güralp

# MARIS

## OCEAN BOTTOM SEISMOMETER SUITABLE FOR INSERTION INTO THE SEAFLOOR FOR EXCEPTIONAL DATA QUALITY

The Maris, has a slim-line silhouette designed to be pushed or cored into the seafloor.

### KEY FEATURES

> 120 s to 200 Hz response with user-selectable long-period corner within this range
> Suitable for depths of up to 3,000 m or 9,854 ft,
> Operational at any angle with ultra slim 60 mm diameter enclosure
> Choose either acceleration or velocity response
> STA/LTA and threshold triggering

### APPLICATIONS

> Local, regional and global seismic monitoring
> Monitoring of sub-sea hazards
> Permanent reservoir monitoring (PRM)
> Permanent ocean observatories
> Under-water borehole

# MARIS OBS

Housed in titanium or stainless steel, the Maris houses a triaxial broadband digital sensor that is fully operational at any angle to support versatile installations.

At just 60 mm diameter, the Maris is designed to be pushed or cored into the seafloor to minimise ambient noise for exceptional data quality and increased trawl resistance in shallower deployments.

The Maris system is designed for depths of up to 3,000 m (9,843 ft) although deeper installations can be accommodated. The system, which includes the Minimus digitiser, can be designed for a single instrument or a string of up to eight instruments. The option of a fibre interface enables cables of several kilometers to be employed.

The Minimus delivers data over Ethernet direct to the cabling system and can be housed either in a seperate sub-surface vessel or in a surface box where suitable infrastructure is available, such as a rig.

The Minimus also offers a low-latency mode running causal filters alongside traditional acausal filters for earthquake early warning applications.

For underwater borehole installations, the standard output can be exchanged for an optical fibre output. This allows longer cable lengths to be used between the Maris instrument and the Minimus digitiser. These kinds of installations will require a higher voltage power supply.

Record the full spectrum of seismic events for accurate event cataloguing.

Compared to short-period geophones, the Maris' active feedback sensor ensures consistent amplitude and phase response across the bandwidth of the instrument.

Low self-noise and a wide dynamic range allow accurate detection of small seismic events and recording of strong shaking in one instrument.

The ultra-wide frequency response between 120 s and 200 Hz makes the Maris ideal for seismic monitoring at all scales. For increased flexibility, the long-period corner can be remotely configured to suit the deployment environment.

An internal magnetometer and MEMS based accelerometer work together to provide tilt and horizontal orientation. The appropriate correction can be applied to deliver high-quality waveforms with no need for post-processing.

## Key features

- Triaxial orthogonal (ZNE) instrument with high cross-axis rejection (> 65 dB)
- State-of-the-art seismic sensor allows operation over a full tilt range of ±180° by automatically centring the mass
- Titanium grade 5 casing to protect the instrument against corrosion and water pressure for depths of up to 3,000 m (9,843 ft) (deeper options are available)
- 120 s to 200 Hz with user-selectable long-period corner within this range
- ROV operable connectors make it possible to string multiple units together for daisy chain arrays or to extend an existing string without recovery.
- Customer can select either velocity or acceleration variants depending on the preferred output (configurable prior to shipping)
- Low latency outputs available (approx. 0.04 s delay)
- Streaming of instrument response and calibration parameters dramatically simplifies data management (RESP and Dataless SEED formats)
- If desired, Minimus can digitise data at site with real-time streaming over Ethernet to the onshore data centre
- Power and Ethernet stream via dry-mateable connector
- Synchronised absolute time with onshore GPS
- Flexibility to connect with a wide range of cable systems e.g. option of a fibre interface enables cables of severeal kilometers to be employed
- System is designed for permanent cabled deployment with installation via ROV

