



ORCA Instrumentation Unit

Status

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Réunion NUMerEnv, 29/09/2021

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Global context of the IU/CU

The IU is part of the positioning calibration of the KM3NeT detector.

The IU manage the oceanographic measurements used by the relative positioning system that evaluates the DOM and PMT positions.

Positioning, acoustic system installed on CB :

- Emitter acoustic transducer (fixed)
- Hydrophone acoustic receiver (fixed) to position the base of the CU and therefore the acoustic transmitter
- + Laser fir the inter DOM time calibration on CB

Positioning, oceanographic measurements, installed on IU :

- CTD probe measuring conductivity, temperature, pressure for the calculation of sound velocity (or velocity)
- sound velocimeter allowing the direct measurement of the speed of sound in water
- currentmeter to measure the marine current

Reminder of the IU of the CU

- Autonomous in energy instrumented line
- Inductive cable for data transfer
- Linked to the CB via one 50m electric cable
- The CB is linked to one DU via one 50m hybrid cable



IU main componants

IU = one foot line + one inductive instrumented line



the second leg links the CU to the DU

→ Modification since 2020 : the IU is now totally recoverable

Inductive cable

200 m

Wet mateab

The mechanical anchor







The electronic container

Re-use of one Titanium ANTARES LCM

- Adaptation of the cylinder length
- Re-machine one endcap : add 2 holes one for the ODI one for the BH4F
- Double 0 ring : 1 axial + 1 radial



Main specifications of the electronic board :

- •F1 : Host the IMM inductive mode
- •F2 : RS232 to RS422 conversion (opto-isolated, same as FMCV3)



The inductive system



Proven and off-the-shelf commercial SeaBird system



- **IMM** : Inductive Modem Manager
- ICC : Inductive Cable Coupler : links the inductive cable to the IMM



- **200m inductive cable** : $\frac{1}{4}$ inch wire \emptyset , 3x19 wires, galvanized jacketed Cable breaking strenght : 3 T, termination breaking strenght : 1,6 T-
- RS232 The interfaces are used to interface RS232 devices (non inductive instruments) : inductive signal



- **UIMM** : needs to be powered by instruments (2 to interface 2 non inductive Aquadop currentmeters)
- **SBE44** : has a power out to supply external instrument (3 to interface non inductive miniSVS sound velocimeters 2 to interface CTD non inductive instruments)

Qualification : done by Seabird

- CE certification for all Seabird products
- Applicable EU directives and standards :
 - Machinery directive 98/37/EC EN 61326 Electrical Equipment for measurement
 - EMC directive 2004/108/EC EN 61010 Electrical Safety for measurement
 - Low voltage directive (93/68/EEC)

The instruments : all on the shelf



3 CTD SeaBird : Conductivity Temperature Depth :



Accuracy :

- **Conductivity** : ± 0.0003 S/m
- **Temperature** : ± 0.002 °C
- Pressure : 0,35 bars Need to be recalibrated every 2 years

STRS CU_SR_1.6.2 STRS CU_SR_1.2.2 STRS CU SR 1.3.2

3 Aquadopp Nortek currentmeter (+ others sensors) :



3 MiniSVS Valeport :



Accuracy :

- Sea current : 1% of value ± 0.5 cm/s STRS CU_SR_1.4.2
- Temperature : ± 0.1 °C Pressure : 3 bars Tilts, compass : 0,2° No need for recalibration

Accuracy :

• **SV** : ±0.017m/s

Need to be recalibrated every 2 years

STRS CU_SR_1.1.2

Qualification : done by suppliers :

- CE certification for CTD SEABIRD
- NORTEK is an ISO 9001 company
- VALEPORT is an ISO 9001, 14001, 18001 company
- miniSVS have a CE certification

→ each intrument is delivered with its own calibration certificates

The IU/CB interlink leg





- •Conductor cross-section \geq 1.9 mm2 (14AWG)
- •Twisted pairs: section \geq 0.33mm2 (22AWG), impedance 120 Ω
- •Insulation resistance between wires > 1 G Ω under 1000Vdc

<u>Qualification :</u>

By supplier :

- pressure test : 1 hour @310 bars
- Factory Acceptance Tests : FO attenuation and reflexion @ 1550 nm
- Electrical measurement : resistance, insulation
- Mechanical force in air for connexion

By CPPM at delivery :

- Verification of documentation
- Factory Acceptance Tests : FO attenuation @ 1550 nm
- Electrical measurement : resistance, insulation

Functional tests

2 tests in pool in Ifremer Toulon :

October 2020 + Juin 2021

- → Validation of the instruments fixations
- → Validation of the access to the instruments / measurements
- ➔ Validation of the acquisition scenario



Tests in CPPM :

IU integrated with the CB = CU since the end of june

- \Rightarrow FW of the processor of the CB under development :
- \Rightarrow Communication with the IU is working
- \Rightarrow Still some issues to be coded or debugged
- \Rightarrow Developpement of the CU GUI almost ready



Functional tests

GUI interface :

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ORCA IU sea operations

Resume of the deployment phases

1 the IU is spread out on the sea surface, starting from the anchor with extra buoyancy, while instruments are progressively clipped along the inductive cable.



- 2 the IU is put in a vertical position by removing the temporary flotation
- 3 the IU is descended to the sea bed using the HLL under the DP control
- 4 ROV connects the interlink and tests are made from shore
- 5 and the HLL is released from top buoy thanks to the acoustic release.

Resume of the recovery phase (same as DU)

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- 1 the ROV will disconnect the interlink and will grap the HLL to one of the 4 welded rings on the anchor
- 2 the full IU will be brought to the sea surface with the HLL. (IL is floating)

3 the line is then recovered on the boat desk in the reverse way of the deployment

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