



CODEVINTEC

Tecnologie per le Scienze della Terra e del Mare

Underwater wireless modems and USBL positioning



Offering a powerful USBL transceiver functionality with full benefits of an S2C technology communication link

Applications

Positioning of offshore equipment

- > Track the positions of offshore equipment during installation to ensure accurate placement at predetermined coordinates

Navigation of ROVs and AUVs

- > Simultaneously track positions of multiple ROVs or AUVs and control their missions with instant commands

Cartography

- > Locate underwater features with geo-referenced coordinates when used together with GPS or differential GPS

Increase measurement accuracy

- > Track the position of sensors and detectors to increase the accuracy of measurements

Diver Tracking

- > Monitor positions of several divers and exchange information with them during the mission



EvoLogics S2C R USBL Underwater Positioning and Communication Systems

EvoLogics S2CR USBL is a series of combined positioning and communication devices. Offering a powerful USBL transceiver functionality with full benefits of an S2C technology communication link, S2CR USBL devices provide accurate USBL tracking and full-duplex digital communication, delivering an excellent all-round performance ideal for application scenarios that demand space-, energy- and cost-saving solutions.

Switching between positioning and communication modes is not necessary: **positioning data is calculated simultaneously with acoustic transmissions**. Both features complement each other in a fully integrated positioning and communication system that opens new possibilities for a wide range of subsea applications.

- > **Patented S2C (Sweep Spread Carrier) Technology**
- spread spectrum technology based on extensive bionic studies
- > Simultaneous USBL **positioning and data transmissions**
- > Tracks **up to 255** targets simultaneously
- > Can be used as **Inverted USBL**
- > Self-adaptive algorithms for reliable performance in **adverse underwater conditions**, built-in forward error correction and data compression
- > Advanced communication protocol with several data delivery algorithms: send and receive large volumes of data with **the highest bit rate** possible in current conditions; send and receive short instant messages without interrupting the main data flow between devices
- > Addressing and networking: build relay chains and underwater networks with broadcasting capabilities
- > Low power consumption and additional power-saving options

Modules and Options

- > AHRS (Attitude and Heading Reference System)
- > GPS integration
- > Integrated rechargeable battery
- > Acoustic Wake-Up module
- > Integrated data-logger available
- > Acoustic releaser
- > Short- mid- and long-range devices for shallow or deep water applications
- > OEM versions available
- > Compatible with S2C R modem and LBL solutions

Sensor integration

- > ADCP: Acoustic Doppler Current Profiler
- > SVP: Sound Velocity Profiler
- > CTD: Conductivity, Temperature, Depth, Pressure sensors
- > INS: Inertial Navigation System
- > More options upon request





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A USBL transceiver is mounted on a Vessel and uses acoustic signals **to determine the distances** and bearings to the tracking targets. The USBL transceiver measures the time from transmission of its **acoustic interrogation signal** until an acoustic reply from the Transponder is detected and converts it to distance to the Transponder. Containing **several transducers** separated by a short distance (the ultra-short baseline antenna), the transceiver calculates the angle to the Transponder using the phase-differencing method.

Transponders are attached to several tracking targets, for example, to autonomous underwater vehicles (**AUVs**), remotely operated vehicles (**ROVs**), towfish etc. The Transponders reply to acoustic signals from

the USBL transceiver with their own acoustic pulses, allowing it **to calculate their positions**. Optional third-party external instruments (an AHRS sensor and/or a GPS receiver) provide information about **the vessel's orientation** and real-world coordinates. The customer's Navigation **computer is interfaced** with the USBL transceiver and the external instruments and is connected to the local computer network.

EvoLogics positioning software, the SiNAPS, is installed on the Navigation computer. EvoLogics SiNAPS positioning software controls the positioning system and provides display features **to monitor the mission in real-time**.