## Applications

> Local, regional and global seismic monitoring

> Monitoring of sub-sea hazards

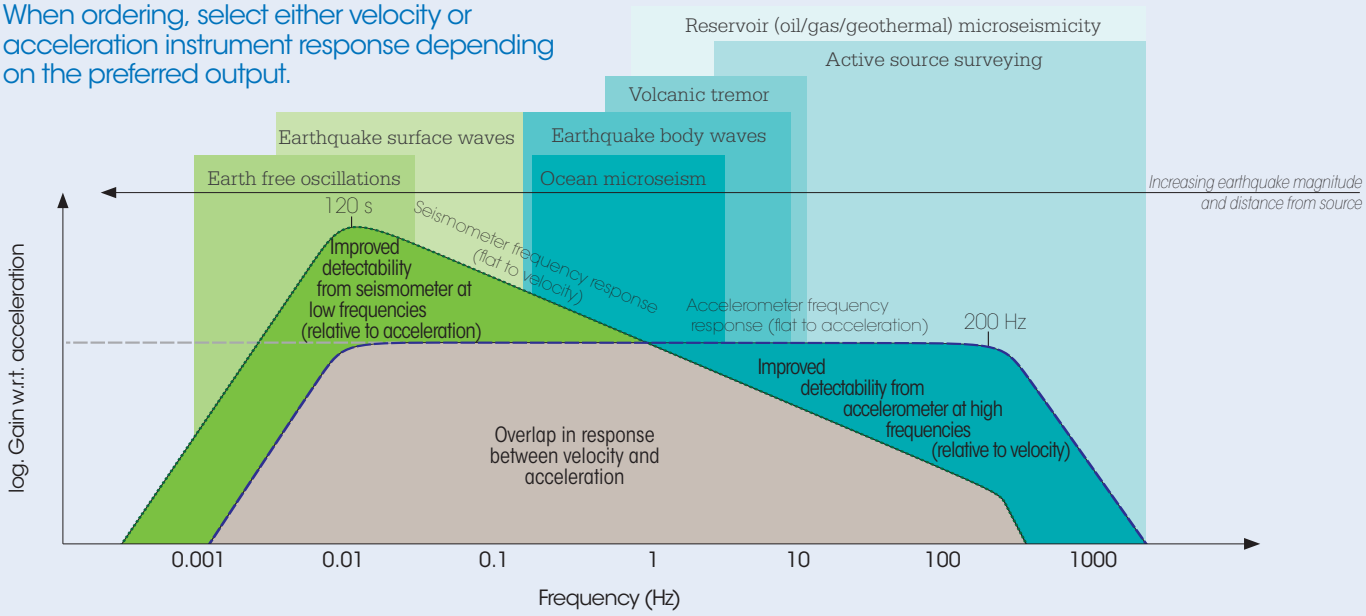
> Permanent reservoir monitoring (PRM)

> Permanent ocean observatories

> Under-water boreholes

# Response selection

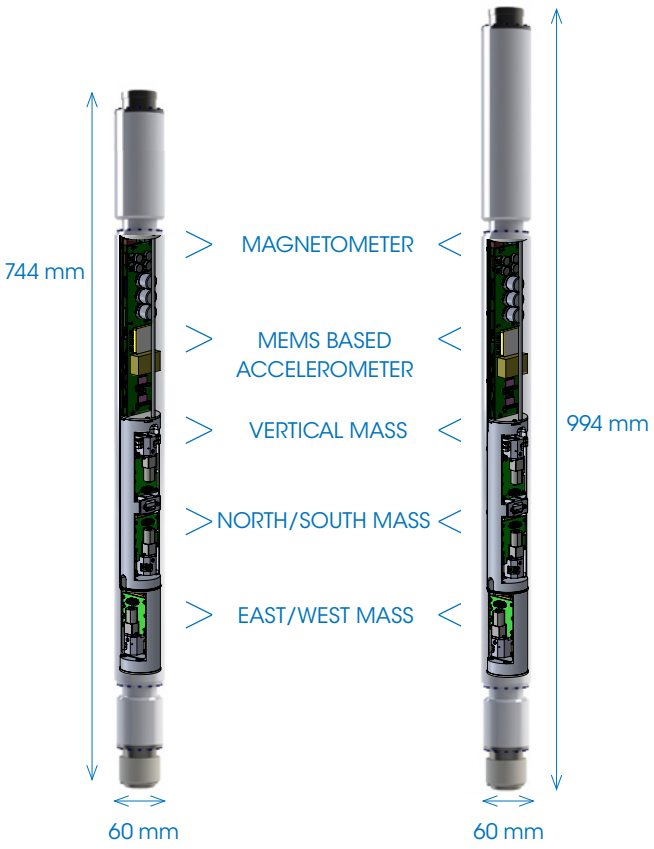
When ordering, select either velocity or acceleration instrument response depending on the preferred output.



