Geospace Seismic Recorder (GSR)

USER MANUAL

OYO GEOSPACE

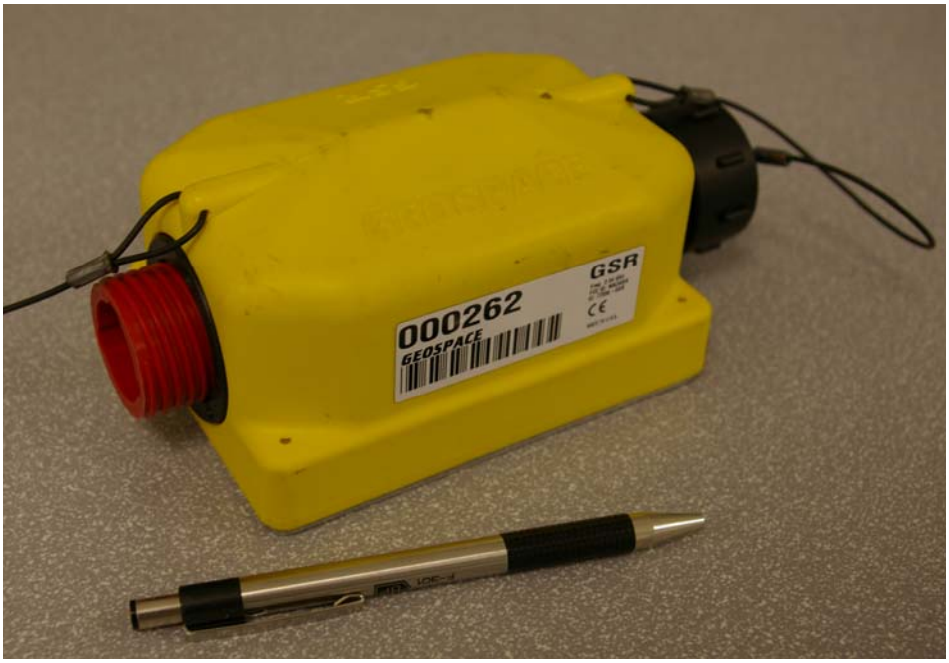
7007 Pinemont

Houston, TX 77040 USA

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Changes or modifications not expressly approved by Oyo Geospace could void the user's authority to operate this equipment.

Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.



GSR MODULE

Deployment

The GSR should be deployed with the metal plate down. This provides sufficient earth grounding and maximum cooling of the unit as well as providing the GPS receiver in the top to the unit with an ideal "view" of the satalite constellation. The seismic sensors should be deployed and plugged into the seismic input connector prior to connection of the battery. The seismic input connector is black on the single channel unit and blue on the multiple channel units. Once the sensors are deployed and attached, connect the battery cable to the red connector. The GSR will immediately begin a power on self test.

The GSR will test all of its internal circuits followed immediately by an impedance test of the seismic sensors. The LED that can be seen from the top of the GSR will flash codes to indicate the GSRs condition. The GSR will then enable the Global Positioning System (GPS) receiver and begin to flash the code that indicates that it is searching for satalites. Within a few seconds the GPS receiver will have sufficient satalite information to obtain a 3 dimensional fix. The flash code will change to indicate this condition and the GSR will now begin to acquire seismic data if it has been programmed to begin recording immediately. See Programming below. After several minutes the internal GSR clock will be sufficiently disciplined and the GPS receiver will be turned off. The flash code will again change to indicate this state. See the flash codes below.

Radio Status Monitoring

A GSR may be connected to a laptop computer and used as a hub to monitor the status of any GSRs within a 50m to 100m radius via a high frequency radio link. In this mode the loptop/hub

monitors and logs status information from all of the GSRs that it communicates with. The laptop stores the GPS location, acquisition status, temperature, battery status and the non-volatile memory status of each GSR. By moving the hub throughout the seismic spread all of the GSRs in the survey may be monitored and logged. This logging may take place during acquisition of seismic data with no adverse effect on the data quality.

Flash Codes

GSR Start-up Error Codes

Critical GSR Error:	LED flashes repeatedly on solid for 1 second followed by off for one second.
Critical Seis Input 1 Error:	LED on solid for 1 second followed by 1 short pulse.
Critical Seis Input 2 Error:	LED on solid for 1 second followed by 2 short pulses.
Critical Seis Input 3 Error:	LED on solid for 1 second followed by 3 short pulses.
Critical Seis Input 4 Error:	LED on solid for 1 second followed by 4 short pulses.
Critical Battery Error:	LED on solid for 1 second followed by 5 short pulses.
Non-Volitile Memory Error:	LED on solid for 1 second followed by 6 short pulses.
Non-Volitile Memory Full:	LED on solid for 1 second followed by 7 short pulses.

