

# Ocean Observatory Vesterålen

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## **1 Introduction**

The sensors installed in the first node of LoVe Ocean Observatory are installed in two locations. At the X-Frame which is connected to the Observatory main cable at STU (Subsea Termination Unit) via a 400 m cable, and at the Satellite, connected to the X-Frame via a 50 m subsea cable.

Passive and active acoustic instruments collect information about biomass distribution and densities as well as of their vocalisation. A time laps camera monitor a deep water coral reef with high resolution. The environment is sampled with oceanographic and other environmental sensors.

The system is designed to adapt additional sensors to be added to the system in future.

## 2 Sensors installed at X-Frame

The Echosounders has two transducers, one installed in a gimball, looking upwards, and the second one installed in a horisontal mechanism. The echosounder is multiplexing between the two transducers, handling the received signals as two different channels.

Both ADCP's are installed facing towards the surface. They have both internal compasses recording the reference direction, and pressure, tilt and roll sensors.

Echosounder, controllers and data recording unit is installed in a Ø250 mm pressure tank, made of carbon fiber with flanges, bottom and toplid in titanium GR2. Pressure rate: 1.500 meters.

### 2.1 Sensors installed

Instrument	Brand	Type	Spec
Scientific Sounder:	Simrad	<b>EK60</b>	<b>Frequency:</b> 70 kHz Splitbeam <b>Pulse length:</b> 64 -2.048 $\mu$ s <b>TX Power:</b> 100 – 1.000W
Sounder Transducers	Simrad	<b>ES70-CD</b>	<b>Transducer:</b> Composit <b>Frequency:</b> 70 kHz Splitbeam <b>Transducer beam:</b> 7,0° <b>Side lobes:</b> < -23 dB <b>TX response:</b> 185 dB re 1 $\mu$ Pa per V <b>RX Sensitivity:</b> -190 dB re 1V per $\mu$ Pa <b>Depth rate:</b> 1.500 meters
ADCP Long Range:	Nortek	<b>Continental</b>	<b>Frequency:</b> 193,5 kHz <b>Beams:</b> 3 beams, slanted at 25° <b>Beam with:</b> 3,0° <b>Max profiling range:</b> 30 – 40 m <b>Cell size:</b> 1-4 mm <b>Max # of cells:</b> 128 <b>Accuracy:</b> 1% of measured value <b>Velocity resolution:</b> 0,1 cm/s
ADCP short range:	Nortek	<b>Aquadop</b>	<b>Frequency:</b> 0,6 MHz <b>Beams:</b> 3 beams, slanted at 25° <b>Beam with:</b> 3,0° <b>Max profiling range:</b> 30 - 40 m <b>Cell size:</b> 1 – 4 m <b>Max # of cells:</b> 128 <b>Accuracy:</b> 1% of measured value $\pm$ 0,5 cm/s

### 3 Sensors installed in Satellite

The satellite is connected to the X-Frame via a 50 m power/Ethernet cable. Each Instrument/sensor is connected to the Satellite Interface unit which is providing power to the sensors, and convert the signal from each individual sensor to Ethernet interface.

The cameras and flash are installed at the camera platform in the end of the adjustable beam.

The hydrophone are installed on the frame above the interface unit, and the rest of the sensors are installed directly on the top of the Interface container.

The Interface container is a Ø160 mm pressure tank, made of carbon fiber with titanium flanges, bottom and toplid. Pressure rate: 1.500 meters



The adjustable beam can be operated, bringing the cameras anywhere from a “Parked” downwards position, to a uplifted position, bringing the cameras 2,5 meters above the seabed. The Camera platform can be trained +/- 30° and tilted bringing the cameras anywhere from a horizontal to a vertical position.

