

Kits and Sensors in INNOVAMARE Project

Corrado Motta, Angelo Odetti, Simona Aracri, Roberta Ferretti

Development of innovative monitoring technologies in the framework of InnovaMare Project

The IT-HR InnovaMare project, led by the Croatian Chamber of Economy, puts together policy instruments and key players for development of innovative technologies for the sustainable development of the Adriatic Sea (<https://www.italy-croatia.eu/web/innovamare>). The project aims at enhancing the cross-border cooperation among research, public and private stakeholders through creation of a Digital Innovation Hub (DIH). The goal is to increase the effectiveness of innovation in underwater robotics and sensors to achieve and maintain a healthy and productive Adriatic Sea, as one of the crucial and strategic societal challenges existing at the cross-border level.

Within InnovaMare, CNR ISMAR and INM institutes and OGS, in cooperation with the University of Zagreb and other project partners, contribute to developing a solution to access and monitor extremely shallow water by means of portable, modular, reconfigurable and highly manoeuvrable robotic vehicles. The identified vehicle is SWAMP, an innovative highly modular catamaran ASV recently developed by CNR-INM. SWAMP is characterised by small size, low draft, new materials, azimuth propulsion system for shallow waters and modular WiFi-based hardware & software architecture.

Two SWAMP vehicles will be enhanced with a series of kits, tools and sensors to perform a series of strategic actions in the environmental monitoring of the Venice Lagoon:

- i) An intelligent winch kit with a communication cable for the management of underwater sensors and tools.
- ii) A GPS-RTK kit for highly accurate positioning in the range of centimetres.
- iii) An Autonomous programmable device for image acquisition and processing based on the Guard1 camera. This camera acquires images content and, by means of a supervised machine learning approach, recognises/classifies features such as fish, zooplankton, seabed, infrastructures. The system is conceived for autonomous monitoring activities extended in time in fixed or mobile platforms.
- iv) A Multibeam Echo-sounder (MBES) coupled with an IMU (for pitch-roll compensation). MBES data can be used, also coupled with Cameras Imagery, through image-detection techniques for reconstruction and comprehensive knowledge of underwater environment and infrastructures. Possible analyses in coastal areas are: seabed mapping also for cultural heritage, offshore structures and resources and monitoring of biodiversity, hydrocarbon, marine litter, pollution.

v) An underwater Radiometer for multiple analysis: temporal dynamics of optical properties of water; temporal dynamics of water turbidity from water reflectance; submerged vegetation and water depth mapping in optically shallow water; produce reference data for validation of satellite data.

vi) Automatic Nutrient Analyzer for real-time nutrient monitoring. This sensor measures nitrate with high accuracy over a wide range of environmental conditions (including extremely turbid and high CDOM conditions), from blue-ocean nitraclines to storm runoff in rivers and streams.

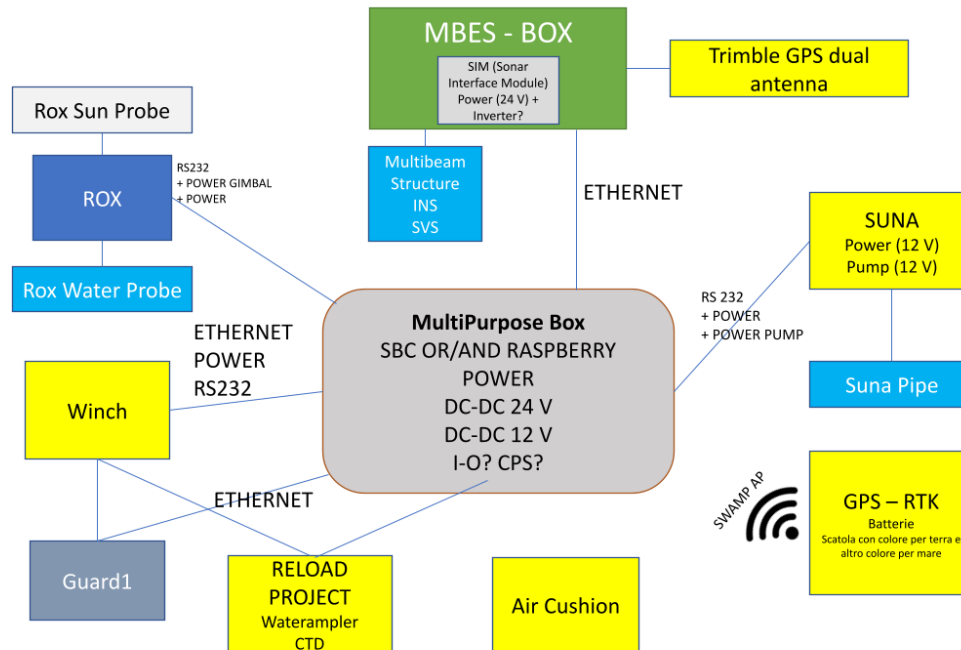
vii) An air-cushion-system-kit will be designed and developed. The vehicle will become a side-wall air-cushion-vehicle with reduction of drag and increase in speed. This will also increase the payload with a reduction of draft.

viii) Water Sampler and CTD in the framework of RELOAD PROJECT, the data collected should allow to increase the knowledge on contaminant fluxes and loads in the Arctic that is particularly important in the era of global warming.

The final result of this pilot action is the creation of an innovative prototype platform for sea environmental monitoring. This will be validated through the analysis of results and draw up of guidelines for the improvement of underwater conditions.

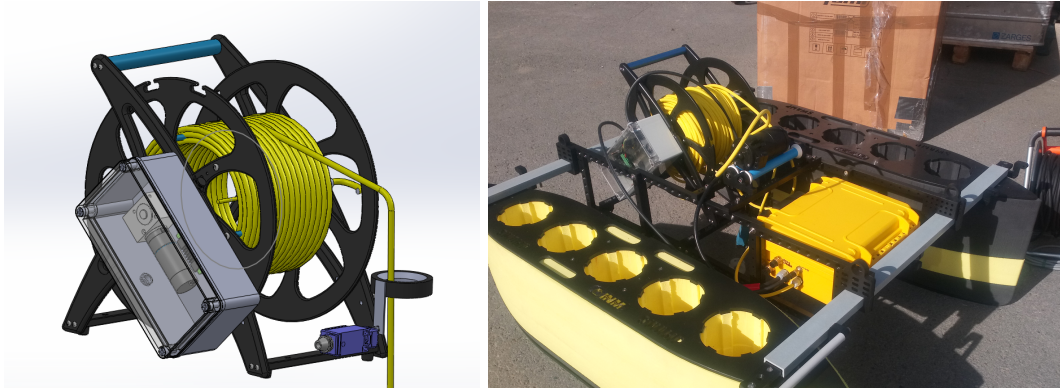
Development of innovative monitoring technologies in the framework of InnoVaMare Project

In the framework of INNOVAMARE Project the Swamp vehicles will be equipped with the following systems



1. Winch kit for the management of underwater sensors and tools
2. RTK GPS kit
3. MBES + INS kit
4. Guard1 kit
5. Radiometer - ROX
6. Automatic Nutrient Analyzer - SUNA
7. Watersampler and CTD for RELOAD PROJECT
8. Surface Effect Ship – SWAMP

1. Winch kit for the management of underwater sensors and tools



Purpose

The management of underwater sensors and tools is important for a surface vehicle in order to explore the underwater environment by maintaining the connection with the surface. This is impossible with an AUV due to the small bandwidth of underwater acoustic links and hardly doable with a tethered ROV that requires a support vessel to follow the vehicle in the case of wide-area observations.

For this reason it was chosen to install onboard SWAMP an automatic winch with a wired connection to the underwater environment. A cable with 4 pairs of twisted conductors was chosen in order to guarantee an ethernet connection, a powering connection and the possibility of sending signals.

Function

A wired winch kit for the management of underwater sensors and tools like

- Guard1 kit
- Radiometer (ROX)
- Automatic Nutrient Analyzer (SUNA)
- Automatic water samplers
- Idronaut 304plus CTD

Movement and management of underwater sensors and samplers. The ethernet connection allows for the data to be sent along the wiring.

Composition of kit:

The kit is composed of a main winch by BlueRobotics that has been customised in order to become autonomous, a motor with its controller and an underwater connector.

Specifications of the cable are reported below:

Parameter	Value	
Physical		
Tether Diameter	7.6 mm	0.30 in
Weight	0.043 kg/m	0.0287 lb/ft
Outer Jacket	Polyurethane Foam	
Buoyancy in Freshwater	Neutral	
Buoyancy in Saltwater	Slightly Positive	
Wire Gauge	0.14 mm ²	26 AWG
Working Strength	35 kgf	80 lb
Breaking Strength	155 kgf	350 lb
Minimum Working Bend Diameter	75 mm	3 in
Compatible WetLink Penetrator	WLP-M10-7.5MM-HC	

Electrical

DC Resistance @ 20°C	0.0386 Ω/ft	0.127 Ω/m
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Insulation Resistance @ 500 VDC	> 500 MΩ/kft	> 1640 MΩ/km
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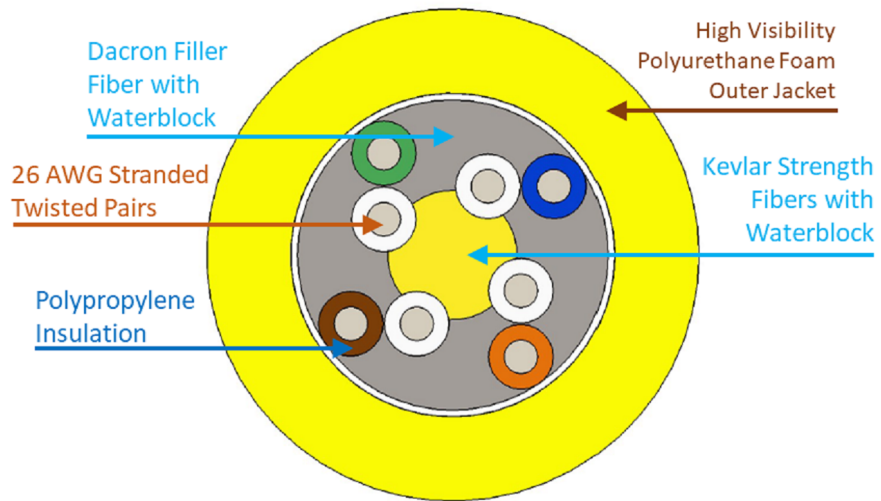
Voltage Rating	300 VDC
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The cable is provided with the following thimble:



