RedWave
The system for underwater positioning and data transmission

The RedWave System is represented by a line of devices, meeting the challenge of underwater positioning and data transmission for a wide range of users: divers, scuba divers, industrial divers, salvage divers, deep divers, remote operated vehicles (ROV), autonomous unmanned vehicle (AUV).

Systems operating principle is similar to operating principles of global satellite navigation systems such as GPS, GLONASS and alike, with minor distinction that the RedBase floating buoys operate as a navigational satellite, creating conjointly a so called long baseline.

The buoys can be easily set in the water area immediately prior to the usage of RedWave navigation devices, from any waterborne vehicle, an inflatable for example. They can be collected just as easily as soon as the work is completed. Four navigational buoys are used to provide positioning. For data transmission no usage of buoys is required.

The application script of diver's navigation during scuba diving and route following.

• In case of a prearranged route all the waypoints are loaded in the diver's navigation device before submersion.

• Sound velocity, temperature and salinity can also be transferred to the device if necessary. This software has a built-in salinity data of all major water bodies with a one geographical degree of grid spacing. When used in fresh water only water temperature is needed.

• Four RedBase buoys are placed on water before submersion (for example from the boat), all of them anchored. Each has a number from 1 to 4.

• The diver with a RedNav navigation receiver can see his or her position relative to the buoys during submersion, and since each buoy has a number from 1 to 4, this information is also represented on the screen of the RedNav device. For example the diver is able to know that Buoy #1 is allocated on the supplying vehicle, thus solving the problem of diver homing.

• If the route waypoints are already stored, the diver can move toward the designated point by switching between them using the control buttons.

• For the whole duration of the dive the RedNav device automatically records a track, which can be uploaded later to a computer for further preservation and analysis.

• The diver can store his or her current location by using the control buttons. It is especially acute in prospecting and exploration works, as well as wildcatting and search procedures. The stored point in the navigation device can be saved on the computer, transferred to another navigation device or used as a waypoint (found-saved-resurfaced-submerged-returned to the point; or found-saved-swam away-returned to the point and so on). Up to 10 points can be saved and can also be uploaded to a computer along with the track after resurfacing.

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The application script using a remote operated vehicle (ROV)

• It is implied that the RedNode navigation receiver is already installed on a ROV and is connected to it information- and energy-wise. As a preliminary four RedBase devices (#1 to #4) are anchored.

• The device transmits the data on geographical location via RS-232 interface to ROV, and ROV software can subsequently transfer this data to the control console.

• Sound velocity value in aquatic environment should be set before starting.

• There are no limits to the number of simultaneously active RedNode devices within one water zone or area.

• After the submersion of the device, the navigation receiver begins to calculate it's own geographical location in three dimensions (such as latitude, longitude and depth) and whilst calculating new position transmitting this data to the ROV in the NMEA 0183 format.

A line of devices represents the RedWave System, meeting the challenge of underwater positioning for a wide range of users: divers, scuba divers, industrial divers, salvage divers, deep divers, remote operated vehicles (ROV), autonomous unmanned vehicle (AUV).

Systems operating principle is similar to operating principles of global satellite navigation systems such as GPS, GLONASS and alike, with the exception of RedBase floating buoy operating as a navigational satellite, creating a so called long baseline all combined.

The buoys can be easily set in the water area immediately prior to the usage of RedWave navigation devices, from any waterborne vehicle, an inflatable for example. They can be collected just as easily as soon as the work is completed. Four navigational buoys are used to provide positioning.

The device with a set of four buoys implements a long baseline (LBL). Navigational buoy or a GIB-GNSS-equipped intelligent buoy is made in the form of a plastic cylinder 600 mm (23,6 in) long and 130 mm (5,1 in) in diameter with a hydroacoustic transducer on a wire. It has positive floating characteristics and a load eye for an anchor. It also has an up-to-date high-production navigational receiver GPS/GLONASS and an innovational navigation hydroacoustic transducer.

The device is a portable individual navigation receiver, fastened on a diver's wrist, which works with a LBL support. Provides data on geographical location and depth. This device is unrivalled in the world.

The device is intended for providing navigational data to ROV, AUV with a LBL support, generated by four RedBase buoys. It also delivers data on geographical location, depth an water temperature.

The device is intended for transmitting and receiving preinstalled coded messages, distance calculation (based on a dissemination in a request-response mode) along with telemetry information (with a simultaneous distance calculation) and to provide a coded connection between ROV and AUV and above-water stations of various configurations.

