

# ÆMISSION

Micro-Seismic and Structural Monitoring 

## Structural or seismic monitoring



  
**LUNITEK**  
**SEISMIC AND STRUCTURAL MONITORING**





# Æmission



**Æmission** is an eight channel datalogger for acoustic emission waves.

It can sample data at 1.25MS/s@18bit or at 5MS/s@16bit.

Piezo-ceramic sensors can be connected directly to the instrument without any external conditioner.

An internal high performance FPGA performs real-time analysis of the data stream coming from the ADCs and extracts the parametric data.

**Æmission** share the same form factor as **ATLAS!**

## **How Acoustic Emission technique works?**

**Acoustic Emission (AE)** is the phenomenon of radiating acoustic waves in solids that occurs when a material undergoes irreversible changes in its internal structure. This is due to the rapid release of localized stress energy. Acoustic Emissions can be detected in a frequency range from few KHz up to 100Mhz, but most of the released energy is from 50KHz to 1 MHz.

Thanks to **AE** technique it is possible to localize the source of the emitting event.

**Lunitek** has been working in this field in close collaboration with the **Polytechnic University of Turin** since 2008.

Professors from Structural Department (Carpinteri, Lacidogna, Bertetto, Niccolini) worked with us to transfer their know-how and to design a cutting-edge technology product.

All these efforts have led to the **Æmission** an 8-channel fast-sampling datalogger with a parametric processing of the acquired data.



### Applications:

- Structural monitoring and surveys
- Post-seismic damage analysis
- Quarry front monitoring

### Configuration:

- Web interface

### Inputs and connection:

- 3 available versions, with 4, 8, 12 or 16 input channels
- TNC connectors
- External Piezo- ceramic sensor

### Analog/Digital section:

- Sample rate:  
1.25MS/s @18bit or  
5MS/s@16bit

### Acoustic emission event trigger:

- Threshold trigger independent for each channel
- Automatic extraction of acoustic emission parameters
- $\beta_t$  and b-value calculus

### Memory management:

- "Industrial Grade" mass storage 32GB or 64GB
- EXT4 file system

### CPU:

- ARM processor
- RAM 128 / 256 MB
- Linux Embedded operating system

### Synchronization:

- Absolute Time UTC through high sensitive integrated GPS receiver (suitable for indoor use as well)
- Accuracy in GPS signal loss condition:  
 $\pm 1$  ppm (32 s/year)
- Accuracy with GPS signal:  
 $<1$   $\mu$ S
- GPS receiver: -167 dBm sensitivity, 72 channels simultaneous reception of GPS, GLONASS, BeiDou and QZSS

### Communication:

- Local network interface via Ethernet cable or WiFi
- SOFT AP function
- Compatibility with following remote communication interfaces: ADSL, HDSL, GSM/GPRS/EDGE/UMTS/HSPA, satellite modem. Internal 3.5 G modem option
- Data download through SCP protocol based program or via web interface
- Compatibility with VPN OpenVPN type or with IPSec (through external router)
- Alarms management towards remote monitoring server
- Remote software updating (local network or via internet)
- Connection and management on remote servers

### Network interconnection:

- Multiple units can be connected to the local network (Ethernet cable or

WiFi) in order to consider them as a single multi-channel instrument

- One unit acts as "MASTER" and collects all data coming from the other "SLAVE" units. The MASTER unit also "merges" all those data in one single file

### Power supply section:

- External power with AC/DC adapter (9 ÷ 28 Vdc)
- Power consumption  $< 10$  W@8 channels
- Back-up LiPO battery, autonomy  $> 8$  hours
- Energy balance controlled by microprocessor
- Remote alarms management in case of blackout
- External battery pack and solar panel options

### Operating conditions:

- Operating temperature range without battery:  $-40 + 85^{\circ}\text{C}$  \*
- Storage temperature range:  $-40 + 85^{\circ}\text{C}$

\*LiPo batteries can be charged in the range  $0 + 45^{\circ}\text{C}$  while discharge is allowed in the range of  $-20 + 70^{\circ}\text{C}$ . If the temperature is out of range, the LiPo battery will be inhibited by the electronics

### Mechanical characteristics:

- Anodized aluminum case (SAE 316 steel option)
- Protection grade IP68
- Dimensions: 17 x 13 x 13 cm
- Weight:  $\approx 2.5$  Kg



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## What is MONFRON?

**MONFRON** is the acronym of "Monitoraggio Fronte di cava" which translates as "Front of Quarry Monitoring system".



This is a large project, which was presented to the Tuscany Region in 2017. The project was funded in January 2018 and sees Lunitek as the lead company, together with **Santucci Group**, the quarry owner, and **ApiAn** the rock climbing organisation.

The project idea is to prevent the sudden and unexpected rockslide falling on quarry workers. Prevention cannot be carried out using traditional instruments for geophysicist (accelerometers, velocimeters, GNSS or laser scanners) because, by the time these types of systems trigger an alert, in most cases, it is already too late, and the rockslide cannot be stopped.

**Lunitek** presented a proposal for monitoring by employing an **Acoustic Emission (AE)** technique over a period of 18 months.

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