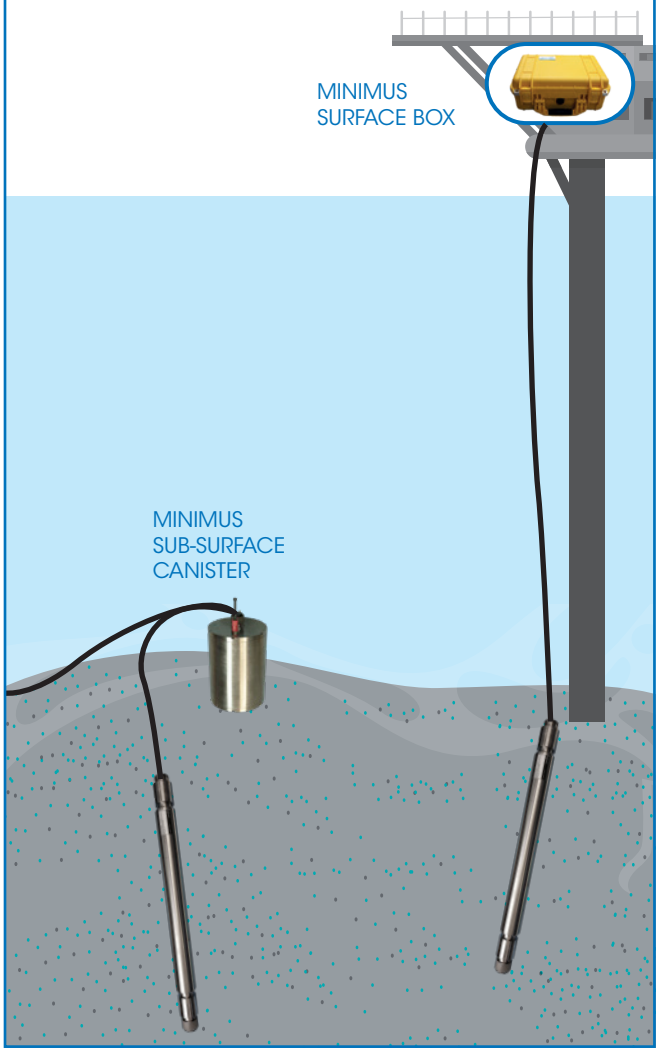

## MARIS OBS INSTRUMENT DIMENSIONS

COPPER CABLE INSTRUMENT

OPTICAL FIBRE INSTRUMENT




## MARIS OBS DEPLOYMENT OPTIONS



# Maris OBS

## SPECIFICATIONS

| BROADBAND SEISMOMETER SYSTEM | |
|---|---|
| Configuration / Topology | Triaxial orthogonal (ZNE) |
| **PERFORMANCE: BROADBAND SEISMOMETER** | |
| Maximum frequency response bandwidth | 120 s (0.0083 Hz) to 200 Hz with user-selectable options available within this range<br>Velocity or acceleration response (configurable prior to shipping) |
| Full-scale clip level | Velocity response nominal: ±25 mm/s (equivalent to differential output sensitivity of 2000 V/m/s)<br>Acceleration response nominal: ±125 mm/s$^2$ (equivalent to differential output sensitivity of 20 V/m/s$^2$)<br>Other options are available |
| Sensor dynamic range | > 149 dB at 1 Hz |
| Self-noise | Below NLNM (New Low Noise Model) from 17 s (0.06 Hz) to 9 Hz<br>< -155 dB from 120 s to 10 Hz |
| Operational tilt range | ±180° |
| Cross axis rejection | > 65 dB |
| Linearity | > 95 dB |
| Lowest spurious resonance | > 450 Hz |
| Centring | Automatic / can be disabled |
| Transfer function | Measured sensitivity, frequency response and instrument poles and zeros are stored within the instrument and accessible via web interface |
| **ENVIRONMENTAL CHANNELS** | |
| Sensor mass positions | Three independent sensor mass position outputs (integrator) |
| Orientation sensors | MEMS based accelerometer (three component); Magnetometer (three component) |
| Other sensors | Temperature; humidity; pressure; input voltage |
| **INTERNAL DIGITISER** | |
| Digital resolution/output format | 24-bit |
| Dynamic range | > 120 dB |
| Anti-aliasing filter at Nyquist | > 172 dB |
| Sampling rates | 1 to 5000 samples per second, user selectable |
| **DIGITAL SENSOR POWER** | |
| Protection | AC-coupled differential electronics |
| Power input voltage range | 10– 36* V DC |
| Power consumption (at 12 V DC) | 2.1 W (copper cable deployment)<br>9.5 W (fibre optic cable deployment) |
| **PHYSICAL** | |
| Diameter | 60 mm |
| Case height excluding connector | 744 mm (copper cable deployment)<br>994 mm (optical fibre deployment) |
| Weight | 5.6 kg (copper cable deployment)<br>6 kg (optical fibre deployment) |
| Sensor enclosure/materials | Titanium Grade 5<br>Gold plated contacts<br>O-ring seals throughout |
| Connector | 300 Bar / 30 MPa water-proof connector |
