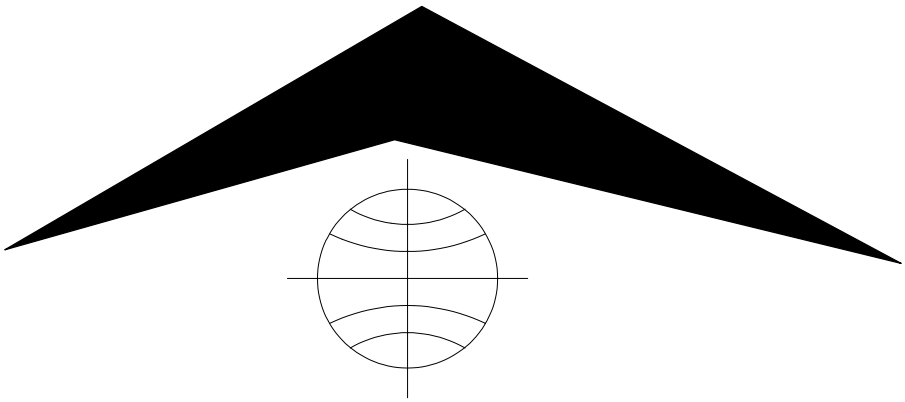
2PGA-1000
POLY- GAMMA PROBE



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Golden, CO U. S. A.
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General Information

Overview

The 2PGA-1000 Poly-Gamma is a combination probe providing natural gamma, spontaneous potential (SP), and single point resistance (SPR), measurements. The operator must make these measurements in two separate runs. i.e. the gamma is made in one run and the S.P. , and SPR are made together on the second run. The Poly-Gamma probe is also the base foundation for the Poly series of probes. The Poly-Gamma when connected to a Poly-Resistivity probe is capable of making multiple Normal resistance measurements along with the, above-mentioned, Poly Gamma measurements, all in one run. The Poly-Gamma probe can be operated as a stand-alone probe on an MGX II or MATRIX logging system.

The SP and SPR measurements must be run in open (uncased), fluid filled, boreholes. The natural gamma may be run in any borehole conditions within specifications.

Controls, Connectors, and Layout

Connectors for the tool are as follows. The probe top described below is a Mount Sopris standard single conductor probe top. Other variations of probe tops and wiring can be accommodated at the factory but will not be discussed in this document.

PROBE TOP CONNECTOR:

Pin	Signal	Origin
Probe top housing	Tool power ground	Armor
Center pin in probe top	Tool power positive	Center conductor

BOTTOM CONNECTOR:

This connector is made of rings and the numbering of the rings begins from the inner most ring.

Ring	Signal	Origin
1	SP, SPR or 64" Normal	Electrode below probe top
2	Center conductor	Center pin on probe top
3	Pulse return	Returns Gamma pulse to center cond.
4	Pulse	Output from Gamma circuit
5	Armor	Armor of probe top
6	Gate	From Poly Electric tool

Layout for the tool in general is as follows starting at the bottom of the tool. The bottom connector is below the scintillation crystal and Photo multiplier. Next is the electronic section for the gamma and electric measurements, followed by the electrode and probe top.

Theory of Operation

SINGLE POINT RESISTANCE

The single point resistance measurement is made by passing an AC current between a surface electrode or (mud plug), and the probe electrode. The probe electrode is located just below the probe top and should be the only piece of metal exposed during the logging process. The surface electronics rectifies the AC voltage between these two electrodes and by using Ohms law the system calculates the resistance between them.

Ohms law: $r = E / I$

r = resistance in ohms;
E = potential in volts;
I = current in amperes.

The SPR measurement is the sum of cable resistance, and the resistance based on the composition of the medium, the cross sectional area and length of the path through the medium. Therefore the single point resistance log is not quantitative.

SPONTANEOUS POTENTIAL

The spontaneous potential, also known as self-potential or SP uses the same electrodes as the SPR measurement. This natural potential, which originates from electrochemical differences between borehole and formation fluid, or electro-kinetic "streaming" is measured by the surface electronics. The circuit measures a DC voltage between the surface electrode and the probe electrode. This potential may be positive and /or negative with respect to the surface electrode.

