# SYTGEM geotechnical and microseismic monitoring system

Operational monitoring of geohazards must consider not only early warnings but also worsening and triggering factors. This leads to monitor numerous different physical parameters related one to each other through both transitory and long term physical interactions for better in-sight and forecast. Moreover, crisis management situations may call for the monitoring of the most exposed structures at risk. Such a **global monitoring** approach calls clearly for advanced systems featuring high level of integration, flexibility and connectivity.

The SYTGEM-vlp is a multi-parameter multi-frequency monitoring unit with very low power technology for easy deployment in adverse field conditions. It includes **smart data acquisition protocols** and networking capabilities for large scale projects. Each unit may be connected easily to Bus cabled and/or radio linked SYTGEO$^®$ receivers, RGPS SYTGEO$^®$ receivers and SYTMIS$^®$ microseismic and acoustic probes.
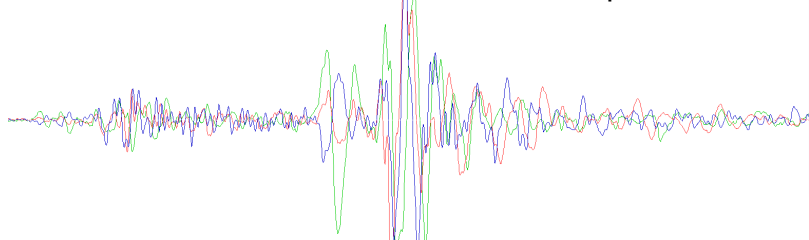
The SYTGEM-vlp monitoring unit features unique remote administration functions and is ready for Cloud monitoring technology.

Highlights

Very Low Power technology

Multi-parameter-frequency

Smart acquisition protocols

High level connectivity

Ready for Cloud Monitoring

Fields of application

Mines and quarries

Geological storage

Enhanced geothermal systems

Dams and embankments

Landslides and rockfalls

INE-RIS

controlling risks for sustainable development

SYTGEM-vlp
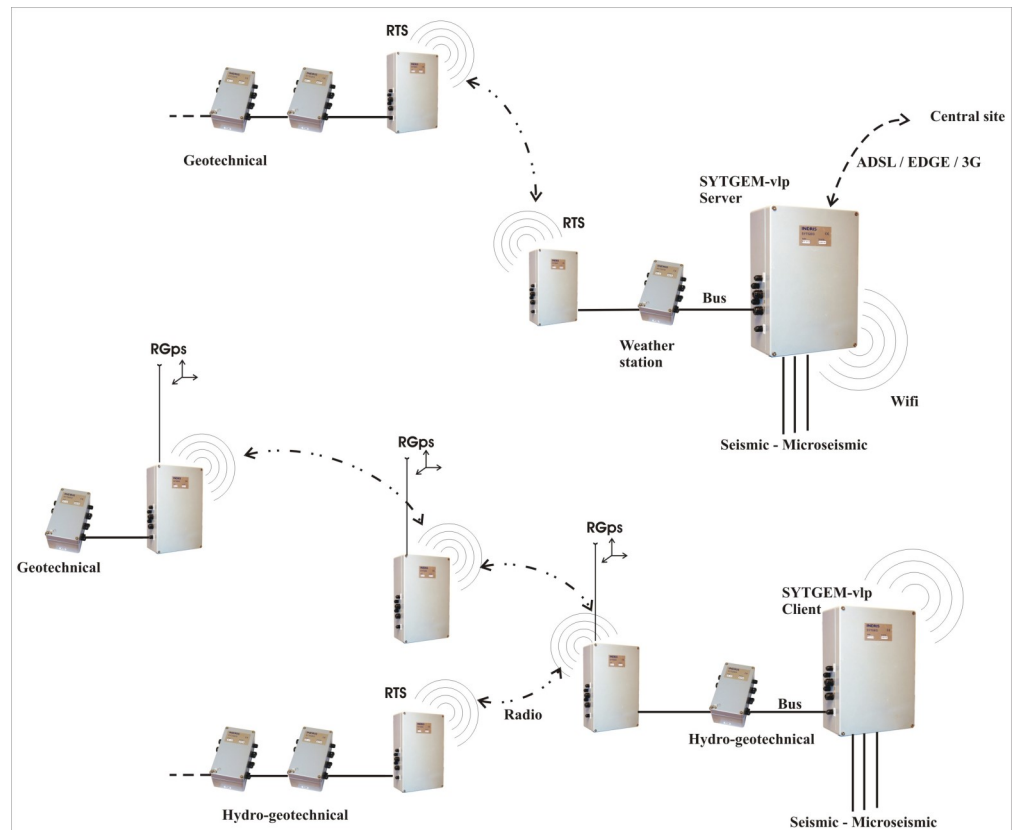
Geotechnical and Microseismic Monitoring System

SYTGEM-vlp overview :

♦ Motherboard with ARM core phyCORE PXA270 processor, 32 bits, running at 520 MHz, Linux based OS, SYTGEOscop-vlp embedded application, large memory with : 32 Mo flash, 64 Mo RAM, 1 Go with SD card dedicated for data

♦ 4x20 characters LCD screen interface with 3 press buttons

♦ Serial bus interface for controlling SYTGEO receivers and synchronizing SYTGEM-vlp units

♦ I/O board combining optically coupled inputs and relay outputs

Optional :

♦ Packs of ion-lithium or rechargeable lead batteries

♦ Fast microseismic acquisition board up to 150 kHz for 8 channels, DA : 16 bits

♦ GPS timing device

♦ 1 to 4 SYTGEO receiver boards mounted inside

♦ Edge/3G and Wifi b modules

Architecture scheme of a monitoring / early-warning system based on a pair of SYTGEM-vlp units, each connected to SYTGEO receivers through cable bus and RTS / RGps radio transmitters

CENARIS Centre National de Surveillance des Risques du Sol et du Sous-Sol

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maîtriser le risque
pour un développement durable

Multi-parameter monitoring capabilities

Hydro-geotechnical - Meteorological measurements

Cable and/or radio connection of 1 to 15 R4, RP, RC and RM SYTGEO receivers to monitor more than one hundred sensors related to: stresses, displacements, strains, inclinations, forces, pressures, temperatures, levels, flows, directions, pluviometry, visibility, etc .

