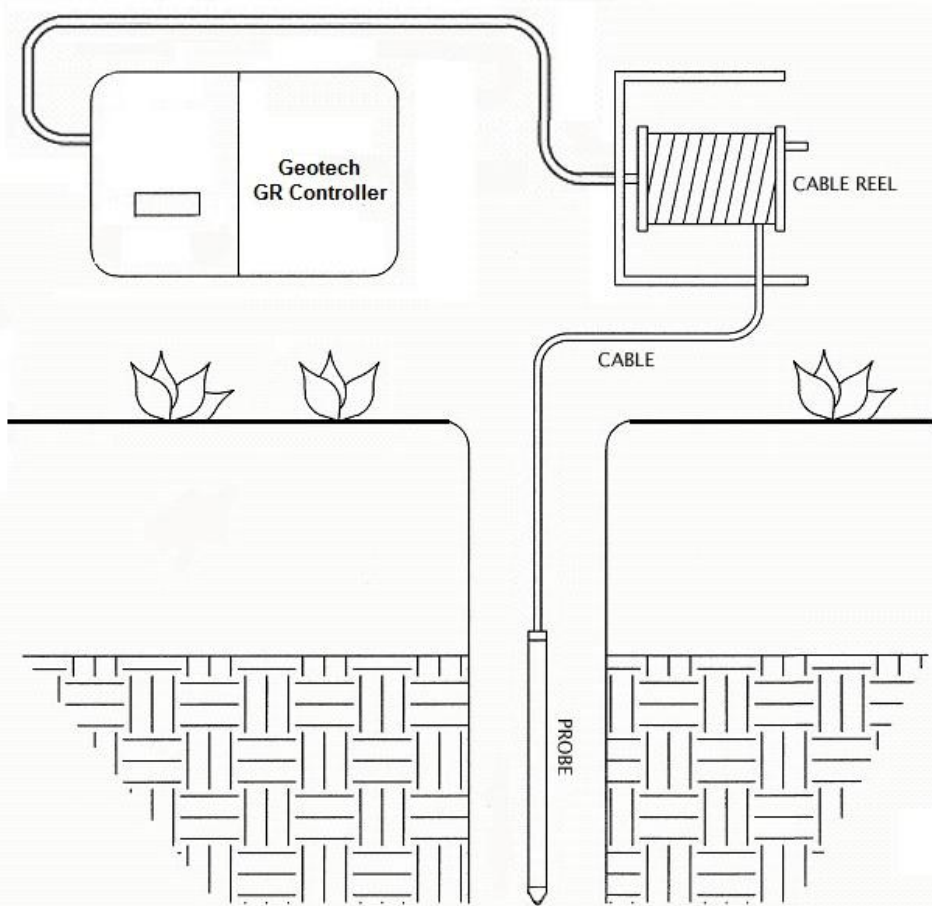


Figure 7-2 – Diagram of Gamma Ray Set Up.

Section 8: Replacement Parts List

| Parts Description List | Parts |
|--|---------|
| MANUAL,INSTRUCTION,GAMMA GR SYSTEM | 1225011 |
| 3 | |
| ASSY,PROBE,GAMMA RAY,GEOTECH | 5225001 |
| 7 | |
| CABLE,PROBE LEADER,M-F,13'4" HC,GR | 1225000 |
| 1 | |
| ASSY,REEL,CR | 5225000 |
| 5 | |
| ASSY,REEL,CR EXTENDER,500FT INCLUDES 500FT CABLE | 5225000 |
| 9 | |
| CABLE,4-COND,500FT W/FEM CONN CR | 1225001 |
| 9 | |
| CABLE,4-COND,500FT W/M-F CONN CR EXTENDER | 1225002 |
| 1 | |
| MARKER,CABLE,130-255FT CR | 1225002 |
| 4 | |
| MARKER,CABLE,260-385FT CR | 1225002 |
| 5 | |
| MARKER,CABLE,390-515FT CR | 1225002 |
| 6 | |
| GUARD,PVC,CABLE & TUBING | 2140000 |
| 7 | |
| POWER SUPPLY,12V,12W CE APPROVED,CONTROLLER2 | 1115001 |
| 1 | |
| ASSY,POWER CORD,DC W/ AMP | 5750000 |
| 8 | |
| BATTERY/CHARGER,MODULAR,12VDC 7.5Ah, MALE CIG PLUG | 7725000 |
| 0 | |

| | |
|--|---------|
| BATTERY MODULE W/O CHARGER 12VDC,7.5AMP | 7725000 |
| 1 | |
| CHARGER,12VDC BATTERY MODULE 500mA,MALE CIG PLUG | 7725000 |
| 2 | |
| ADAPTER,CIGARETTE TO CLIPS | 1750003 |
| 5 | |

The Warranty

For a period of one (1) year from date of first sale, product is warranted to be free from defects in materials and workmanship. Geotech agrees to repair or replace, at Geotech's option, the portion proving defective, or at our option to refund the purchase price thereof. Geotech will have no warranty obligation if the product is subjected to abnormal operating conditions, accident, abuse, misuse, unauthorized modification, alteration, repair, or replacement of wear parts. User assumes all other risk, if any, including the risk of injury, loss, or damage, direct or consequential, arising out of the use, misuse, or inability to use this product. User agrees to use, maintain and install product in accordance with recommendations and instructions. User is responsible for transportation charges connected to the repair or replacement of product under this warranty.

Equipment Return Policy

A Return Material Authorization number (RMA #) is required prior to return of any equipment to our facilities, please call our 800 number for appropriate location. An RMA # will be issued upon receipt of your request to return equipment, which should include reasons for the return. Your return shipment to us must have this RMA # clearly marked on the outside of the package. Proof of date of purchase is required for processing of all warranty requests.

This policy applies to both equipment sales and repair orders.

FOR A RETURN MATERIAL AUTHORIZATION, PLEASE CALL OUR
SERVICE DEPARTMENT AT 1-800-833-7958.

Model Number: _____

Serial Number: _____

Date of Purchase: _____

Equipment Decontamination

Prior to return, all equipment must be thoroughly cleaned and decontaminated. Please make note on RMA form, the use of equipment, contaminants equipment was exposed to, and decontamination solutions/methods used. Geotech reserves the right to refuse any equipment not properly decontaminated. Geotech may also choose to decontaminate the equipment for a fee, which will be applied to the repair order invoice.

Geotech Environmental Equipment, Inc.

2650 East 40th Avenue Denver, Colorado 80205

(303) 320-4764 • **(800) 833-7958** • FAX (303) 322-7242

email: sales@geotechenv.com website: www.geotechenv.com