Cable pinout is reported:

Pair	Wire	Color	Binder Connector Pin #
Pair 1	Wire 1	Blue	1
	Wire 2	Blue/White	2
Pair 2	Wire 1	Orange	3
	Wire 2	Orange/White	4
Pair 3	Wire 1	Green	5
	Wire 2	Green/White	6
Pair 4	Wire 1	Brown	7
	Wire 2	Brown/White	8

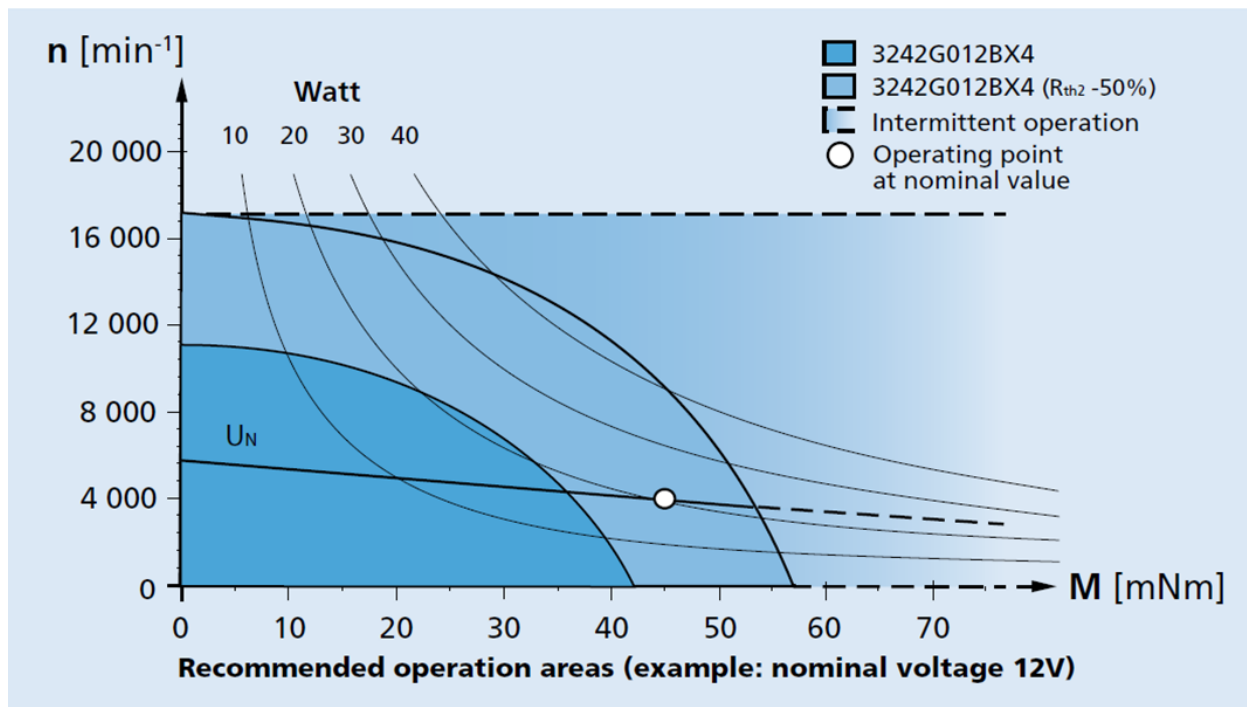


At the end of the cable on the underwater-side a MCIL8F connector is molded with the following Pinout

<u>SUBCON – MCIL8M</u>	<u>Colour</u>
1 - <u>black</u>	<u>White/orange</u>
2 - <u>white</u>	<u>Orange</u>
3 - <u>red</u>	<u>White/green</u>
4 - <u>green</u>	<u>green</u>
5 - <u>orange</u>	<u>White/blue</u>
6 - <u>blue</u>	<u>blue</u>
7 - <u>white/black</u>	<u>White/brown</u>
8 - <u>red/black</u>	<u>brown</u>

The chosen motor is a Faulhaber motor:

3242X036BX4 AES-4096 with a 32GPT 6.6:1 reduction gearhead with a CONTROLLER MC5010 S RS and STECKERSET MC50xx V3.0-MOTORSEITE, STECKERSET MC5005/5010 V3.0-VERSORG connectors whose functioning characteristics are reported below:



With the following data on payload:

Data									
Weight	1	[kg]	9,81	[N]					
Design Speed V	167	[mm/s]	0,167	[m/s]	10	[m/min]			
Diameter Winch	200	[mm]	0,2	[m]					
Prog Speed w	16	[rpm]	1,7	[rad/s]					
Torque	1962	[mNm]	1,96	[Nm]					
Motor data									
Torque T	20	[mNm]	0,02	[Nm]	Stall T	250	[mNm]	0,25	[Nm]
Speed w	4480	[rpm]	469,1	[rad/s]					
Power P	9,4	[W]							
Rated current	0,8	[A]							
Voltage	36,0	[V]							
Reduction									
rid 1	1	:	6,6						
T	132	[mNm]	0,13	[Nm]	Stall T	1650	[mNm]	1,65	[Nm]
w	678,79	[rpm]	71,1	[rad/s]					
P	9,4	[W]							
Gear reduction									
Principles	1								
Tooth number	20								
Reduction	1	:	20						
Torque T	2640	[mNm]	2,64	[Nm]	Stall T	33000	[mNm]	33	[Nm]
Speed w	33,939	[rpm]	3,6	[rad/s]					
Power P	9,4	[W]							
Efficiency	0,5								
Winch									
Diameter	225	[mm]	0,25	[m]					
Tangential Velocity	400	[mm/s]	0,400	[m/s]	24,0	[m/min]			
Weight	10,6	[N]	1,1	[kg]					
Stall Weight:	132	[N]	13,5	[kg]					
Time (10 m)	10 m	in	25	[sec]					

2. RTK GPS kit

Purpose

RTKs generally receive data from a single reference station, which can be either a permanent type or temporarily installed in the field. In both cases, the principle of operation is the same.

The working principle of RTK from single reference station is based on two basic points:

1. the reference station is installed at a point of known coordinates;
2. corrections are sent to the rover through a communication medium (typically a radiomodem or GSM connection).

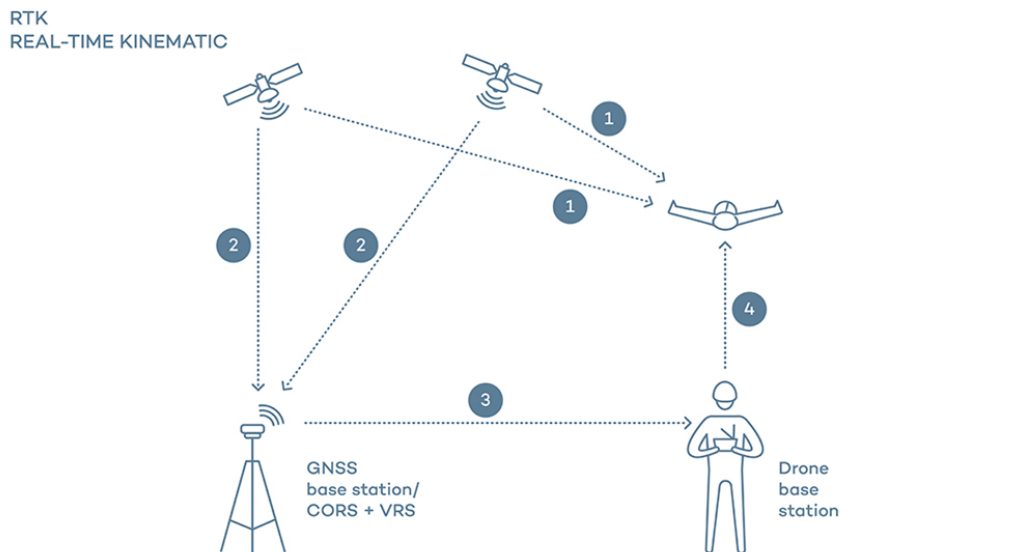
There are three important points to note regarding the connection between the reference station and the rover:

1. both observe the same set of satellites;
2. the reference sends all its positions and satellite observations to the rover;
3. the rover combines the reference's observations with its own to calculate an RTK position.

- The position is calculated using RTK algorithms, including System 1200's recent and advanced SmartRTK, which allows it to work optimally even at distances up to 50 km from the reference station.

GPS Real Time Kinematics kit

Precise positioning



Function

The RTK is short for real time kinematics. A GPS receiver capable of RTK takes in the normal signals from the Global Navigation Satellite Systems along with a correction stream to achieve 1cm positional accuracy.

Composition of kit:

The original Piksi Evaluation Kit is intended for entry-level applications. Each kit contains everything needed for an RTK setup, including GPS modules for rover and base station, plus radios with effective line-of-sight ranges up to 300 meters, GPS antennas and accessories.

The two receivers in an RTK system need to be able to communicate to pass correction data from the reference station to the rover receiver. This entry-level kit includes a basic low-power radio link to get you up and running quickly and is suitable for short baseline applications. The radio link runs open source firmware. It has a transmit power of up to 100mW, giving approximately 300-meter range with line of sight.

Kit Components:

Piksi Multi Evaluation Kits – 2.4 GHz

Designed to provide a seamless easy-to-use RTK positioning experience through a single kit, enabling easy set up of a centimetre-accurate GNSS RTK system for rapid prototyping and testing.