GAMMA

The natural gamma measurement is made by the use of a Sodium Iodide crystal, which when struck by a gamma ray emits a pulse of light. This pulse of light is then amplified by a Photo multiplier tube, which outputs a current pulse. These pulses are then detected, shaped and transmitted up the cable line. The center of the Sodium Iodide crystal is approximately 20 inches, or 508 mm below the center of the R & SP electrode. The approximate location of the gamma detector is referenced by a band of colored tape on the housing of the probe. The user must maintain this band of tape, or marker, as it may tend to degrade with use of the tool. When a Poly Gamma tool is used in conjunction with the Poly Electric tool, the pulses are sent down to the circuitry in the Poly resistivity and sent up the cable in a digital format.

The Poly Gamma tool is capable of using a power source that is positive or negative with respect to the armor. This gives the tool more flexibility and reduces the risk of damage to the tool due to a wrong switch position or the choice of a wrong probe file. Worthy of note is the crystal detector and the Photo multiplier tube. Both of these devices are fragile at best and are quit costly to replace. Sopris has taken steps to afford these items as much protection as possible. These items are subject to be damaged by sudden shock so when shipping or transporting the tool ensure it has proper protection from vibration and shock to reduce the chances of damage.

2PGA-1000: Specifications:

Power Requirements
DC. voltage + or - at probe top. MIN. 52 VDC MAX. 88 VDC@ 35mA nominal, 100mA start up.

Tool Output
Positive pulse, 1.25uS wide, adjustable if required.

Gamma Detector
NaI (tl) .875" dia X 3.0" long 22.22mm dia. X 76.2mm long

Gamma Detector location
Using the center of the R & SP electrode measure towards the bottom of the tool 20”, or 508 mm.

Measurement Range
0-100K CPS Gamma, Accuracy 1% FS, Resolution 0.02% FS
± 1500 mV SP, Accuracy 1% FS, Resolution 0.02% FS
0-5000 Ohms SPR, Accuracy 1% FS, Resolution 0.02% FS

Operating temperature range
14 to 120 degrees F -10 to 50 degrees C

Pressure rating
2000 PSI 13789 k PASCAL

Dimensions

Length	31.3 inches	79.5 cm	
Diameter	1.63 inches	4.1 cm	with neoprene heat shrink and PVC electrical tape
Weight	7 lbs	3.2 kg	

Installation

Installing the Poly - Gamma and support equipment

Before operating the Poly - Gamma probe, determine if the probe will be used as a stand-alone probe, or if it will be used in conjunction with a Poly Series probe.

Poly - Gamma stand alone mode

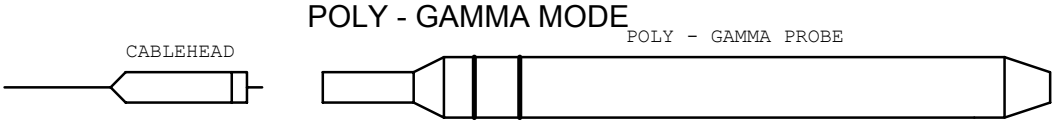
In order to operate the probe in the borehole the lower thread protector must be installed in the bottom of the probe. This thread protector seals out any borehole fluid and shorts two of the rings on the bottom connector of the probe, to send the pulses from the gamma circuitry up the cable line. Remove the thread protector from the probe top then thread the probe top onto the cablehead of the winch assembly. Inspect the o-ring on the cablehead for cuts or abrasions before each use to ensure an adequate seal. If you are going to run a Spontaneous Potential log, the probe top and cablehead, including the spring, must be taped at least 2 feet above the measure electrode. Follow the operating instructions in this manual or in the logging software before logging in regards to this tool.