S2C Technology

Challenging hydroacoustic conditions represents huge barrier for reliable underwater communication

Offshore operation demands that all systems must work even **under harsh conditions**. The key to this success is to have a reliable data connection with any malfunction increasing the risk to the operation. Under good conditions, currently available underwater modems can transmit data satisfactorily. However, when the hydroacoustic conditions turn worse due to inter-

fering noise and varying multipath propagation etc., a superior technology modem is required.

Even in calm seas, the stratification of water body can cause **severe signal reverberations** and dynamic fluctuation of channel properties, resulting in poor transmission.

Adapting a solution from nature: S2C underwater technology

Dolphins and whales have adapted to the situation under water very well, communicating over long distances. They chirp and sing across a broad frequency bandwidth. This continuous change of frequencies not only serves to transmit information, but also to compensate for sources of interference such as echoes and noise. **Building upon eight years of studies on the physics of dolphin communication**, EvoLogics has developed the patented SweepSpread Carrier (S2C) technology.

To mimic dolphin sound pattern, modems built on S2C technology continuously spread the signal

energy over a wide range of frequencies and **adapt the signal structure** so that the multipath components do not interfere with each other.

At the receiver end, advanced signal processing collects the energy and converts the received signals into narrow band signals.

This results in achieving **significant depression of multipath disturbances** and substantial system gain, enabling successful decoding of signals also in crucial environments even when they are heavily masked by noise.

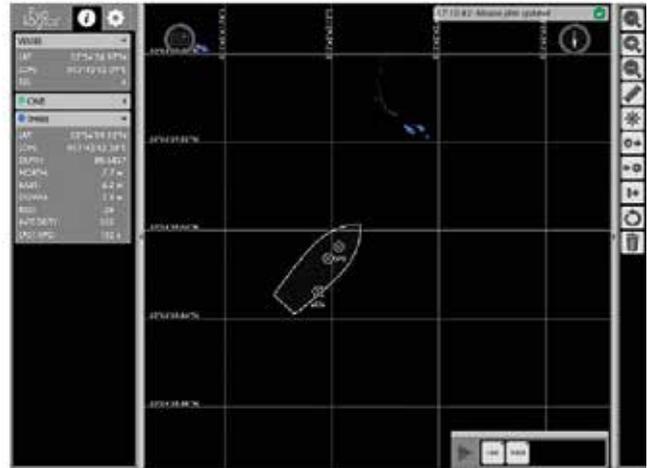




SiNAPS

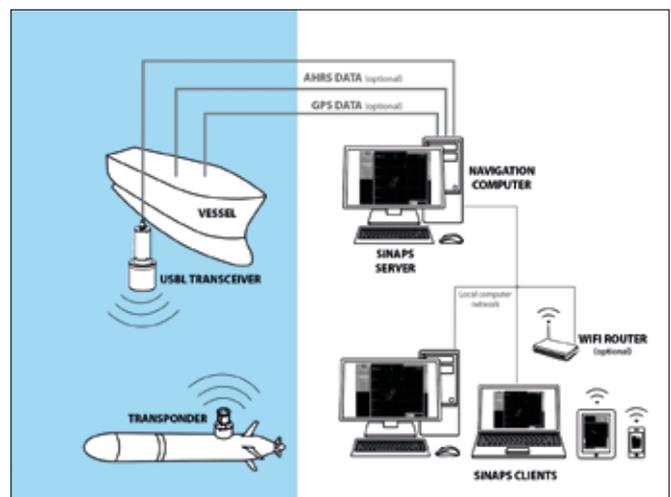
SiNAPS, the new S2C intelligent Navigation and Positioning Software

- > Web-based user interface - **use the software on any device** in the local computer network
- > **Real-time multiple target tracking**
- > Extensive system configuration options
- > **Increased positioning accuracy** when interfaced with an internal or external AHRS (Attitude and Heading Reference System) sensor and an external GPS receiver
- > Useful display tools, distance measurement tool, settings management tools
- > Advanced data management options: internal database, realtime
- > NMEA data output, customizable data export



EvoLogics SiNAPS is a client-server application. The SiNAPS server is a software component, installed on the Navigation computer interfaced with the USBL transceiver and other external instruments.