Modules

- 2x Piksi Multi GNSS Modules
- 2x Piksi Multi Evaluation Boards
- Includes a 6-month Skylark™ license in eligible geographies

Cables and adapters

- 2x MMCX (male) to SMA (female) cables
- 2x Micro-USB cables
- 2x full power supply with international plug adapters
- 2x barrel jack to cigarette lighter adapters
- 2x DC barrel plug splitters (1 female into 2 male)
- 1x RS-232 USB adapters
- 1x mini null modem connectors (DB9 male to DB9 male)
- 1x IDC ribbon cables
- 2x tripod mount adapters
- 1x ethernet cables
- 1x 11-position Picoblade pigtail cables
- 2x 7-position Picoblade pigtail cables

- 2x SMA (male) to TNC (male) antenna cables
- Antennas and radios
- 2x L1/L2 GPS/GLN/BDS survey antennas
- 2x FreeWave radio modems
- 2x FreeWave radio antennas
- Piksi Multi
- Multi-band, multi-constellation centimetre-accurate GNSS.

Multiple signal bands enable faster convergence times, and multiple satellite constellations enhance availability. Piksi Multi supports GPS L1/L2, GLONASS G1/G2, BeiDou B1/B2, Galileo E1/E5b, SBAS and is hardware-ready for QZSS L1/L2.

Benefits of this kit are:

- Fast RTK convergence times
- Easily integrated into a variety of applications
- Future-proof hardware with in-field software upgrades
- Piksi Multi GNSS Receiver Pack
- Quick integration packs for customers seeking to create custom RTK solutions for unique projects, or for seasoned RTK systems integrators.



The Piksi RTK Kit includes everything you need to get an RTK setup running out of the box.

Contents

- 2x Piksi OEM Modules
- 2x 433MHz radio modems
- 2x 433MHz antennas
- 2x Piksi to radio cable assemblies
- 4x Picoblade UART pigtails
- 2x Micro-USB cables
- 2x Linx Technologies external GPS antennas

Piksi

Piksi is our flagship product - a low-cost, high-performance GPS receiver with Real Time Kinematics (RTK) functionality for centimetre-level relative positioning accuracy.

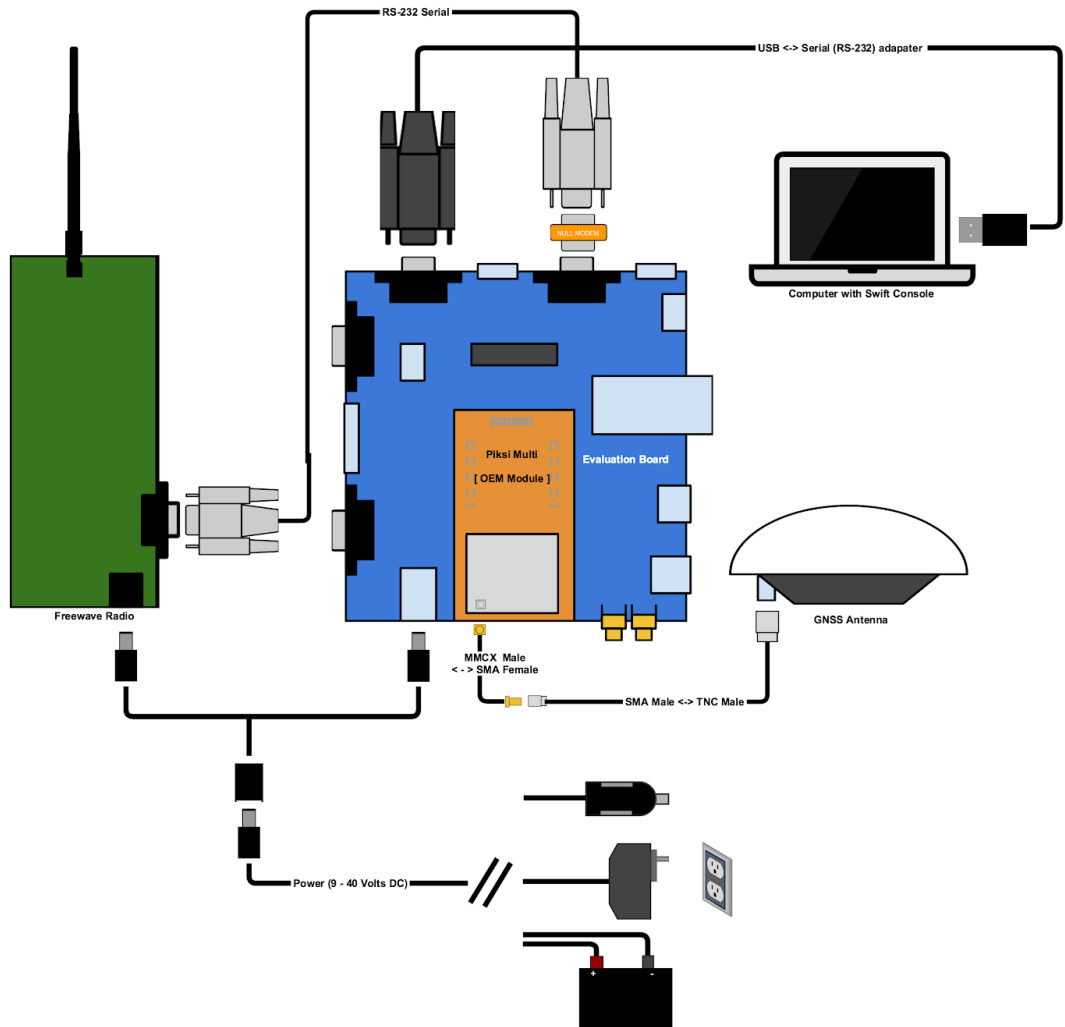
RTK systems require two Piksi receivers to achieve centimetre-level positioning, one rover and one acting as a reference station. The RTK Kit includes two of our Piksi OEM modules ready to integrate into your system.

Radio Modem

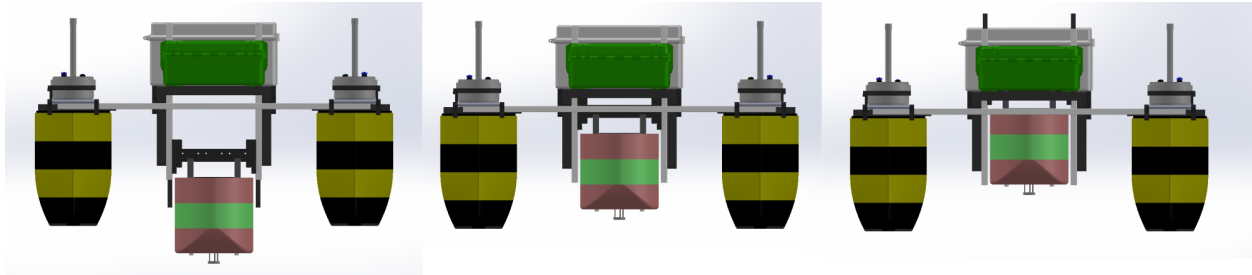
The two receivers in an RTK system need to be able to communicate to pass correction data from the reference station to the rover receiver. The RTK Kit includes a basic low-power radio link to get you up and running quickly and is great for short baseline applications.

The radio link runs open source firmware. It has a transmit power of up to 100mW, giving approximately 200-meter range with line of sight.

The radio is available in 433Mhz (Europe and other countries that don't allow 915Mhz) versions for licence free operation.



3. Multibeam echosounder (MBES)



Purpose

Imagery data from high resolution cameras coupled with multi-beam echo-sounder acoustic data (water column and seafloor) processed through image-detection techniques reconstruction and comprehensive knowledge of underwater environment and marine infrastructures.

Repeatable observations over space and time.

Applications:

- Monitoring discharge and vertical methane and oil migration in coastal areas
- Monitoring leakage from abandoned or decommissioned wells/sealines
- Detecting hydrocarbon reservoir leakage
- Monitoring of dynamic coastal seabed sediment budget to better understanding coastal erosion
- Monitoring in specific sites most of the MSFD descriptors: the biodiversity (D1), the occurrence of non-indigenous species (D2) the population of commercial fish species (D3) , eutrophication (D5), the sea floor integrity (D6), permanent alteration of hydrographical conditions (D7), presence of marine litter on the seafloor (D10)
- Monitoring and virtual reconstruction of underwater cultural heritage sites
- Monitoring of pollution in harbour areas
- Identification of offshore groundwater resources
- Monitoring of pipelines and other human offshore infrastructures

D10 Marine Litter

D9 Seafloor Integrity

D7 Permanent alteration of hydrographical conditions

Eutrophication (D5),

Geochemical and Geophysical Monitoring of Hydrocarbon Seepage

Function

MBES technology is a state of the art device to collect high precision bathymetric data. High resolution mapping of the seafloor is of crucial importance to understand the functioning of the marine environment, in lagoons even more so as the sediment transport can impact the coastal planning and support the assessment of local anthropogenic impacts. MBES integrated in the SWAMP system enables the mapping of shallow and depth variable areas such as tidal lagoons, e.g. Venice.

Composition of kit:

The kit is composed of a MultiBeam Sonic 2020, a INS, a Sonar Interface Module, a Sound Velocity System, GPS antennas, a power inverter and a PC board for the management of the Sonar.

Sonar has the following characteristics:



High Resolution
Multibeam
Systems
for:

Hydrography

Offshore

Dredging

Defense

Research

SONIC 2020

Wideband Multibeam Echo Sounder

Features:

- Ultra Compact & Low Cost
- Wideband 200 kHz – 400 kHz
- Optional UHR™ 700 kHz
- Beam Widths to 1° x 1°*
- Selectable swath 10° to 130°
- Sounding depth to 100m+
- Embedded processor/controller
- Low weight, volume and power consumption

System Description:

The Sonic 2020 is the most compact high performance wideband shallow water multibeam echo sounder, suitable for a wide variety of general mapping applications.

The Sonic 2020 provides user selectable operating frequencies between 200 kHz and 400 kHz to 1 Hz resolution and optional 700 kHz, with unparalleled flexibility to trade off resolution and range and controlling interference from other active acoustic systems.

In addition to selectable operating frequencies, the Sonic 2020 provides variable swath coverage selections from 10° to 130°, the ability to rotate the swath port or starboard in real-time, as well as roll and pitch stabilization.