Total acquisition time varies from a few seconds to tens of minutes, depending of the topology, the numbers of receivers and sensors installed.

GPS-RTK Geodesic measurements

Radio link of a permanent network of 2 to 15 GPS-RTK sensors, composed of 2 to 15 SYTGEO RGps receivers, one as reference considered at fixed location, others located for real-time 3D displacement measurements.

Average acquisition time per GPS-RTK sensor ranges from 15 to 30 min depending on local conditions and expected accuracy.

SYTGEO RGps receiver is based on SYTGEO RTS technology and Magellan bifrequency GPS sensor unit.

Seismic - microseismic - acoustic measurements

♦ 8 differential channels with 16 bits AD conversion

♦ Output voltage to seismic probes : ±12V

♦ Input voltage amplitude : ±5V

♦ Commutable bandwidth at –3dB : 0,1Hz to 1kHz or 0,1Hz to 5kHz

♦ Signal accuracy : ±0,5% à 400Hz, noise level : < ±1mV

♦ Selectable sampling frequency : 1 kHz à 150Khz

♦ Multi-criteria automatic triggering, automatic adjustable recording time length

♦ Automatic activation of calibrated signal from seismic probes (depending of configuration and options) allowing complete test of all seismic channels and correct functioning of monitoring unit .

Detailed specifications

Interface

♦ 4x20 characters LCD screen interface with 3 press buttons

♦ Activation of functions, display of operational indicators and status variables

Connectivity

♦ 1 fast Ethernet connection (10/100 Mbp)

♦ 3 USB host connections, data file transfer on USB key

♦ 2 asynchronous serial ports (RS232) : 1 SUBD 9pts for 3G modem and 1 for cable link to other SYTGEM-vlp unit (HE10 board to board connector)

♦ Edge/3G and Wifi b modules (optional)

Time synchronization

♦ Resolution 1ms, time accuracy ± 2min per month, GPS timing device optional

♦ Synchronization accuracy between interconnected SYTGEM-vlp < 2ms

Input - output board

♦ 8 bistable relay outputs, capacity of 2A with 30Vdc or 0,5A with 125Vac. Common, Open and Close contacts are isolated to control outer automates and processes

♦ 8 optically isolated inputs with common reference, polarized at 3V/0,5mA, for software driven automatic triggering of data acquisition cycle or shift in monitoring mode from : Normal ↔ Vigilance ↔ Alarm ↔ Normal

Main auto-diagnosis parameters

♦ Temperatures, voltages on bus cable, power batteries and external source, remaining battery charge

♦ No responding SYTGEO receiver, sensor flaw

♦ Seismic Autotest calibrated signal

♦ Data storage memory availability

SYTGEM-vlp

Geotechnical and Microseismic Monitoring System

Remote control

SYTGEM-vlp monitoring unit is interactively updated, parameterized and controlled through :

♦ local Ethernet / Wifi connection with a laptop equipped with SYTGEOscop application for Windows

♦ over-the-air across the internet from central site with automatic and full manual remote control of most functions and parameters : auto-diagnosis, reset, data transfer, data acquisition mode, triggering parameters, I/O control, software update

Data acquisition and transfer

♦ CAPA protocol - dynamic Coupling of Active and Passive Acquisition - enhances considerably the monitoring of transient processes

♦ User-defined Vigilance and Alert variables improves the accuracy of monitoring whenever necessary, with potential triggering events or early signs of instability, based on GAMA protocol - Automatic Management of Acquisition Modes - Normal, Vigilance, and Alarm

♦ Periodic data transfer with self-adjustment of time intervals following monitoring mode

Electrical specifications

In autonomous installation, pack of 18V nominal batteries. External voltage supply : from 8V to 32V following configuration of the monitoring system. Indicative power required min./ave./max. during data acquisition 0.75W/1W/2W, during remote control or data transfer mode < 4W.

This product complies to : 73/23/CEE low voltage directive , electrostatic discharges : EN 61000-4-2 (06/95) + A1 (10/98), surge immunity EN 61000-4-5 (06/95), radiated and conducted electromagnetic fields EN 55022 (04/01) class B, radiofrequencies EN 61000-4-3 (02/95) EN 61000-4-6 (02/97), immunity to fast transients EN 61000-4-4 (06/95).

Operating and storage temperatures for standard configurations

♦ operating : –20°C à +60°C, storage : –25°C à +75°C

♦ IP66 enclosure closed, IP13 when opened

Enclosure description

♦ Polyester enclosure, 2 key locks, Internal caution markings

♦ 20 cable glands for cable with ϕ from 4 to 18 mm, connector block for 1,5mm² max.

♦ Dimensions in cm : H = 95, l = 64, p = 30

♦ Indicative weight : 27Kg (without battery)

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For more information and custom applications, please contact us.

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