The SiNAPS server receives, processes and stores data from the USBL transceiver and external instruments. It performs all the necessary calculations to display this information on-screen. The SiNAPS client is the web-based user interface of the positioning system. **It displays real-time information about the positions of the Vessel and the targets**, provides access to data management tools and system configuration settings. The user interface **can be opened in most current web browsers** on any device in the local computer network. It is possible to open SiNAPS clients on multiple devices at once. To access SiNAPS UI, one must simply navigate the web browser to the correct address.





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EvoLogics S2C R USBL Underwater Positioning and Communication Systems. Specifications and configuration options

S2CR 48/78 USBL
S2CR 42/65 USBL
S2CR 18/34 USBL



S2CR 12/24 USBL
S2CR 7/17 USBL



S2CR 48/78

S2CR 42/65

S2CR 18/34

S2CR 12/24

S2CR 7/17

General

		S2CR 48/78	S2CR 42/65	S2CR 18/34	S2CR 12/24	S2CR 7/17
OPERATING DEPTH	Delrin	200 m	200 m	200 m	200 m	200 m
	Aluminium Alloy	2000 m	2000 m	2000 m	2000 m	2000 m
	Stainless Steel	2000 m	2000 m	2000 m	2000 m	2000 m
	Titanium	2000 m	2000 m	2000 m	6000 m	6000 m
OPERATING RANGE		1000 m	1000 m	3500 m	6000 m	8000 m
FREQUENCY BAND		48 - 78 kHz	42 - 65 kHz	18 - 34 kHz	13 - 24 kHz	7 - 17 kHz
TRANSDUCER BEAM PATTERN		horizontally omnidirectional	wide - angle 100 degrees	horizontally omnidirectional	directional 70 degrees	hemispherical

USBL

SLANT RANGE ACCURACY ¹⁾		0,01 m				
BEARING RESOLUTION		0.1 degrees				
NOMINAL SNR		10 dB				

Connection

ACOUSTIC CONNECTION		up to 31.2 kbit/s	up to 31.2 kbit/s	up to 13.9 kbit/s	up to 9.2 kbit/s	up to 6.9 kbit/s
BIT ERROR RATE		less than 10 ⁻¹⁰				
INTERNAL DATA BUFFER		1 MB, configurable				
HOST INTERFACE ²⁾		Ethernet, RS-232 (RS-485 ³⁾ /422 optional)				
INTERFACE CONNECTOR		up to 2 SubConn® Metal Shell 1500 Series				

Power

POWER CONSUMPTION	Mode	S2CR 48/78	S2CR 42/65	S2CR 18/34	S2CR 12/24	S2CR 7/17
	Stand-by Mode	2.5 mW	2.5 mW	2.5 mW	2.5 mW	2.5 mW
	Listen Mode ⁴⁾	5 - 285 mW	5 - 285 mW			
	Receive Mode ⁵⁾	less than 1.3 W	less than 1.3 W			
	Transmit Mode	5.5 W, 250 m range	5.5 W, 250 m range	2.8 W, 1000 m range	2.5 W, 1500 m range	3 W, 2000 m range
		8 W, 500 m range	8 W, 500 m range	8 W, 2000 m range	5 W, 3000 m range	10 W, 4000 m range
	18 W, 1000 m range	18 W, 1000 m range	35 W, 3500 m range	15 W, 6000 m range	40 W, 8000 m range	
	60 W, max. available	60 W, max. available	80 W, max. available	40 W, max. available	80 W, max. available	

POWER SUPPLY ⁶⁾ External 24 VDC (12 VDC optional) or internal rechargeable battery (optional)



	S2CR 48/78	S2CR 42/65	S2CR 18/34	S2CR 12/24	S2CR 7/17
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Physical