The Sonic 2020 frequency agility, productive swath coverage, high update rate, narrow focused beam widths down to 1° and 60 kHz broadband signal processing provide hydrographic professionals with high quality data output for shallow water survey operations.

The Sonar consists of a combined outboard receiver / projector module, and the Inboard Sonar Interface Module (SIM). Third party auxiliary sensors are connected to the SIM. The Sonar data is tagged with GPS time.



As with other pioneering Sonic wideband multibeam echo sounders, separate topside processors have been eliminated, dramatically reducing system size, improving system reliability and increasing system efficiency with beam forming done at point of reception.

The sonar operation is controlled from a graphical user interface on a PC or laptop typically equipped with navigation, data collection and storage applications software.

The operator sets the sonar parameters in the sonar control window, while depth, imagery and other sensor data are captured and displayed by the applications software.

Commands are transmitted through an Ethernet interface to the Sonar Interface Module. The Sonar Interface Module supplies power to the sonar heads, synchronizes multiple heads, time tags sensor data, and relays data to the applications workstation and commands to the sonar head.

The receiver head decodes the sonar commands, triggers the transmit pulse, receives, amplifies, beam forms, bottom detects, packages and transmits the data through the Sonar Interface Module via Ethernet to the control PC.

The ultra-compact size, low weight, low power consumption of 22 W and elimination of a separate topside processor make the Sonic 2020 ideal for small survey vessel, ROV or AUV operations.

R2sonic LLC
5307 Industrial
Oaks Blvd.
Austh, TX USA
78735

T: 512 891 0000

www.r2sonic.com

Spec-Sheet Version 1.7. Subject to change without notice

* Beam width to 1° x 1° with UHR 700 kHz option

SONIC 2020 Wideband Multibeam Echo Sounder

Systems Specification:

Selectable Frequencies	200 kHz – 400 kHz to 1 Hz resolution Optional 700 kHz
Beamwidth, Across Track	1.0**
Beamwidth, Along Track	1.0**
Number of Soundings	Up to 1024 per swath, per head
Selectable Swath Sector	10° to 130°
Sounding Depth*	100 m**
Pulse Length	15 μ s – 1000 μ s
Pulse Type	Shaped CW
Depth Rating	100 m
Operating Temperature	-10° C to 40° C
Storage Temperature	-30° C to 55° C

Electrical Interface

Mains	90-260 VAC, 45-65 Hz
Power Consumption	22 W (Sonar Head)
Uplink/Downlink:	10/100/1000Base-T Ethernet
Data Interface	10/100/1000Base-T Ethernet
Sync In, Sync out	TTL
GPS	1PPS, RS-232
Auxiliary Sensors	RS-232
Deck Cable Length	15 m

Mechanical

Sonar Dimension	140 x 161 x 133.5 mm
Sonar Mass	4.4 kg (in air)
SIM Dimension	280 x 170 x 60 mm
SIM Mass	2.4 kg

Sonar Options

TruePix™ Imagery Output
Ultra-High Resolution UHR™ 700 kHz
Raw Water Column Data Output
Switchable Forward Looking Sonar Output
iZNS™ Integrated Inertial Nav. System
4000m Immersion Depth Rating
Mounting Hardware & Assemblies
Antifouling Coating Protection

* Beam width to 1° x 1° with UHR™ 700 kHz option

**Max sounding depths depend on environmental conditions

Sonar Interface Module (SIM)



Sonic 2020 Receiver / Projector



High Resolution
Multibeam
Systems
for:

- Hydrography
- Offshore
- Dredging
- Defense
- Research

R2Sonic LLC
5307 Industrial
Oaks Blvd.
Austin, TX USA
78735

T: 512 891 0000

www.r2sonic.com

Pioneers of Wideband High Resolution Multibeam Systems

INS has the following characteristics:

R2Sonic I2NS Integrated Inertial Navigation System Specifications



The R2Sonic I2NS integrates seamlessly with R2Sonic Wideband Multibeam Echosounder Systems (MBES), providing accurate and robust geo-referencing and motion compensation for hydrographic surveys. The R2Sonic I2NS is an industry proven, tightly coupled solution for vessel roll, pitch, heave, heading, position and velocity, that is easy to set up with the Applanix POSView, operate and control through the monitoring window built into the Graphical User Interface (GUI). All MBES and I2NS data flow through a single Ethernet port, eliminating the need for additional processing modules and cabling, which makes for a neat, single cable, interfacing solution.

The R2Sonic I2NS IMU comes in a compact waterproof housing that can be mounted on the vessel center of rotation or directly on the R2Sonic MBES mount bracket to minimize patch testing between mobilizations. The R2Sonic I2NS processing and interface are integrated into the Sonar Interface Module (SIM). The SIM has connections for the dual GNSS antennas, the IMU, as well as serial input/output ports. The GNSS antennas track all available GPS, GLONASS, Galileo, Beidou, QZSS and Geostationary satellites, with support for Fugro Marinestar™ GPS and GNSS subscription service.

The R2Sonic I2NS provides continuous positioning information, even in areas where GPS reception is compromised by multipath effects and signal loss, making it ideal for vessels operating around structures and in high multipath environments such as ports and harbors.

It can also be upgraded to enable the logging of raw GNSS and inertial observables for later processing through GNSS aided inertial post-processing software.

R2Sonic offers three accuracy and options: Type I, II and III. All types are based on the Trimble Applanix line of industry standard INS and use the same R2Sonic waterproof IMU housing enclosure, SIM architecture and software interface, providing the customer with maximum flexibility and choice of systems to suit job requirements and budget.



Main Advantages:

- Seamless integration with R2Sonic MBES
- Compact IMU in waterproof housing
- Selectable accuracy configurations
- Inertial aided RTK (Real Time Kinematic) positioning
- High immunity to GNSS (Global Navigation Satellite System) outages
- Export license not required for most countries
- Affordable pricing options
- 3-year standard warranty

• I2NS Type I: 0.01° roll/pitch accuracy with RTK. Based on Trimble Applanix OceanMaster™

• I2NS Type II: 0.02° roll/pitch accuracy with RTK. Based on Trimble Applanix WaveMaster™

• I2NS Type III: 0.03° roll/pitch accuracy with RTK. Based on Trimble Applanix SurfMaster™

Technical Specifications

I2NS Integrated Inertial Navigation System

I2NS Type I – 0.01°

Integrated INS	DGPS	RTK	Accuracy During GNSS Outages
Position	0.5-2m depending on quality of differential corrections	Horizontal: 1cm or better Vertical: 1.5cm or better	~3m for 60 s total outages (RTK) ~1m for 60 s total outages (IAPPK)
Roll & Pitch	0.02°	0.01°	0.03°
Heading	0.01° w/4m baseline 0.02° w/2m baseline	Same	Negligible for outages < 60 s
Heave	5cm or 5% 2cm or 2% TrueHeave™	5cm or 5% 2cm or 2% TrueHeave™	5cm or 5% 2cm or 2% TrueHeave™

I2NS Type II – 0.02°

Integrated INS	DGPS	RTK	Accuracy During GNSS Outages
Position	0.5-2m depending on quality of differential corrections	Horizontal: 1cm or better Vertical: 1.5cm or better	~3m for 30 s total outages (RTK) ~1m for 60 s total outages (IAPPK)
Roll & Pitch	0.03°	0.02°	0.04°
Heading	0.015° w/4m baseline 0.03° w/2m baseline	Same	Negligible for outages < 60 s
Heave	5cm or 5% 2cm or 2% TrueHeave™	5cm or 5% 2cm or 2% TrueHeave™	5cm or 5% 2cm or 2% TrueHeave™

I2NS Type III – 0.03°

Integrated INS	DGPS	RTK	Accuracy During GNSS Outages
Position	0.5-2m depending on quality of differential corrections	Horizontal: 1cm or better Vertical: 1.5cm or better	~6m for 30 s total outages (RTK) ~3m for 60 s total outages (IAPPK)
Roll & Pitch	0.04°	0.03°	0.05°
Heading	0.06° w/4m baseline 0.08° w/2m baseline	Same	0.2° (IAPPK, 60 s outage) 0.3° (RTK, 60 s outage)
Heave	5cm or 5% 2cm or 2% TrueHeave™	5cm or 5% 2cm or 2% TrueHeave™	5cm or 5% 2cm or 2% TrueHeave™

Input/Outputs

Ethernet Input Output	1000Base-T
Serial RS232 Input Output	2 COM Ports bi-directional, user assignable to NMEA output 1 COM Port connected directly to the internal GNSS receiver (for supplying corrections or firmware upgrades)
Base GNSS Correction Input	RTCM V2.x, RTCM V3.x, CMR and CMR+

With dual GPS antennas with the following characteristics:

Technical Specifications of the I2NS Type II

	DGPS	RTK	Accuracy During GNSS Outages
Position	0.5-2m depending on quality of differential corrections	Horizontal: 1cm or better Vertical: 1.5cm or better	-3m for 30 s total outages (RTK) -1m for 60 s total outages (IAPPK)
Roll & Pitch	0.03°	0.02°	0.04°
Heading	0.015° w/4m baseline 0.03° w/2m baseline	Same	Negligible for outages < 60 s
Heave	5cm or 5% 2cm or 2% TrueHeave™	5cm or 5% 2cm or 2% TrueHeave™	5cm or 5% 2cm or 2% TrueHeave™

The Sound Velocity Sensor is the following:



ultraSV OEM Sound Velocity Sensor

ultra-fast, ultra-compact, ultra-dependable. The next generation of sound velocity sensor.

Redesigned from the connector up, the ultraSV offers a truly smart and exchangeable sound velocity sensor without compromise.

Ideally suited to system integrators and OEM applications, the ultraSV is a truly exchangeable SV sensor with all critical electronics contained within the housing.

Each sound velocity measurement is made using a single pulse of sound travelling over a known distance, so is independent of the inherent calculation errors present in all CTDs. Our unique digital signal processing technique virtually eliminates signal noise, and gives almost instantaneous response; the digital measurement is also entirely linear, giving predictable performance under all conditions.