Poly - Resistivity mode

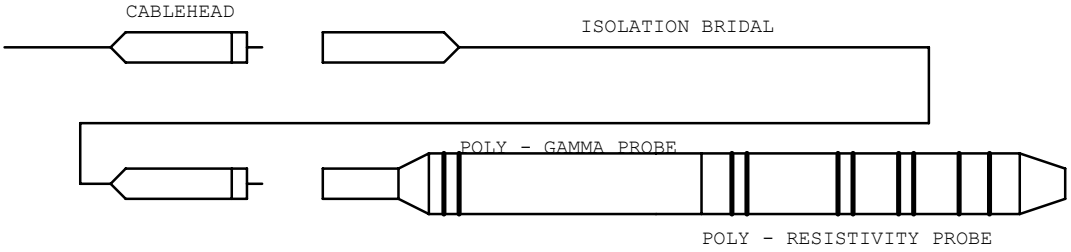
If the Poly - Gamma is to be used in conjunction with the Poly - Resistivity probe you will need to remove the thread protector from the bottom of the Poly - Gamma probe. Then remove the thread protector from the top of the Poly - Resistivity probe. Thread the two probes together and hand tighten this connection. With a roll of PVC electrical tape, cover all exposed metal surfaces at this connection, not the electrode located just below this connection. Next you will need to install the isolation bridal. This bridal comes as an accessory to the Poly - Resistivity probe and must be used in order to achieve a valid measurement. Install the bridal on the cablehead first by only rotating the bridal and not the cablehead. This is easily done by extending the bridal to its full length. Damage to the cablehead may occur if any other methods are used. Next remove the thread protector from the probe top of the Poly - Gamma and thread the probe onto the bridal assembly, rotating only the probe assemblies. Cover all exposed metal surfaces at this connection, but not the electrode, with PVC electrical tape. Follow the operating instructions in the Poly - Resistivity manual or in the logging software before logging.

CONNECTIONS FOR POLY - GAMMA

POLY - GAMMA MODE



POLY - RESISTIVITY MODE



Operating Procedure

Operation

GAMMA-GAMMA MEASUREMENTS

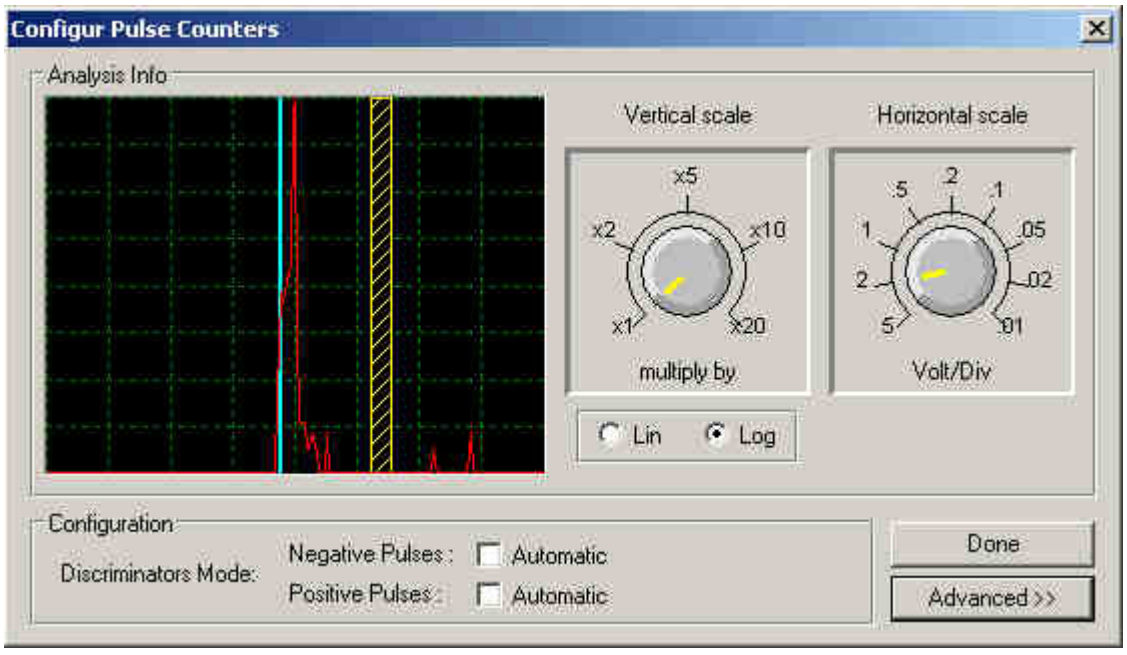
To use the Poly - Gamma with the 2GGA 1000 density sub, you will need to remove the bull nose from the bottom of the probe and install a 2ADM-1020 adapter. This adapter will allow you to connect the GG-375 gamma-gamma source sub or the newer version 2GGA-1000 source sub to the bottom of the 2PGA. The 6" spacer can be used if necessary. Consult Mount Sopris Instrument Company for more information.