### 3.1 Sensors installed

Instrument	Brand	Type	Spec
Still Camera	METAS	<b>DSF5210</b>	<p><b>Size :</b> Ø220 x 336 mm (D x h)  <b>Material :</b> Titanium GR2/Carbonfiber  <b>Sealing:</b> Dual, Radial and Axial  <b>Depth rating:</b> 150 Bar  <b>Weight in air:</b> 12,2 kg  <b>Weight in water:</b> - 0,6 kg  <b>Camera module:</b> Canon EOS 550  <b>High-sensitivity:</b> 18 Megapixel CCD  <b>ISO:</b> 80 - 6400  <b>Lense:</b> 18-55 mm wide-angle zoom lens. f: 3,5 – 5,6  <b>Mission plan:</b> Setup via Web interface.  <b>Memory Card:</b> 16 GB memory card (SD) for internal rec.  <b>Downloading pictures:</b> USB interface for  <b>Image recording:</b> RAW or jpeg</p>
Camera Flash	METAS	<b>DSF4365</b>	<p><b>Size :</b> 120 x 275mm (d x h)  <b>Material :</b> Titanium GR2/Carbon fiber  <b>Sealing:</b> Dual, Radial and Axial  <b>Depth rate:</b> 150 Bar  <b>Interface:</b> Camera trigger cable  <b>Connector:</b> MB2-8  <b>Max guide number:</b> 58 (at ISO 100, 105 mm zoom setting)  <b>Maximum view angle:</b> 14 mm  <b>Flash mode:</b> manual or E-TTL</p>
Hydrophone:	Ocean Sonic	<b>SB35 ETH</b>	<p><b>Frequency range:</b> 10 Hz – 200 kHz  <b>Peak measured signal:</b> 175 dB re.1µPa  <b>Noise:</b> 30 dB re. 1 µPa<sup>2</sup>/Hz at 10 kHz  <b>Sensitivity:</b> -171 dBV re. 1 µPa with pre-amp  <b>Material:</b> Titanium GR2</p>

Instrument	Brand	Type	Spec
Chlorophyll	Seapoint	Chlorophyll Fluorometer	<p><b>Output Time Constant:</b> 0.1 sec.  <b>Excitation Wavelength:</b> 470 nm CWL, 30 nm FWHM  <b>Emission Wavelength:</b> 685 nm CWL, 30 nm FWHM  <b>Sensing Volume:</b> 340 mm<sup>3</sup>  <b>Minimum Detectable Level:</b> 0.02 µg/l  <b>Sett Gain:</b> 1X  <b>Sett sensitivity:</b> 0,033 v/(µg/l)  <b>Sett range:</b> 150 µg/l)  <b>Depth capability:</b> 6.000 m</p>
Turbidity	AADI	4112A	<p><b>Gain:</b> 20X  <b>Range:</b> 0-125 FTU  <b>Sensitivity:</b> 40 mV/FTU  <b>RMS Noise:</b> &lt; 1 mV  <b>Light source wavelength:</b> 800 nm  <b>Sensing distance:</b> &lt; 5 cm from window  <b>Linearity:</b> &lt; 2% deviation 0-750 FTU  <b>Temperature coefficient:</b> &lt;0,05% pr °C</p>
Pressure	AADI	4117D	<p><b>Pressure:</b>  <b>Range:</b> 0 – 20000kPa (0 – 2900 psia)  <b>Resolution:</b> &lt;0.0001% FSO  <b>Accuracy:</b> ±0.04% FSO</p> <p><b>Temperature:</b>  <b>Range:</b> 0 - 36° C (32 - 96.8 °F)  <b>Resolution:</b> &lt;0.001°C (0.0018°F)  <b>Accuracy:</b> ±0.1°C (0.18°F)  <b>Response Time (63%):</b> &lt;10 seconds</p>
Conductivity	AADI	4319A	<p><b>Conductivity:</b>  <b>Range:</b> 0 – 7.5S/m  <b>Resolution:</b> 0.0002S/m  <b>Accuracy:</b> ±0.005S/m  <b>Response Time (90%):</b> &lt;3s 1)</p> <p><b>Temperature:</b>  <b>Range:</b> -5 – 40°C (23 - 104°F)  <b>Resolution:</b> 0.01°C (0.018°F)  <b>Accuracy:</b> ±0.1°C (0.18°F)  <b>Response Time (63%):</b> &lt;10 seconds</p>