DATA SHEET

Product Details



SOUND
SPEED



VALEPORT TERMINAL
SOFTWARE

Valeport Limited
St. Peter's Quay, Totnes,
Devon TQ9 5EW United Kingdom

Telephone: +44 (0) 1803 869292
Email: sales@valeport.co.uk
www.valeport.co.uk

VALEPORT

Performance

Range	1375 – 1900 m/s
Resolution	0.001 m/s
Accuracy	±0.020 m/s
Sample Duration	~30 µs @1500 m/s
Sample Rate	Up - 300 Hz

Electrical

Voltage	5V DC regulated ±3%
Power	< 250mW
Connector	SubConn MCBH6F

Communications

Output	RS485 \ TTL
Protocol	4800 - 230400 baud (8,1,N)
Format	Proprietary NMEA string

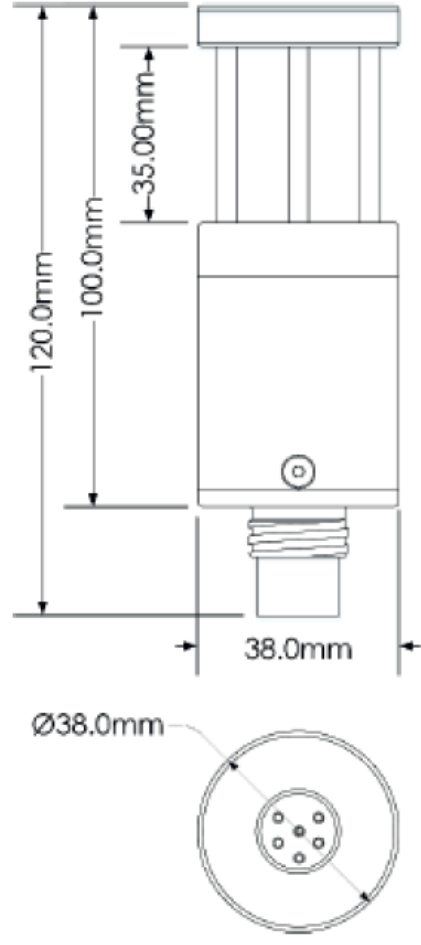
Physical

Depth Rating	200m
Size	38mmØ x 120mm (including connector)
Weight	<0.3 kg in air
Housing & Bulkhead	Titanium
Transducer Window	Titanium
Sensor Legs	Carbon Composite
Reflector Plate	Titanium

Ordering

ultraSV	06520550 -TTL- F (Female Connector) 06520550-TTL-M (Male Connector) 06520550-RS485
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Note All systems supplied with a manual no cables are supplied.
Contact Valeport for options



The power inverter characteristics:



200W True Sine Wave DC-AC Power Inverter

TS-200 series



■ Features :

- True sine wave output (THD <3%)
- High surge power up to 400W
- High efficiency up to 88%
- Fanless design, cooling by free air convection
- Built-in remote ON-OFF control
- Front panel indicator for operation status
- Power ON-OFF switch
- Protections: Bat. low alarm / Bat. low shutdown / Over voltage / Over temp / Output short / Input reverse polarity / Overload
- Application : Home appliance, power tools, office and portable equipment, vehicle and yacht ...etc.
- 3 years warranty



SPECIFICATION

MODEL	TS-200-112	TS-200-124	TS-200-148	TS-200-212	TS-200-224	TS-200-248
OUTPUT	RATED POWER					
	200W					
	MAXIMUM OUTPUT POWER					
	230W for 180 sec. / 300W for 10 sec. / surge power 400W for 30 cycles (typ.)					
	AC VOLTAGE					
	Factory setting set at 110VAC					
INPUT	100 / 110 / 115 / 120VAC selectable by setting button S.W			200 / 220 / 230 / 240VAC selectable by setting button S.W		
	FREQUENCY					
	60±0.1Hz 50/60Hz selectable by setting button			50±0.1Hz 50/60Hz selectable by setting button		
	WAVEFORM					
	True sine wave (THD<3%) at rated input voltage					
AC REGULATION <small>Note.1</small>						
±3.0% at rated input voltage						
FRONT PANEL INDICATOR						
Operation status : Green : normal, Orange (flashing) : remote control OFF, Red : abnormal						
BATTERY INPUT PROTECTION	BAT. VOLTAGE					
	12V	24V	48V	12V	24V	48V
	VOLTAGE RANGE (Typ.) <small>Note.3</small>					
	10.5 ~ 15VDC	21 ~ 30VDC	42 ~ 60VDC	10.5 ~ 15VDC	21 ~ 30VDC	42 ~ 60VDC
	DC CURRENT (Typ.)					
	20A	10A	5A	20A	10A	5A
	NO LOAD CURRENT DRAW (Typ.)					
1.25A	0.63A	0.32A	1.25A	0.63A	0.62A	
OFF MODE CURRENT DRAW						
≤ 1mA						
EFFICIENCY (Typ.) <small>Note.1</small>						
86%	87.5%	88%	86%	87.5%	88%	
BATTERY TYPES						
Open & sealed Lead Acid						
FUSE						
30A*2	30A*1	15A*1	30A*2	30A*1	15A*1	
BAT. LOW ALARM						
11.3±4%	22.5±4%	45±4%	11.3±4%	22.5±4%	45±4%	
BAT. LOW SHUTDOWN						
10.5±4%	21±4%	42±4%	10.5±4%	21±4%	42±4%	
BAT. POLARITY						
By internal fuse open						
OUTPUT PROTECTION	OVER TEMPERATURE					
	85°C ± 5°C	80°C ± 5°C	80°C ± 5°C	85°C ± 5°C	80°C ± 5°C	80°C ± 5°C
	Protection type : Shut down o/p voltage, re-power on to recover; by internal RTH1 detect power transistor					
	OUTPUT SHORT					
Protection type : Shut down o/p voltage, re-power on to recover						
OVER LOAD (Typ.)						
105 ~ 115% load for 180 sec., 115% ~ 150% load for 10 sec.						
Protection type : Shut down o/p voltage, re-power on to recover						
GFCI PROTECTION						
Optional (Only type F) None						
FUNCTION	REMOTE CONTROL					
Open : Normal work ; Short : Remote off						
ENVIRONMENT	WORKING TEMP.					
	-10 ~ +35°C @ 100% load ; +60°C @ 50% load			-10 ~ +40°C @ 100% load, +60°C @ 50% load		
	WORKING HUMIDITY					
	20% ~ 90% RH non-condensing					
STORAGE TEMP., HUMIDITY						
-30 ~ +70°C / -22 ~ +158°F, 10 ~ 95% RH						
VIBRATION						
10 ~ 500Hz, 3G 10 min./1 cycle, 60 min. each along X, Y, Z axes						
SAFETY STANDARDS						
Design refer to UL458			None			
LVD						
None			EN60950-1			
SAFETY & EMC	WITHSTAND VOLTAGE					
	Bat. WP-AC QP:3.0KVAC AC O/P-FG:1.5KVAC					
	Bat. WP-AC O/P, AC O/P-FG:100M Ohms / 500VDC / 25°C / 70% RH					
ISOLATION RESISTANCE						
Bat. WP-AC O/P, AC O/P-FG:100M Ohms / 500VDC / 25°C / 70% RH						
EMC EMISSION			Compliance to EN5022 class A, T2/345/CEE, 95/54/CE, E-Mark			
EMC IMMUNITY						
None			Compliance to EN61000-4-2,3,8			
OTHERS	MTBF					
	106.2K hrs min. MIL-HDBK-217F (25°C)					
	DIMENSION					
205*158*98mm (L*W*H)						
PACKING						
1.83Kg; 6pcs/10.8Kg/1.44CUFT						
NOTE	1. Efficiency & AC regulation is tested by 200W, linear load at 13V/26V/52V input voltage. 2. All parameters not specified above are measured at rated load, 25°C of ambient temperature. 3. The tolerance of each voltage value by models is: 112/212 → ±0.5V; 124/224 → ±1V; 148/248 → ±2V					

The chosen PC board is the following:

MIO-5272

7th & 6th Gen Intel® Core™ U-series (i7/i5/i3/Celeron®*), 3.5" MI/O-Compact SBC

NEW

WISE-PaaS/RMM CE FCC

Features

- 7th & 6th Gen Intel® Core™ U-series (i7/i5/i3/Celeron®*)
- DirectX 12, OpenGL 4.4, OpenCL 2.1
- 2 x 204-pin SO-DIMM up to 16GB DDR3L- 1600/1333 MHz DRAM
- Flexible I/Os expansion: MIOe to approach vertical market application
- Support TPM 2.0 (optional)
- Supports Intel AMT11.0, WISE-PaaS/RMM and Embedded Software APIs

Software APIs:

GPIO
HW Monitor
Brightness
Watchdog
Backlight On/Off
SMBus/ CPU Speed
System Infrating

Utilities:

Monitoring

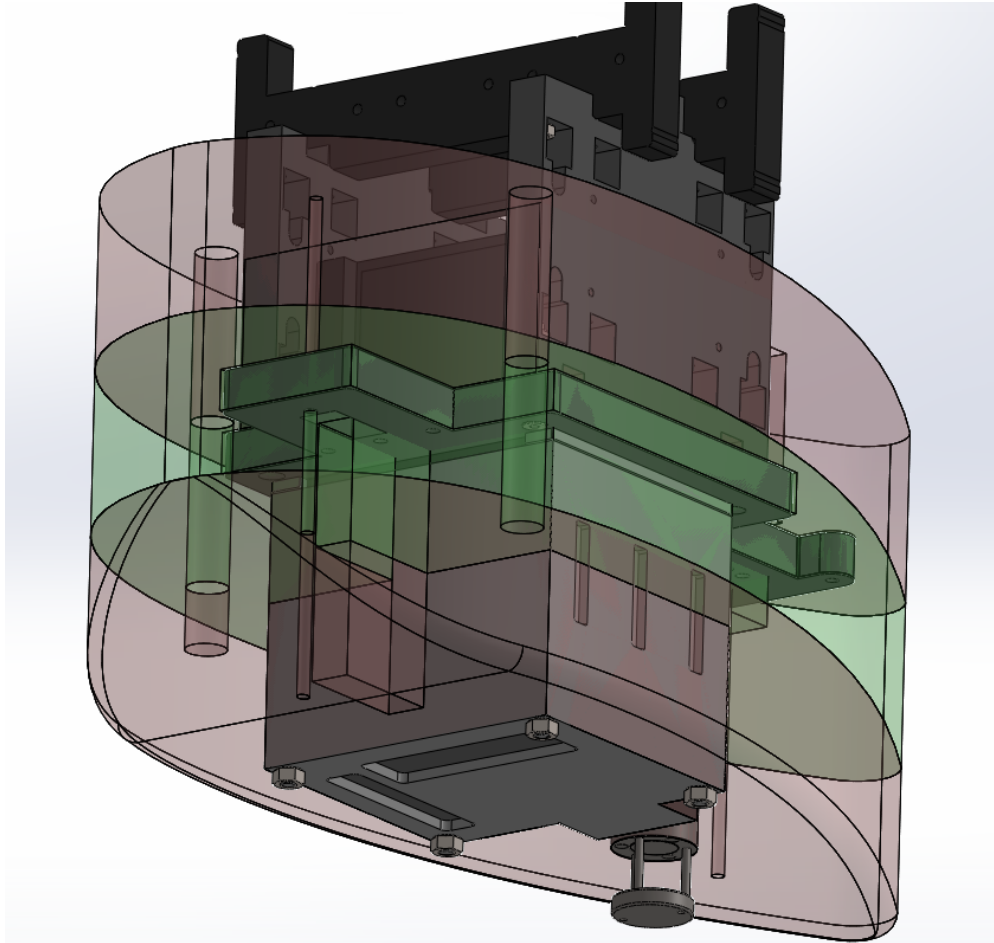
Specifications

		Intel 7 th Core™ U-series	Intel 6 th Core™ U-series	Intel Core i5 6300U	Intel Core i3 6100U	Intel Celeron 3955U*
Processor System	CPU	Intel Core i7 7800U	Intel Core i7 6600U	Intel Core i5 6300U	Intel Core i3 6100U	Intel Celeron 3955U*
	Base Frequency	2.8 GHz (Dual-Core)	2.6 GHz (Dual-Core)	2.4 GHz (Dual-Core)	2.3 GHz (Dual-Core)	2.0 GHz (Dual-Core)
	Max Turbo Frequency	3.9 GHz	3.4 GHz	3.0 GHz	-	-
	L3 Cache	4MB	4MB	3MB	3MB	2MB
Memory	BIOS	AMI UEFI 128 Mbit				
	Technology	DDR3L 1600 MHz				
Display	Max Capacity	16 GB				
	Socket	2 x 204-pin SODIMM				
	Controller	Intel HD Graphics 620/520/510 (Celeron)				
	Processor Graphics	DirectX 12, DirectX 11.3, OpenGL 4.4, and OpenCL 2.1 Full AVC/VC1/MPEG2 HW Decode				
	VGA	1920 x 1200 @ 60Hz or 2048 x 1152 @ 60Hz with reduced blanking				
	LVDS	LVDS with 3.3V, 5V and 12V on LCD VDD power, 5V and 12V support on LVDS Inverter Dual channel 24-bit LVDS, max resolution up to 1920 x 1200 at 60Hz				
Ethernet	HDMI	Supports HDMI 1.4 for HD Video playback Max resolution up to 4096 x 2160 at 24 Hz				
	Multi-Display	VGA + HDMI, VGA + LVDS, HDMI + LVDS, VGA + HDMI + LVDS				
	Speed	10/100/1000Mbps				
Audio	Controller	GbE1: Intel i219, GbE2: Intel i210				
	Connector	2 RJ45 on Rear I/O				
WatchDog Timer	Codec	High Definition Audio (HD), Line-In, Line out, Mic-In				
	Amplifier	Optional via MIOe				
Storage	Output	System reset, Programmable counter from 1 – 255 minutes/ seconds				
	SATA	2, up to 6.0 Gb/s (600 MB/s)				
	mSATA	1 x Full-size (support either mSATA or miniPCIe)				
	Ethernet	2				
Rear I/O	VGA	1				
	HDMI	1				
	USB 2.0	2				
	USB 3.0	2				
	LED	Power, HDD				
Internal I/O	DC Jack*	1				
	Serial	2 x RS-232/422/485 with auto flow control (ESD protection: Air gap ±15KV, Contact ±8KV)				
	USB	2				
	PC	1 (Shares with SMBus pin)				
Security	SMBus	1				
	GPIO	8-bit general purpose Input/output				
Expansion	TPM2.0*	Support by request				
	Mini PCIe	2 x Full-size (One with SIM card holder, Another one with mSATA support, default support mSATA)				
	MIOe	Displayport*, SMBus, USB3.0, LPC, 2 x PCIe x1, Line out, +5 Vsb/+12 Vsb power, Power On, Reset				
Power	Power Type	Single 12V DC power Input				
	Power Supply Voltage	Supports single 12V Input, ± 10%				
	Power Consumption (Typical)	i7 7800U: 6.48W, i7 6600U: 6.46 W, i5 6300U: 5.26 W, i3 6100U: 5.02 W, Celeron 3955U: 4.88 W				
	Power Consumption (Max)	i7 7800U: 22.03W, i7 6600U: 22.03 W, i5 6300U: 20.67 W, i3 6100U: 20.45 W, Celeron 3955U: 17.61 W				
	Power Management	ACPI				
Environment	Battery	Lithium 3 V / 210 mAh				
	Operating	0 – 60 °C (32 – 140 °F) (Operating humidity: 40 °C @ 95% RH Non-Condensing)				
Physical Characteristics	Non-Operating	-40 °C – 85 °C and 90 °C @ 95% RH Non-Condensing				
	Dimensions (L x W)	148 x 102 mm (5.7" x 4"), same as 3.5"				
	Weight	0.67kg, weight of total package				
	Height	Top Side: 16.5 mm, Bottom Side: 7.8 mm, PCB: 2.0 mm				

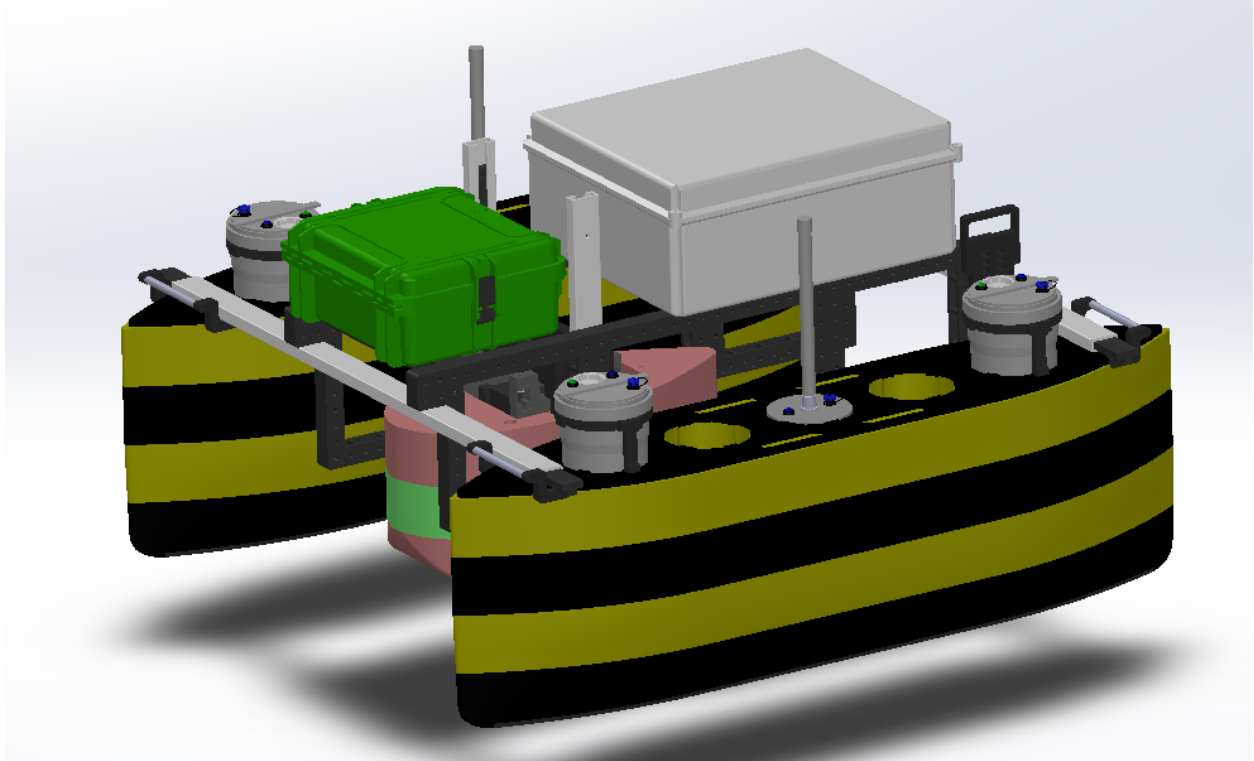
* Supported by request; please contact Advantech if this function is needed.

The kit is installed on the payload frame of SWAMP.

The Sensor head, the INS and the SVS are installed on a movable structure that can be installed at different depths.