| Sensor and load-bearing cable | Kevlar-refinforced, AC-coupled<br>Working load 11 kN<br>Breaking strength 45 kN |
| Orientation indicator | North vertical scribe mark on side on outer casing and inside connector |

| ENVIRONMENTAL | |
|---|---|
| Operating temperatures: | -30 to +60 °C |
| Humidity | 0-100% relative humidity |
| Robustness | IP68 to 3,000 m depth (standard)<br>Deeper options are available |
| **MINIMUS SUB-SURFACE CANISTER/SURFACE BOX** | |
| Sub-surface canister dimensions | 314 mm × 223 mm diameter |
| Weight | 26 kg (without connectors) |
| Operating temperature | -20 to +60 °C |
| Surface box dimensions | 422 mm × 323 mm × 175 mm excl. connectors |
| Weight | 7.5 kg |
| Operating temperature | -20 to +60 °C |
| Additional sensor inputs | Primary channels:<br>Four at 24 bits. Differential input: 40 V peak-to-peak (± 20 V). |
| Secondary channels: | Three analogue channels for sensor mass positions. One internal callibration channel |
| Internal environmental channels: | Humidity<br>Temperature<br>Supply voltage<br>MEMS accelerometer (three component)<br>Magnetometer (three component) |
| Flash memory and storage | Dual redundant 64 GB microSD cards<br>(1 fixed, 1 hot-swappable) |
| Data recording formats | miniSEED (metadata stored in Dataless SEED format) |
| Configuration and control | (Ethernet) Güralp Discovery - free download, web browser interface. (Bluetooth) GüVu free Android or iOS phone/tablet app |
| Data streaming protocols (via Ethernet) | GCF (Scream!), GDI-link[1] and SEEDlink[1]<br>([1]metadata sent in RESP, StationXML and dataless SEED file formats) |
| **POWER CONSUMPTION OF MINIMUS AND ONE DIGITAL SENSOR** | |
| Copper cable deployment<br>Optical fibre deployment | ~ 4.5 W<br>~ 20 W |
| **TIMING PROTOCOLS** | |
| Minimus underwater canister<br>Minimus surface box | Precision Time Protocol (PTP)<br>GNSS (GPS, GLONASS or BeiDou) or PTP<br>Option for temperature compensated crystal for autonmous deployments |

**OPTICAL FIBRE SURFACE INTERFACE UNIT FOR DEPLOYMENTS OVER 100 M**

For deployments requiring cables longer than 100 m, an optical fibre cable and compatible Minimus digitiser must be used.

Optical fibre systems must be specified at point of order.

**Power voltage for operation of single unit only. Connection to additional instrumentation or use of longer cables may result in a higher input voltage requirement*

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