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GeoWatch

A Newsletter from GeoSys

GeoSys provides Geophysical Measuring Solutions

In this GeoWatch:

Editorial

Dear GeoWatch reader,

The evolution process in the geophysical instrumentation market goes on. More and more, we are faced with specifications which demand the latest commercial products in the marketplace. I can cite the example of Hard Disk capacity in Seismic Equipment. The demand for higher and higher capacity has been increasing continually, reaching a level of around 4 GByte! Now, the availability of such peripheral devices does not mean that automatically they can be used in a seismic equipment. Sometimes I get the impression that one tends to forget firstly, that the seismic equipment will be exposed to vibrations and secondly, that the investment in a seismic equipment is done for a longer term than an investment in a commercial PC.

Another example is the evolution of Modem device. Do you remember the time when you were considered lucky having 2400 Baud instead of 1200 Baud connection? This is not more than, say, 3 years ago! In the meantime the technological advancement has taken off like firing a rocket. Today, we are about to test the 4th generation modems with 33.6 kbp/s speed and ISDN with up to 128 kBit/s is already knocking on the door!

I'm very proud that this tremendous achievement in communication speed can still be supported by our 5-year old GSR design! In the Communications field, too, one seems to forget that the sites where geophysical instruments are remote. They are far away from civilisation and telephone exchange. So, unfortunately, the high speed communication is only between your Computer and Modem. For the speed through the telephone line, often you would be happy (as it was 3 years ago) to be able to use successfully 2400 Baud!

I'm just saying, let's be careful. I like to be motivated and driven by the latest technology, but I feel highly committed to fulfilling requirements of geophysical instrumentation in terms of reliability, robustness (mechanical and electrical) compared to the consumer market.

Solutions can be found for both the issues. Shock resistant hard disks are available! The only point is that they are typically 1 year behind the commercial models in terms of capacity. It's obvious that a hard disk specifications should not just consist a term about it's capacity but should also say something about the vibration and shock resistance.

In terms of the modem my recommendation is to get away from the request of instrument internal modems. Modems are commercial products and therefore not really designed for the geophysical market. If you use external modems you can buy the modem locally, you have for all your different instrument just one modem type which safes you a lot of time you spend in understanding the different modem set-up, and last but not least you can easily, fast and cost effectively replace a modem which is not properly working. GeoSys has for you an additional solution: The modem Protection Circuit. This circuit packs your external, commercial modem into an industrial environment, please read therefore the article in this GeoWatch issue.

GS_ICM: GeoSys' solution for Modem Protection

Features
- Intelligent Modem Protection
- Supports any Modem Type
- Ring detection circuit
- Connects T+T line only during line use
- Disconnects modem from Power line during stand-by
- Increases Instrument autonomy time

The GeoSys Modem Protection circuit protects your Modem efficiently. Besides the standard over voltage protection, the modem connection is controlled by an intelligent logic. Incoming calls are detected by a ring detector which is galvanically isolated to the rest of the modem protection circuit. On an incoming call or on a dial up string from the remote site, the modem is powered up and connected to its T+T lines. Since the connection time is very small compared to the stand-by time, the risk of the modem getting destroyed due to over voltage bursts is drastically reduced.

Generally, if the modem is active also during the stand-by time and powered from your recorder power supply, the system autonomy time is reduced. As the GeoSys GS_ICM Modem Protection circuit has to be powered with a few mA of current, your system autonomy is not reduced.

The GeoSys Modem Protection can be used in any application with the GeoSys/Terra GSR and IDS recorders as well as other products, including those of our competitors!!

Specifications:
- Hold time: 1 minute
- Ring acceptance time: 0.5 s after first ring
- Connection: Modem DB-25, T+T Line, Power Supply, Seismic Instrument RS-232 Line
- Power supply Voltage: 5 VDC / 8 to 16 VDC (jumper selectable)
- Modem Output power: 5 VDC or Modem Power supply Voltage
- Modem Output current: max. 0.5 A
- Stand-by current consumption: 15 mA
- Active current consumption: Modem Power + 15 mA standby current consumption
- Power supply: from standard modem Power supply or from recorder
- Mechanical dimension: 80 x 50 x 120 mm
- Operating temperature range: - 20 °C to 70 °C

*Specifications are subject to change without notice

Technical Corner

Edited by: Lukas Gätzi

The new GSR-18

The compact GSR-18 Digital Accelerograph is the latest addition to the GeoSys range. Although small in size (and price, too!), the GSR-18 is a big-performer as it can be seen from its specifications and features. The design is truly modular which facilitates incorporation of a wide range of optional accessories. The GSR-18 supports more than 100 second Pre-Event-Time. Sensor, Modem, GPS, up to 10 MByte Flash Memory on Board, PC Card, Battery & Charger can all be mounted internally making the GSR-18 the most versatile, power-packed and robust Strong Motion Recorder in the world. We provide a glimpse of its unlimited capabilities through the Block Diagram & Features List below:

Small Size / Large Memory:
- 228 x 330 x 184 mm, 6.5 kg
- 2 MByte standard Memory
- Up to 3 minutes Pre-Event Time

Rugged:
- Cast Aluminium with hinged lid; O-ring sealed

Communications:
- 4 LED operational indicators; Programmable Scrolling LCD
  Optional:
  - 28.8 Modem; Spread Spectrum Radio Modem
  - UHF & VHF Radio modem
  - Total of 6 RS-232 Lines

Low Power Consumption:
- 150 mA @ 12 V
- One 12V 7 Ah battery @ 70% utilisation 32 hrs. autonomy
- External or Internal power supply and battery charger
  Optional:
  - Internal charger can charge external battery
  - Solar panel battery charging

Rich in Features and Options:
- SSA-320 Accelerometer ± 0.25, ± 0.5, ± 1, ± 2, ± 4 g
- Internal sensor single point mounting
- Up to 10 MByte on Board Flash
- 4, 10, 20, 40 MByte PC Card
- GPS with antenna cable
  (RS-232 / RS-485 / 5 V and 12 V Supply)
- Internal clock 0.3 ppm standard
- 4 User selectable Alarm Outputs

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Cross Axis Sensitivity

The measurement of acceleration in the z-axis should not have any impact from x or y axis. If the resulting acceleration is in 45° direction to x, y, and z axis, one should measure 1 / SQRT(2) = 0.707107 g in each axis. The bad news is that no sensor in the marketplace shows this theoretical ideal. The impact of the perpendicular axis on the axis of interest is called 'cross axis sensitivity' and is expressed in g/g. A value of 0.02 g/g seems to be the standard in this field. The calculation example shows, that with this cross axis sensitivity your z measurement is not just the value of the z direction; but 0.02 times the value of the x-axis and the y-axis added to it. Your measured acceleration can have, therefore, an error of 0.02 + 0.02 = 0.04 g/g (i.e. 4%)!

The good news is that the SSA-320 Force Balance Accelerometer of GeoSys / Terra Technology has a cross axis sensitivity which is as low as 0.0005 g/g. The worst case total error in a measured value is as low as 0.001 g/g (i.e. 0.1%), which fits excellently in the modern trend of higher accuracy recording.

Interview with GeoMan

GeoWatch: Hello, who are you?
GeoMan: *I'm GeoMan*
GeoWatch: What brings you here?
GeoMan: *By accident I had a chance to see the new GeoSys Product catalogue showing all the excellent products. I read about the highly dedicated and talented individuals working in GeoSys and in alliance with Terra Technology having the tenet to provide 'geophysical measuring solutions' to the customers' problems. I got impressed and decided to help these smart guys in reaching their goal.*
GeoWatch: Thanks a lot GeoMan but where are you coming from?
GeoMan*: Well, I don't like to talk very much about this! … please do not ask me standard things like age, weight…!*
GeoWatch: You are making it difficult for us, what should we ask you then? What do you intend to do here?
GeoMan: *See, I do have so many ideas and visions as you guys. So, the best thing would be to let me start working. One of my first tasks is definitely make such interviews in the next issues of GeoWatch - what do you think?*
GeoWatch: Fine, we agree with you. In fact, we are very happy about this! **GeoMan**, welcome here in GeoSys, feel comfortable and good luck!

Digital Drum Recorder:

In Seismology, an old established way of recording the signals produced by a Seismometer is using a Drum Recorder. The seismometer is a transducer which converts the ground motion (i.e. the movement of the earth's surface) into an electrical signal. These signals are continuously varying or 'analog' in nature. In an analog drum recorder, these are 'amplified' and 'filtered' using electronic circuitry, before finally being fed to a 'pen motor amplifier'. The 'pen' or 'stylus' makes impressions on a 'smoked' paper which is wrapped around a 'rotating drum'. Thus, a record of seismic activity spread over a user selectable period of few hours to few days, can be obtained.

In addition to the above basic functions, there are many features such as easy field portability, DC-powered (battery) operation, high precision timing system, simple set-up procedure, which make these recorders a 'reliable' and 'faithful' seismic data acquisition system. Over the years, the popularity of these analog drum recorders has not diminished due to the fact that the earthquakes can be 'seen' while being 'recorded', day after day.

However, analog recorders have serious limitations. Firstly, from the recorded seismic events, the scientist can only find out the 'onset time', 'duration' and 'amplitude' of the earthquake. But the accuracy up to milliseconds is ruled out. Secondly, and most importantly, the data cannot be processed on a computer unless it is digitised. Using digitisers to convert the paper records into samples for computer processing is a laborious and error-prone method.