The SIM and the PC, powered by the inverter are installed inside the onboard Boxes:



4. GUARD1 Imaging Device

Purpose

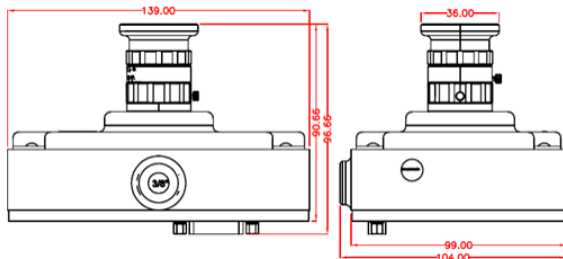
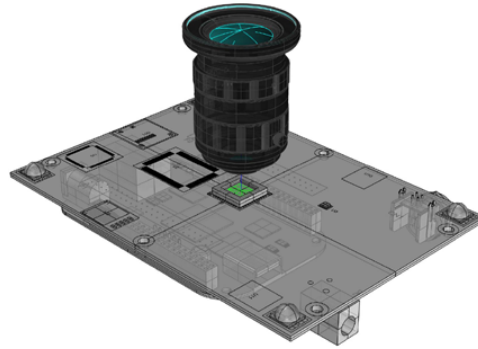
Autonomous and programmable device for image acquisition and processing (European Patent EP 2863257)

The acquired image content is recognised/classified (e.g. fish, gelatinous zooplankton, benthic organisms, seabed, artificial infrastructures)

The information extracted from the acquired images is transmitted outside the device.

Conceived to be deployed on fixed or mobile platforms for autonomous monitoring activities extended in time (low power consumption)

- The image processing methodology is based on supervised machine learning approach
- The recognition/classification algorithm can be automatically run on board the imaging device.



Function

Underwater cameras are used to collect data about habitat mapping, species behaviour, seafloor composition. The Guard1 Image Device, integrated in the SWAMP system is connected to a central unit, single board computer. This connection allows for real-time visualisation. The transmission rate is dependent on the bandwidth available at the acquisition site.

Composition of kit:

The Camera can be programmed to operate in different modes:

- The worst case is when, during the execution of a transect, the CPU remains on with a maximum consumption of 2W and periodically (e.g., every second) acquires an image. In this case to the 2W of the CPU, between one image and the next, must be added a maximum consumption of 36W (illuminator) for a maximum time of 150ms;
- the intermediate case is when between one acquisition and the next, the camera goes into low-consumption mode with a power consumption on the order of mW;
- the low-consumption case is the one in which between one acquisition and the next the chamber is turned off. In this phase, the absorption between one image and the next is on the order of microW.

Regarding the consumption of the Camera, the following is an estimate in excess:

- the camera power supply can charge between 12V and 36V.

- The illuminator consists of 4 LEDs each with a maximum power consumption of 9W for a total of 36W;
- the maximum time to acquire an image is 150ms and during this phase the CPU absorbs a maximum of 2W;

Consequently, during the acquisition of an image the camera draws a maximum of 38W (36W+2W) for a maximum of 150ms.

The battery is installed inside the case. One image every second for two hours is 7200 images. Even with a small battery there should be no problem.

5. Radiometer

Purpose

RoX (produced by JB Hyperspectral) is an automated field spectroscopy device capable of collecting continuous and long-term hyperspectral measurements of reflectance. Its robustness and flexibility make the RoX suitable for water application.

Objective are:

- To understand the temporal dynamics of optical properties (R_{rs}) of water types
- To investigate the temporal dynamics of water turbidity as derived from the sampled water reflectance (R_{rs})
- To map submerged vegetation and water depth in optically shallow water
- To produce reference data for validation of satellite data



Function

Mounted on SWAMP the radiometer (ROX) can automatically gather reflectance data that can be viewed in real time through a simple port emulator/terminal.

The real time visualisation happens thanks to a thorough system integration that renders the SWAMP system apt to multipurpose real-time monitoring in the most diverse scenarios, from the Arctic Sea to the Mediterranean lagoons.

During the deployment in the Venice Lagoon, ROX collects reflectance data at the water-air interface and under water. This can be useful to validate satellite data and assess the turbidity status of the water column. Thanks to the integration with SWAMP, ROX can operate safely in extremely shallow lagunar waters.

Composition of kit:

ROX is provided with its own watertight case, which encompasses, other than the radiometer system, also a GPS module, power and data connections, gimbal.

ROX has been mounted on a tailored sensor frame attached to SWAMP. The frame hosts two vertical sliding rods.

The water sensor of ROX can be easily fixed to one of the rods, which can be lowered to the desired depth. The position of the rod remains fixed during the deployment.

The air sensor is attached to the same rod, but it is of course facing upwards.

This configuration ensures the geometric coherence of the probes.

The frame mounted on SWAMP can host a collection of sensors, it also ensures the modularity envisaged for the SWAMP system.

6. Automatic Nutrient Analyzer

Purpose

Why monitor nutrients?

Nitrogen compounds, phosphorus, silicon etc are the basis of the growth of phytoplankton that lies at the base of the trophic network of the sea.

Changes in the availability of nutrients induce a modification of the ecosystem and this has a strong impact on coastal communities which are based on sea-related economies.

The SUNA V2 is the ultimate solution for real-time nutrient monitoring. This sensor measures nitrate with industry leading accuracy and stability over a wide range of environmental conditions (including extremely turbid and high CDOM conditions), from blue-ocean nitraclines to storm runoff in rivers and streams. The SUNA V2 incorporates the proven MBARI-ISUS nitrate measurement technology, which is based on the absorption characteristics of nitrate in the UV light spectrum.



Function:

The SUNA probe, mounted on the SWAMP system, aids the gathering of nutrient data in the Venice Lagoon during one of the INNOVAMARE trials. Lagunar environments are highly variable in terms of salinity and temperature, they host complex unique ecosystems, therefore their bio-physical monitoring is crucial to understand and protect biomes of lagoons.

Thanks to the integration in the SWAMP system the data can be visualised in real time, allowing a prompt intervention in case of misplacement or general malfunctioning.

Composition of kit:

The SUNA nutrient probe gear to be integrate in the SWAMP system encopasses

SUNA V2 - 12 V, 1 A probe

Seabird Pump - 12 V, 1 A

Inflow/Outflow pipes

The probe lies outside of the water and is attached to the dedicated frame, designed to host the sensors. The inflow pipe conveys the water pumped from below the surface in between the sensor cells, where the data is acquired, the sampled water then returns to the environment.

7. Watersampler and CTD for RELOAD PROJECT

Purpose

The aim of RELOAD project was the quantification of heavy metal discharge with freshwater runoff to an Arctic fjord ecosystem.

SWAMP is equipped with a payload frame hosting a multipurpose box that allowed to manage manifold tools and sensors: a precise dual frequency GNSS receiver, a single beam sonar and an automatic winch with 60 m of data-cable that was used to released below the surface (down to 40 m) an automatic watersampler together with a CTD sensor.

Function

In the Hornsund Fjord SWAMP was used to sample water and record CTD data from interesting freshwater runoff spots in the direct front of three tidewater glaciers: Hansbreen, Hornbreen and Storbreen.

The data collected should allow to increase the knowledge on contaminant fluxes and loads in the Arctic that is particularly important in the era of global warming. Climate-related changes in environmental conditions are influencing contaminant fate in the environment. Intensive glacier melting can affect the delivery of contaminants accumulated in glacier ice over the last century. As a consequence, fjord ecosystems probably receive higher loads of contaminants today than before, and these may pose a threat to the ecosystem. Unfortunately, this problem is nowadays not well addressed in current research. Therefore, more extensive, complex studies are necessary to increase knowledge on key processes having impact on contaminant fluxes to the marine ecosystem and the campaign just ended has been carried out to give a contribution in this direction.

Composition of kit:

The kit is composed of a CTD 304 plus from IDRONAUT and an automatic watersampler developed within the project.



IDRONAUT OCEAN SEVEN 304Plus CTD LOGGER

VERY LOW POWER, SELF-RECORDING, UV-ANTIFOULING, DISSOLVED OXYGEN
ARCTIC, ANTARCTICA, BRINE, ROVs, AUVs, UNDERGROUND WATER MONITORING

The OCEAN SEVEN 304Plus CTD completes the line of high quality and accuracy IDRONAUT OCEAN SEVEN CTDs, fulfilling the demand of a high performance CTD probe with very small diameter and very low power consumption. This CTD can be easily integrated/adapted to third-party systems like floating profilers and/or oceanographic moorings, ROVs and AUVs. IDRONAUT prides itself on the design of its full ocean depth, pump-free, low-maintenance sensors. Central to which is the high accuracy seven-platinum-ring quartz conductivity cell (patented) which can be cleaned in the field without the need for re-calibration. This unique quartz cell employs a large diameter (8 mm) and a short length (46mm) to guarantee self-flushing. The OS304Plus does not require pumps or any other external device to flush the sensors, which minimizes its power consumption and allows the use in Arctic and Antarctica. The OS304Plus CTD standard interface is RS232C; other optional interfaces are: TTL, RS485 and wireless Bluetooth®. The RS485 interface overcomes the RS232C limitation (200m cable). The OS304Plus communicates at a speed up to 115k2 bps, thus reducing data uploading time to a minimum. The OS304Plus housing can be manufactured with either a 316 grade L stainless steel housing, a white POM housing or a titanium housing allowing deployment to depths of 1000 dbar, 2000 dbar or 7000 dbar respectively.

Features:

- ◆ Up to 8Hz CTD simultaneous sampling.
- ◆ Very low power consumption
- ◆ Expandable: oxygen, turbidity and other sensor interfaces, available upon request.
- ◆ Large memory (2Gbytes) 60.000.000 data sets.
- ◆ High-speed data uploading.

UV ANTIFOULING

A UV-LED (Ultraviolet, 250 to 300 nm @500µW, Light-Emitting Diode) is integrated into the conductivity sensor quartz cell (patent pending). The UV-LED sterilizes the early growth of biofouling, thus eliminating environmental drift in the conductivity sensor.

TOP-COVER BULK-HEAD CONNECTOR

The OCEAN SEVEN 304Plus is equipped with the MCBH series of wet-pluggable connector

SAMPLING MODES

- Continuous:** Sampling at configurable rate: 0.1 Hz to 8 Hz.
Multiple cycles can be obtained by switching the CTD on/off.
- Pressure:** Data is sampled at pressure intervals.
Multiple profiles are obtained by switching the CTD on/off.
- Timed:** CTD collects a series of samples and then sleeps for the configured time interval.
Time intervals are: between 5s up to 1 day.
- Conditional:** Data acquisition is started and continues while the reading from a selected sensor is above a threshold value. Monitoring of the selected sensor threshold value can be configured to occur at intervals: between 5s up to 1 day.
- Burst:** Burst sampling carried out at configured time intervals: between 5s up to 1 day.