GSR Run Time Codes

GPS on but no GPS fix:	One LED flash per second.
GPS on with GPS fix:	Two quick flashes once per second.
Recording with GPS off:	One quick flash each 8 seconds.
Sleeping:	Two quick flashes each 10 seconds.
Running geophone tests:	LED flashes on for 10 ms 5 times per second.

Downloading

The GSR non-volatile memory may be read and cleared by removing the battery connection and inserting the unit into one of the outlets in the GeoReaper. See the GeoReaper User Manual for further instruction.

Programming

The GSR recording parameters such as sample rate, pre-amp gain, record mode, and testing, are programmed and stored in non-volatile memory in the GSR by the GeoReaper. See the GeoReaper User Manual for further instruction.

- Scalability greater than 50,000 channels
- Delivers high resolution with a 24-bit delta-sigma ADC
- Built-in GPS receiver and disciplined clock
- Up to 30 days of continuous recording
- Compatible with explosive, vibratory and impulsive energy sources
- Accepts standard analog sensor inputs
- Has a built-in full resolution test generator
- Available as 1, 2, 3 or 4 channel versions
- Has an LED Status/Deployment State Indicator
- RFID for location/inventory assistance
- Wireless short range communication for status verification

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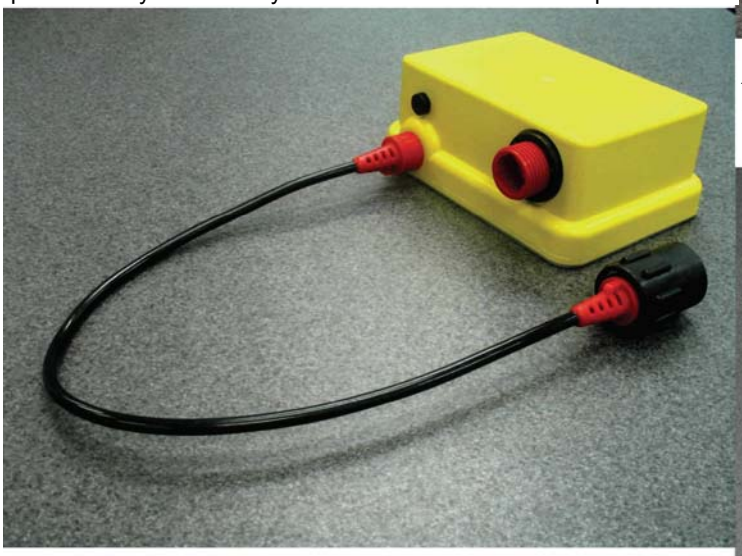
Geospace Seismic Recorder (GSR)

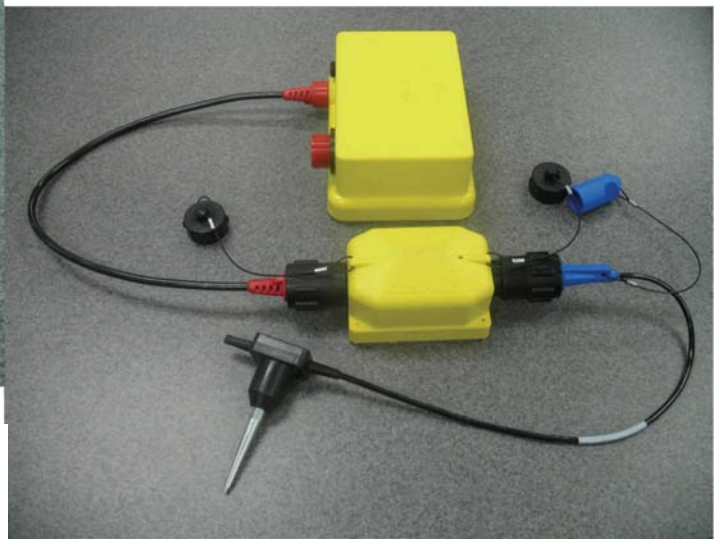
Cable-Free
Autonomous Data Recording

The GSR is designed for cable-free/radio-free seismic data recording. The self-contained unit includes 1 to 4 channels of 24-bit digitization, an integrated/high sensitivity GPS receiver, built-in test signal generator, up to 4 GB per channel of non-volatile solid-state data storage, and a high-speed data port. The unit is housed in a sealed case, with input connector, extended life battery connector/data port connector.

