ELPROMA

FOSREM

A PHOTONIC SEISMOMETER







ELPROMA ELECTRONICS

FOSREM

FOR SEISMOLOGY STRUCTURES ENERGY EXPLORATION DEFENCE SPACE

3-axis Fibre-Optic
Rotational Seismometer



50 nrad/s / √Hz	**0.01–100** Hz	**1000** Hz	**>166** dB
SENSITIVITY	FLAT FREQUENCY BAND	DATA OUTPUT RATE	DYNAMIC RANGE

SUMMARY

FOSREM is a 3-axis, ultra-precise photonic loop interferometer that measures rotation directly against an inertial frame of reference, using the Sagnac effect in three mutually orthogonal fibre loops. With no moving inertial mass and PTP timing, it captures the rotational components of the seismic wavefield, completing a full 6DoF observation alongside classical translational seismometers.

CAPABILITIES AT A GLANCE

SENSING

- 3 orthogonal (XYZ) Sagnac fibre loops
- Absolute rotation measurement
- Zero moving parts

TIMING & DATA

- PTP (IEEE 1588) timing
- 1000 Hz output
- miniSEED over Ethernet (TCP/UDP)

ROBUSTNESS

- IP66 field enclosure
- No acceleration or pressure susceptibility
- Optional mobile router PCU2
- Optional backup battery PSU

PERFORMANCE

- Dynamic range 50 nrad/s – 10 rad/s
- Settling time < 1 min

✓ APPLICATIONS

- ✓ **Rotational seismology**: recording rotational components of seismic waves, supporting early-warning systems
- ✓ **Passive resource exploration**: non-invasive imaging of geological structures via synchronised FOS networks (FOM-MEM)
- ✓ **Structural health monitoring**: torsional vibration of wind turbines, bridges, towers, tunnels and large machines
- ✓ **Security & defence**: long-range detection and classification of man-made events such as detonations and heavy transport

SENSOR PERFORMANCE

Sensitivity	50 $\frac{\text{nrad/s}}{\sqrt{\text{Hz}}}$ (ARW-based)
Passband	0.01–100 Hz
Settling time	< 1 minute

OPERATION RANGE

Operating temp.	−10 °C to +50 °C
Storage temp.	−40 °C to +80 °C
Max. rotation	10 rad/s
Dynamic range	>166 dB (50 nrad/s to 10 rad/s)
Tilt range	any
Acceleration	no susceptibility
Pressure	no susceptibility

INTERFACE

Protocol	Gigabit Ethernet (RJ45), PTP required[1], VPN support
Output	Web-based real-time data visualization; SeedLink data streaming
Data format	miniSEED (1 ms time resolution), RAW + customized converter
Output rate	1 kSPS / resampling capability
Storage	256 GB (approx. 30 days of miniSEED)
Power supply	PoE+ (IEEE 802.3at minimum)[2]
Consumption	approx. 22 W
MMI	web-based interface for configuration and data monitoring

[1] PTP (IEEE 1588) with hardware timestamping; timing accuracy depends on PTP signal quality.
[2] PoE+ requires an IEEE 802.3at-compatible switch.

PHYSICAL CHARACTERISTICS

Ingress	IP66 (suitable for outdoor use)
Dimensions	380 (L) × 321 (W) × 320 (H) mm
Weight	approx. 20 kg

PCU2

FOS6-dedicated mobile router with integrated PTP time server and PoE+, providing the components required for FOS6 operation



CAPABILITIES

GNSS	GPS, GLONASS, Galileo, QZSS
Wi-Fi	Dual-band (2.4 GHz and 5 GHz)
Synchronization	IEEE 1588 PTP (hardware timestamping), GNSS-based
LTE modem	Two SIM slots with selectable active SIM
Gigabit Ethernet switch	1× WAN, 2× LAN, 1× dedicated FOS6 port

POWER SUPPLY

Input voltage	+12 V to +24 V DC
PoE output	PoE+ (IEEE 802.3at)
Consumption	approx. 30 W (including FOS6)

PHYSICAL & ENVIRONMENTAL

Ingress	IP66 (suitable for outdoor use)
Operating temp.	−10 °C to +50 °C
Storage temp.	−40 °C to +80 °C
Dimensions	320 (L) × 442 (W) × 181 (H) mm
Weight	approx. 3 kg

PSU

Optional. Battery-backed power supply for the FOS6 + PCU2 system.



BATTERY

Type	Li-Ion / $LiFePO_4$
Capacity	100 Ah (>24h backup runtime)
Self-discharge	< 4 % monthly
Charging / working temp.	−15 °C to +45 °C

POWER SUPPLY

Input voltage	+9 V to +35 V DC
Max. charging input current	8 A
Output voltage	13.2 ± 1 V

PHYSICAL & ENVIRONMENTAL

Ingress	IP66 (suitable for outdoor use)
Operating temp.	−10 °C to +50 °C
Storage temp.	−40 °C to +80 °C
Dimensions	184 (L) × 293 (W) × 92 (H) mm
Weight	approx. 17.5 kg

Use cases

Six sectors that use FOSREM rotation data, and what it does in each.

STRUCTURAL HEALTH MONITORING



For operators of bridges, viaducts, tall buildings and wind farms. Fatigue and concrete cracks change a structure's torsional stiffness, often unseen until failure. FOSREM tracks torsional modes and natural frequencies, and detects structural change from rotation caused by wind or traffic.

VULCANOLOGY



For institutes of geophysics and oceanography studying submarine volcanism, ocean currents rock seabed sensors, rendering horizontal components useless. FOSREM's optical rotation data removes tilt-induced gravity noise, boosting horizontal SNR. With 3C translational data, it determines wave direction without multi-sensor arrays.

EXPLORATION GEOPHYSICS



Oil, gas and ore survey teams lose reflected waves in noise and incorrectly detect water and wave direction. Rotation data shows deeper layers and isolates S-waves, which respond to fluids in rock, before you drill. As a 6-DOF sensor, FOSREM finds wave azimuth and velocity on its own, so a survey needs fewer sensors.

SEAFLOOR SEISMOLOGY



Ocean institutes and offshore operators contend with tilt: currents rock seabed sensors, and conventional seismometers read it as ground motion. FOSREM rotation data removes tilt noise from the translational record. With 3C translation it forms a 6-C point array that finds wave direction from one station.

SECURITY AND DEFENCE



Border and defence agencies need to locate illegal blasts and tunnelling. Nearby detonations clip conventional sensors, and EMI jams them. FOSREM records without clipping, is insensitive to EMI and radiation, and tells an explosion from an earthquake. It runs autonomously, with remote control over internet or GSM.

RESEARCH



Universities and seismic observatories record only translation with 3C seismology, and resolving source dynamics or back-azimuth has meant large synchronised arrays. Paired with a 3D broadband seismometer, FOSREM turns a single site into a 6-C point array that separates P, S, Love and Rayleigh waves.

THE PRECISION OF LIGHT AT YOUR DISPOSAL



Anna Nikiel

Business Development Manager

+48 723 679 797

a.nikiel@elpromaelectronics.com

+48 22 7517680

sales@elpromaelectronics.com

elpromaelectronics.com

Elproma Electronics Sp. z o.o., ul. Duńska 2A, 05-152 Czosnów, PL
VAT PL5260208680