USE WITH AN MGX II SYSTEM

To use the Poly - Gamma with the MGX II logging system, make sure the correct tol files have been installed in the C:\MSLOG\tol\current directory. This should be done by using the MSLConfig program, using the ADD Tol Files function. Failure to use the MSLConfig program may result in incorrect power and pulse discriminator settings. ALWAYS use MSLConfig to install tol files when using the MGX II logger. Select the proper tol file (for gamma or SP/SPR mode) and follow the standard MSLog logging procedures.

USE WITH A MATRIX LOGGING SYSTEM

To use the Poly - Gamma with the MATRIX logging system, make sure the correct tol files are installed in the C:\Matrix\tol\current directory. The files are most easily installed using the MTXFileConfig.exe file supplied with the software. The 2PGA files are normally already installed in the correct directory during installation. In the case of the Matrix logger, the power settings are automatically handled by the logger, and depend on the wireline type and length settings entered during logger setup, using the MatrixSettings program. Different wirelines will have specific settings for pulse discrimination for the gamma function. The user can observe the discriminator settings and make changes as necessary using the "Settings" button in the Telemetry window on the dashboard. The pulse discriminator bar should be placed in the middle of the pulse display, as shown in the following figure. Once the correct discriminator setting is made, SAVE the configuration, and the settings will be recorded in the tol file for future use. In general, the settings supplied with the "factory" tol file will not need adjustment.



Performance Checks and Calibrations

Calibrations are performed at the factory and require a basic knowledge and understanding of the tool. In the event the user feels the tool needs to be calibrated it is advisable to speak with a representative of Mount Sopris. Performance checks for the gamma measurement can be made on the surface before logging. With the tool powered on and viewing data on the computer screen a small source of natural gamma radiation can be placed in close proximity to the detector area about 6 inches above the bottom of the probe. An increase in gamma counts will then be observed on the computer screen if the tool is working properly. To verify the electric measurements are working the user may use a calibration box, available from Mount Sopris, which when connected properly to the system, provides different resistance and voltage values for calibration. To check the Electrode of the tool for connection place an Ohmmeter set to read ohms on the center conductor of the probe top. Place the other meter lead on the electrode. The meter should read approximately 620 ohms.

Preventative Maintenance

The 2PGA-1000 Poly - Gamma requires little maintenance other than washing the probe off after each use. ***Never take the probe apart. This probe is very difficult to disassemble and requires special steps to be taken in order to gain access to the inside of the probe without damaging the electronics. If you have read this after attempting to disassemble the probe chances are the probe has experienced damage and will need repaired.*** Inspecting o-rings occasionally and keeping the threads on both ends of the probe clean, will minimize problems in the future. The heart of the gamma section is the Photo multiplier tube and the Sodium Iodide crystal. Both units are very fragile and can be damaged if the probe is dropped or sees very abrupt shock. Take great care while handling or packing the probe for transportation.