With the advent of 'digital' technology, seismic recorders based on state-of-the-art electronic components have out-performed the analog ones in all respects. The analog signals generated by sensors are sampled and converted into digital signals using A/D converters with ultra-high resolution. The digitised data are then filtered/processed and stored in 'memories' of various forms and capacities. The 'micro-controller', which is the 'brain' of the system, intelligently monitors and 'detects' events for recording, thus eliminating spurious data to a large extent. The recorder can be set for automatic, unattended operation using a portable 'notebook' computer and user-friendly software. Due to the absence of any moving part, the inanimate functioning makes the unit look like a 'black box'. However, an 'LCD window', to display parameters, and a couple of LEDs, as status indicators, provide the 'living signs' to the operator. The information stored in the memory can be 'seen' on the screen of a PC simply by connecting a cable to the recorder and running a computer program.

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More advanced features of such digital systems include highly accurate timing based on 'GPS', data transmission from field to central station over telephone lines or via 'telemetry', auto calibration and remote interrogation, multi-channel recording etc. It is now routine to run a network comprising a number of stations and acquire/process digital data in almost 'real time', 'on-line' mode. With the help of advanced software, it is possible to re-plot the digitised earthquakes and display the waveforms, as they would appear on drum recorder. With software tools to 'scale', 'filter' and 'transform' the waveforms, the job of the seismologists is greatly simplified in evaluating data. Also, standardised powerful software packages available from the public domain and coming from pool of scientific resources help the seismologist in interpretation and derivation of many and important parameters. The evolution of seismic instrumentation based on digital technology, which has been found to be reliable and by many orders of magnitude more powerful, is a real boon to the scientists.

However, in spite of all these advantages of state-of-the-art digital technology, a feature was missing. The analog drum recorders produce a chart where, at a glance, seismic events which occurred during a specified period can be viewed. Whereas in digital recorders, the events are stored serially and one has to browse through the files for picking up data of real interest. The correlation of events over a period of time is not so straightforward.

Now, here comes an ingenious solution! The software-based solution collects seismic event data over a time window and print out the waveforms on a paper! It is a revolutionary concept to combine the best of both the worlds. The data files created by the digital recorder can be processed individually for independent analysis whenever required, but this special software produces a printout of events logged in a specific time slot, selectable in hours or days, as a 'quick look' facility.

There are many advantages: Firstly, you do not need as many recorders as there are sensors. The same software can plot the data from any number of channels. If sensor signals are being transmitted over Telemetry links to a Central Station, then the Central computer system can easily be programmed to print out the events every 12/24/48…72 hours! Secondly, the events are stored in Digital format already, which means that the main events of interest, once they are identified from the periodic printout, can be further processed without any delay. This is like having your cake and eating it, too!

News from the Representatives

Our collaboration with Pizzi Company - Florence is spreading its wings! We have reached as far as Syria, where we offer our activities jointly and propose static and dynamic monitoring systems of absolute reliability.

This formidable combination allows us to present ourselves as possible interlocutors able to solve all the problems concerning geophysical, structural and environmental monitoring. The combined experience of GeoSys and Pizzi will be once more synonymous with security, professionalism and reliability.

Our local collaborators will put at your disposal qualified and competent technicians, warm premises, prompt and dynamic commercial service. We assure you that they will be able to answer your questions by proposing the most suitable solutions for each specific problem.

This important liaison is guaranteed by our new representative:

Mr. Imad Otahbashi
CB Center Company
P.O. Box 31566
Damascus Syria

Tel./Fax: +963 11 777 98 73

GeoSys success in the Nuclear Power Market

GNC-CR Systems for Nuclear Power Plant in Tihange, Belgium and Zorita, Spain have been delivered and installed and a further installation in Doel, Belgium is scheduled for autumn 1997.
The systems are fully seismically qualified with CE approval and running under the Windows 95 or NT based "GeoView" software recently developed by GeoSys. One of the highlights of the software is the 'Automatic Seismic Event Qualification', wherein an intelligent algorithm automatically determines whether a recorded event is a seismic event or a human induced event.

Relationship with Bergen University grows further…

A close relationship established some time ago with Bergen University has been strengthened after the visit of Prof. Dr. Jens Havskov and Mr. Terje Utheim of UB to GeoSys Head Quarters in Switzerland, for a 2-day Technical Co-ordination meeting. The important decisions taken were: SEISAN getting a Windows Entry, SEISLOG reading GSR data, GSR producing '1 second time stamped' telemetry data packages for optimum interface with SEISLOG.

New General Catalogue

GeoSys recently brought out their new short-form catalogue. It shows the large variety of GeoSys's products and provides the customer with a brief company profile. If you would like to have a copy of it, please contact GeoSys or its nearest representative.

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