Above: GSR Data Recorder.
Below: GSR unit connected to geophone string and battery unit.



Above: GSR Battery Unit



GSR System Tests

The seismic channel performance and sensor tests can be performed by the GSR System. The user can choose a partial or complete set of tests that can be run in sequence. The user can also choose to display all of the results or only the failures. In the tests described below, the System Software automatically controls the Channel Input Switch Positions and Test Oscillator Settings during the tests. All tests can be run at all sample intervals and preamp gains of the GSR.

- **Harmonic Distortion**
- **Impulse Response**
- **Equivalent Input Noise**
- **Instantaneous System Dynamic Range**
- **Gain Accuracy**
- **Common Mode Rejection**
- **Geophone Impedance and THD**
- **Crossfeed (multi-channel)**

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All specifications subject to change without notice

Geospace Seismic Recorder (GSR)

Features and Specifications

24-bit digital recorder
Built-in GPS and disciplined clock
Built-in full resolution test signal generator
Solid-state flash memory
Scalability greater than 50,000 channels
Greater than 30 days of continuous recording
Compatible with vibratory, explosive and impulsive energy sources.
LED Status/Deployment State Indicator
RFID for location & inventory assistance
Accepts standard analog sensor input
IEEE 802.15.4 wireless status retrieval

- Available as 1,2,3, or 4 channel versions
- 24-bit delta-sigma ADC
- 3 Hz to 1600 Hz freq. response
- <1 µsec. of UTC (GPS clock)
- Up to 4 GBytes per channel flash memory storage
- 12 Volt external battery
- Operating Temperature: -40° C to +85° C
- Humidity: 0 to 100%
- Selectable Gains:
  - X1, X2, X4, X8, X16, X32, X64
    0, 6, 12, 18, 24, 30, 36 dB
- Sample Intervals:
  - 4, 2, 1, .5, .25 milliseconds
- Max Timing Error: 20 µseconds

Max input signal: 1.80 Vrms @ 0 Gain
Total Dynamic Range: 140 dB
System Dynamic Range @ 0dB Gain: 126 dB @ 4 msec SI 124 dB @ 2 msec SI 120 dB @ 1 msec SI 117 dB @ .5 msec SI 106 dB @ .25 msec SI
Equivalent Input Noise @ 2 msec SI: 1.13 µV @ Gain 0 dB .58 µV @ Gain 6 dB .33 µV @ Gain 12 dB .22 µV @ Gain 18 dB .19 µV @ Gain 24 dB .18 µV @ Gain 30 dB .17µV@Gain36dB
Input Impedance: 20 kohms/0.06 µf Difference Mode 205 kohms Common Mode

System Dynamic Range @ 2 msec SI 124 dB @ Gain 0 dB 123 dB @ Gain 6 dB 122 dB @ Gain 12 dB 120 dB @ Gain 18 dB 115 dB @ Gain 24 dB 110 dB @ Gain 30 dB 105 dB @ Gain 36 dB
Total Harmonic Distortion: 0.0005%
Common Mode Rejection: 0.001%
Gain Accuracy: 1%
Anti Alias Filter: Rejection @ Nyquist: 130 dB Frequency @ -3 dB: 0.87 Nyquist Linear or Minimum Phase
Time Standard: <1 ppm
Weight: 2 pounds
Max. Dimension: 3.5"Wx3.0"Hx6.67"L

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GeoRes-XTC GSR Data Management System

The GeoRes-XTC consists of two embedded software modules:

GeoReaper performs pre-deployment parameter programming, i.e. sample rate, pre-amp gain, record mode, testing, etc. and data collection via Ethernet connection to the Data Transfer Module (DTM) and a high speed PC.

GeoMerge allows the system to read and import all three major components of SPS (R, S and X records). It will merge all GSR data into SEG-D or SEG-2 files according to SPS X records (Cross-Reference File, sorted in the same order as the Source 'S' File) and convert all latitude and longitude information into the same coordinates used in the SPS files. These data are then output to the field database (RAID memory) and/or hard media (tape, disk, etc.).

The GeoRes-XTC is compatible with third party generated SPS files.

GeoRes-XTC High Speed Computer

Data Transfer Module (DTM)

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