DIMENSIONS ⁷⁾	Housing	Ø 110 x 170 mm	Ø 110 x 170 mm	Ø 110 x 170 mm	Ø 113 x 220 mm	Ø 113 x 260 mm
	Total length	315 mm	315 mm	315 mm	365 mm	405 mm
	USBL sensor	Ø 130 x 145 mm	Ø 130 x 145 mm	Ø 130 x 145 mm	Ø 175 x 145 mm	Ø 175 x 145 mm
WEIGHT, dry/wet	Delrin	4790/1090 g	4790/1090 g	5775/730 g	8500/4230 g	8500/4230 g
	Aluminium Alloy	5500/1800 g	5500/1800 g	5500/1800 g	9800/5300 g	9800/5300 g
	Stainless Steel	11400/6200 g	11400/6200 g	13130/6130 g	13640/9540 g	13640/9540 g
	Titanium	9900/4900 g	9900/4900 g	9830/4830 g	13420/8920 g	13420/8920 g

Configuration options

Housing

DELIRIN	Plastic non-magnetic corrosion-resistant housing, depth rating 200 m
ALUMINIUM ALLOY	Light metal housing for short-term deployments, depth rating 2000 m
STAINLESS STEEL	Robust metal housing, suitable for long-term deployment in harsh environments, depth rating 2000 m
TITANIUM	Corrosion resistant, suitable for long-term deployment in harsh environments, depth rating 6000 m

Interface

1 CONNECTOR	RS-232 ⁸⁾ or Ethernet
2 CONNECTORS	RS-232 + RS-232 or RS-232 + Ethernet

Modules

WAKE-UP MODULE ⁹⁾	RS-232 interface	✓
	Ethernet interface	✗
	RS-232 + RS-232 interface	✓
	RS-232 + Ethernet interface	✗
INTERNAL AHRS ¹⁰⁾	RS-232 interface	✗
	Ethernet interface	✓
	RS-232 + RS-232 interface	✗
	RS-232 + Ethernet interface	✓

iUSBL CONFIGURATION Inverted USBL: the transceiver is installed on the target

Unique application scenarios might require custom solutions. OEM versions and streamlined transducer units are available. EvoLogics and Codevintec experts are always ready to address any special requests!



Notes

- ¹⁾ Slant range estimation is based on the measured propagation time, slant range accuracy depends on sound velocity profile, refraction and signal-to-noise ratio.
- ²⁾ See the Configuration Options for available standard interface combinations.
- ³⁾ RS-485 protocol does not support duplex communication and must be customized. Contact EvoLogics for more information!
- ⁴⁾ User-configurable Listen Mode is only available with a Wake-Up module installed. Power consumption in Listen Mode depends on Listen Mode settings.
- ⁵⁾ Power consumption for the RS-232 interface option. Add 600 mW for the Ethernet interface option.
- ⁶⁾ Contact EvoLogics for more information on power supply options!
- ⁷⁾ S2CR 48/78, 18/34 - dimensions of a Delrin housing, other builds are slightly larger; S2CR 12/24, 7/17 - dimensions of a titanium housing, other builds are slightly smaller. Contact EvoLogics for more information on device dimensions!
- ⁸⁾ One RS-232 Interface can be replaced with either RS-485 or RS-422 interface. More interface configurations available by special request. Contact EvoLogics for more information!
- ⁹⁾ The Wake Up Module turns the rest of the device on if it detects incoming acoustic signals or incoming data on the host interface. Once the device completes receiving or transmitting data, it switches itself off. Please note: the Wake Up Module is only compatible with the RS-232 interface! It is not compatible with Ethernet, RS-485 or RS-422.
- ¹⁰⁾ Internal Xsens® MTI AHRS (Attitude and Heading Reference System) compensates the changes of roll, pitch and heading. Power consumption increases by 400 mW with AHRS installed.