Troubleshooting

Problems with the Tool

In the event the tool develops a problem, follow the troubleshooting procedure listed below.
NEVER DIS-ASSEMBLE THE PROBE WITHOUT KNOWLEDGE OF PROCEDURE

GAMMA Problems

No counts from the probe.
1. Are the MGX switches set correctly? **PULSE 2** and **ON** positions.
2. Are the PROBE CURRENT and PROBE POWER LED's on?
3. Is the correct probe file being used? MGX and MGX II versions.
4. Check cable for conductive leakage across the center conductor to ARMOR. (20 Meg MIN.)
5. Is the thread protector installed in the bottom of the probe in the stand-alone mode?
6. Is the logger supplying the correct voltage as specified in this document?
7. If no result from the above , consult Mount Sopris.

SP & SPR Problems

Troubles with electric logs.
1. Check that the MGX or MGX II is connected properly.
2. Ensure surface electrode is placed in the ground and add some water to this area if possible.
3. Check switch setting on the logger, **ELECTRIC** and **ON** positions, and ensure the correct probe file is in use.
4. If no response from the above, remove the probe from the cablehead and with a DVM set to read ohms check the resistance from the center pin in the probe top to the electrode located below the probe top. The meter should read 620 Ohms.
5. While cablehead is disconnected from step 4 check the cable line for leakage from the center conductor to the ARMOR. (20 Meg MIN.)
6. If no result from the above consult Mount Sopris.

Disassembly Instructions

The 2PGA-1000 Poly -Gamma Probe should **never be disassembled** unless service is necessary. This is a very difficult probe to disassemble, and is highly recommended that any service be performed by Mount Sopris or a qualified technician. An M3 socket head cap screw has been placed near the top of the probe to prevent the housing from being accidentally turned off the probe top. If probe must be entered first remove the bull-nose from the bottom of the probe. Use a long M3 screw and anchor it into the center of the slip-ring connector in the bottom of the probe. Pull the slip-ring connector straight out and remove the connector from the rear. Now remove the M3 socket head screw from joint of the housing and probe top. Unscrew the housing from the probe top and slide housing off. Use care with the fragile PMT and crystal inside. Reverse steps to re-assemble.

Schematics

Available upon request

2PGA-1000

Drawing #	500S-2094	50002094A.S01	Title: Power Supply, Disc, Pulse Driver
Drawing #	500S-2094	50002094A.S02	Title: High Voltage Osc. And Dynode Multiplier
Drawing #	500S-2067	50002067A.S01	Title: High Voltage Interface
Drawing #	500K-2074	50002074A.S01	Title: Signal Cable Poly Gamma

Appendix

Suggested QA Procedure

General notes for Quality Assurance are presented here for users who need to utilize these techniques when collecting data. These users will need to periodically calibrate their equipment using equipment whose calibration is traceable to an approved standard. Details of these calibrations must be recorded.

When an instrument is calibrated, records need to be kept regarding the calibration standard(s) used and what was changed on the instrument to calibrate it. Typically, the corrections made to the instrument involve changing constants that are used to scale the raw instrument reading so that the proper value is reported. The constants must be recorded during a calibration procedure. The Mt. Sopris family of Acquire programs records the calibration constants that were used to acquire the data. This aids the QA process, but does not replace the need for recording these constants at the time of calibration. The reason for this is that the length of time since the last calibration is unknown with only this information.

The device providing the standard must be traceable to an accepted standard. Examples of organizations providing standards for measuring instrumentation are: The U. S. National Bureau of Standards; The American Petroleum Institute; and the American Society for Testing Materials. For example, if the voltmeter or the density standard used for calibration is not traceable to an approved organization, such as those listed above, the calibration should not be considered valid. Records should be kept indicating the last time that standard being used for calibration was calibrated or checked against an approved standard. The QA procedure necessary for some programs mandate that the calibration standards be periodically checked against a standard approved by a proper agency.

A QA procedure may dictate that data taken from a given locale be associated with records indicating the exact time and location that the data was collected. The data itself may have to be collected in a certain format to meet requirements. Often, QA procedure specifies that surveys must be repeated and the data from the successive surveys compared. This technique is used to eliminate poor or invalid data.

Casing and Water Factors for 2PGA-1000