DATA STORAGE AND BATTERY ENDURANCE

The OS304Plus CTD is equipped with a 2-Gbyte internal non-volatile SD FLASH memory which allows the storing of about 60,000,000 data sets each one being composed of the reading of: CTD sensors plus the acquisition date and time. Different types of battery can be installed in the CTD housing.

- | | | |
|-----------------|--|-------------|
| ➤ 2 x size "AA" | Alkaline 1.5V battery assembled in a single pack. | 3.0V |
| ➤ 1 x size "AA" | Lithium non-rechargeable battery | 3.6V, 2.4Ah |
| ➤ 1 x size "C" | Lithium non-rechargeable battery | 3.6V, 8.4Ah |
| ➤ 1 x NiMH | rechargeable IDRONAUT custom battery pack (3x1.2 AA) | 3.6V, 2.6Ah |
| ➤ 1 x size "C" | Lithium Ion rechargeable battery | 3.6V, 4.2Ah |

The NiMH rechargeable battery pack allows up to 50 hours of continuous operation, while the "C" size Lithium non-rechargeable battery allows up to 168 hours of continuous operation. Whenever the OS304Plus operates in Timed, Burst and Conditional modes, the battery endurance is considerably extended because the OS304Plus enters a deep sleep mode between acquisitions and drains only 8µAh from the battery.

For instance, by monitoring every hour, the OS304Plus can run for about 12 years on a single Lithium size "C" cell.



TECHNOLOGY
IN SEARCH OF
NEW DEPTHS



SENSOR SPECIFICATIONS

The OS304Plus CTD can be equipped with the following sensors to measure:

Parameter	Range	Initial Accuracy	Resolution	Response Time
Pressure	0..1000 dbar(1)	0.05 %full scale	0.0015 % full scale	50 ms
Temperature	-5..+35 °C	0.002 °C	0.0001 °C	50 ms
Conductivity	0..90 mS/cm(*)	0.003 mS/cm	0.0003 mS/cm	50 ms ⁽²⁾

(*) By reducing the range to 0..70 mS/cm, the resolution becomes 0.0002 mS/cm.

If properly calibrated the range can be extended up to 250 mS/cm to measure in the Brine.

(1) Other standard pressure transducers, immediately available, have: 10, 40, 100, 200, 500, 2000, 4000, 6000, 7000 dbar ranges.

(2) At 1 m/second flow rate.

The fundamental properties of seawater, like: **Salinity, Sound Speed, Water Density, Oxygen ppm** are obtained using the algorithms described in the UNESCO technical papers in marine science no. 44 "Algorithms for computation of fundamental properties of sea water".

The freshwater properties like: **TDS (Total Dissolved Solids), Fresh Water Conductivity** corrected at 20°C and 25°C are automatically calculated.

OPTIONAL SENSOR SPECIFICATIONS

The OS304Plus CTD can be optionally equipped with the IDRONAUT Highly Accurate Precise (0.01%FS) pressure transducer, the IDRONAUT OEM Turbidity Meter, the IDRONAUT polarographic dissolved oxygen sensor and the IDRONAUT pH and REF sensors.

Parameter	Range	Initial Accuracy	Resolution	Response Time
Pressure	0..7000 dbar	0.01 %full scale	0.002 %full scale	50 ms
Oxygen	0..50 ppm	0.1 ppm	0.01 ppm	3 s (from nitrogen to air)
	0..500 % sat.	1 % sat.	0.1 %sat.	3 s (from nitrogen to air)
Turbidity	0.03..>750 FTU	5 FTU*	0.5* FTU	0.1 s

* Accuracy and resolution are referred to 750 FTU scale.

ELECTRONIC SPECIFICATIONS

Real-time and logging:

up to 8Hz.

Interfaces:

RS232C, TTL (0 to 3.3VDC), RS485, wireless Bluetooth®.

Real time clock accuracy:

± 3ppm/year.

Communication speed:

38K4 bps (up to 115k2 bps).

Data memory:

2 Gbyte

Supply voltage:

Battery:

2 x size "AA" Alkaline 1.5V battery assembled in a single pack, 3.0V, or

1 x size "AA" Lithium non-rechargeable battery, 3.6V, 2.4Ah.

External:

5.0 to 18VDC.

Supply current:

Running:

45 mA @ 3.6VDC;

Sleep:

8 µA @ 3.6VDC.

SOFTWARE

Idronaut programmes operating under all Windows versions allow the operator to configure the OS304Plus data acquisition and logger functions and upload data from the memory. They are:

WTERM, ITERM: Terminal emulation programmes to easily communicate with the OS304Plus using the built-in operator interface and communication protocol.

REDAS-5: Data processing and retrieval programme, which allows the display and plotting of conductivity, temperature, pressure and derived variables such as salinity, sound speed and water density, according to UNESCO formulas and recommendations.

µREDAS: REDAS-5 customized for Windows mobiles running on PDA devices.

PHYSICAL CHARACTERISTICS

Housing:

1000 dbar

2000 dbar

7000 dbar

AISI 316/black POM

white POM

Titanium

Dimensions:

diameter

43 mm (upper cap:48mm)

75 mm

48 mm

length

540 mm

580 mm

545 mm

Weight:

in air

1.1 kg

2.2 kg

1.8 kg

in water

0.65 kg

0,5 kg

1.1 kg



IDRONAUT S.r.l

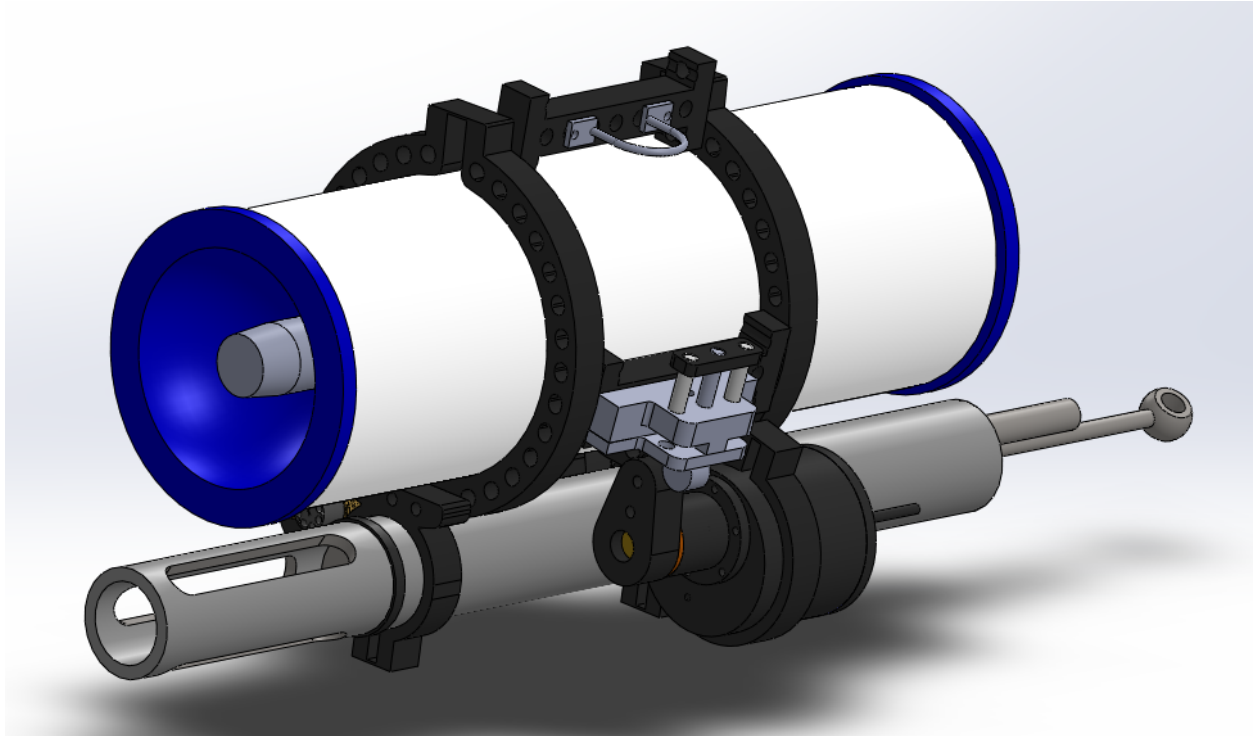
For immediate product information call:

Via Monte Amiata,10
20861 Brugherio (MB) - ITALY
Tel. +39039 879656 - Fax +39 039 883382
e-mail: Idronaut@idronaut.it <http://www.idronaut.it>

NOV-2019

The watersampler is a Van Dorn type watersampler moved by a MicroServo and a battery present in the canister that splits the signal that arrives from the tether of the winch.

The whole kit is reported below:



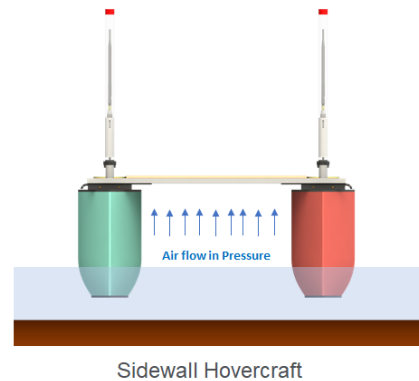
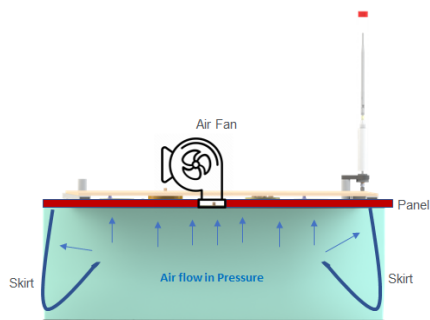
8. Surface Effect Ship – SWAMP

Purpose

This system will be developed later in the project

Composition of kits:

- Reducing drag
- Increasing payload
- Increasing speed



Function

The system

Composition of kit:

Maxon Motor with a Control System

Air Fan

Skirts