RedNav
Diver's Navigator

The device is a portable individual navigation receiver, fastened on a diver's wrist, which works with a LBL support. Provides data on geographical location and depth. **This device is unique and unrivalled in the world.**

Size (H x W x D/antenna included)	130x80x40 / 70 mm
Weight	300 g
Maximum depth	70 m
Maximum number of devices operating in one aquatic area	Unlimited
Rated accuracy in defining geographical location, 2DRMS	0.84 m
Update frequency of navigational data	1 Hz
Screen	2.7" high-contrast OLED (yellow on black), 128x64
Fastening	Durable polymeric belt with a Fastex clasp
Battery endurance	Up to 24 hours
Charger	Wireless, with a 6 hours of battery charging
PC connectivity	Wireless, Bluetooth
PC software compatibility	RedNav Host Utility, setup, waypoints download, track and users points upload
Route functions	Up to 20 loaded waypoints, up to 20 users points that can be used as reference points
Extra	Full track and tracks of buoys positions. Up to 8 hours of records.

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RedBase
Navigational Hydroacoustic Buoy

The device with a set of four buoys implements a long baseline (LBL). Navigational buoy or a GIB-GNSS-equipped intelligent buoy is made in the form of a plastic cylinder 600 mm (23,6 in) long and 130 mm (5,1 in) in diameter with a hydroacoustic transducer on a wire. It has positive floating characteristics and a load eye for an anchor. It also has an up-to-date high-production navigational receiver GPS/GLONASS and an innovational navigation hydroacoustic transducer.

Size (length x diameter)	597 x 146 mm
Weight	3.8 kg
Battery endurance	Up to 24 hours
Operating temperature range	0..+50 °C
Storage temperature range	–20..+60 °C
Time of full recharge (power requirements 220V 50 Hz)	10 hours
Power-producing acoustic communication range	3000 m

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RedNode
Navigational Signal Receiver

The device is intended for providing navigational data to ROV, AUV with a LBL support, generated by four RedBase buoys. It also delivers data on geographical location, depth and water temperature. **This device is unique and absolutely unrivalled in the world.**

Size (diameter and height)	64 x 62 mm
Weight (dry)	260 g
Maximum depth	140 / 300 m
Maximum number of devices operating in one aquatic area	Unlimited
Rated accuracy in defining geographical location (inherent accuracy), 2DRMS	0.84 m
Update frequency of navigational data	1 Hz
Power voltage	5 V
Current consumption	70 mA
Interface	RS-232 + NMEA
Connection	1,5 m cable

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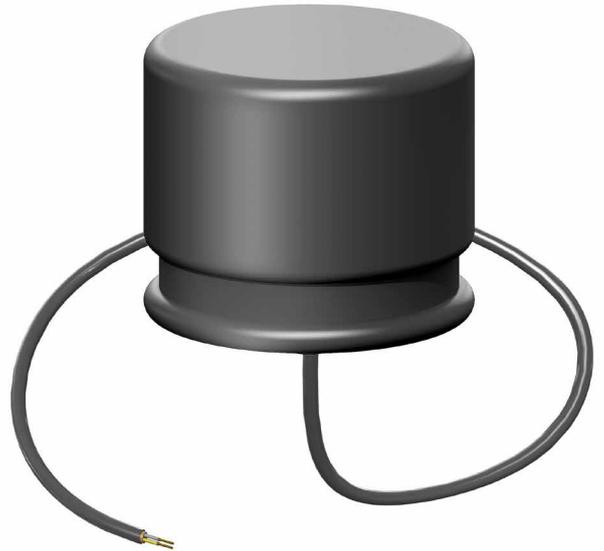
RedGTR

Underwater Acoustic Modem
for Coded Multiuser Connection

The device is intended for transmitting and receiving preinstalled coded messages, distance calculation (based on a dissemination in a request-response mode) along with telemetry information (with a simultaneous distance calculation) and to provide a coded connection between ROV and AUV and above-water stations of various configurations.

Size (diameter and height)	64 x 62 mm
Weight (dry)	260 g
Maximum depth	400 m
Maximum number of devices operating in one aquatic area	Up to 20
Maximum number of possible messages, transmitted within a 20 user network	Up to 50
Telemetry information	Temperature, depth, battery charge
Power voltage	5 V
Current consumption	70 mA
Interface	RS-232 + NMEA
Connection	1,5 m cable
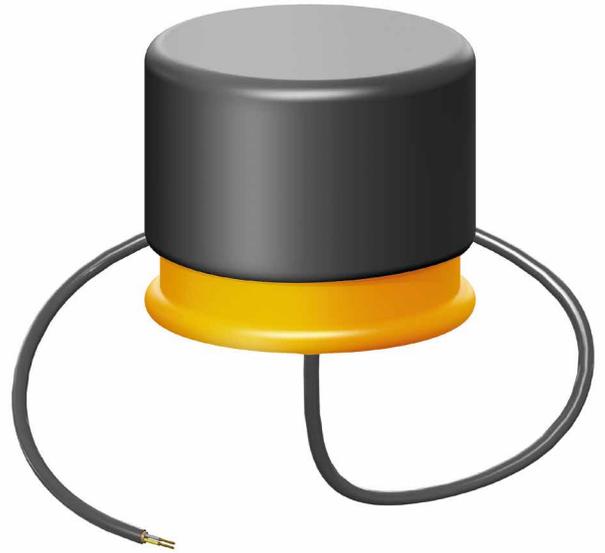
RedLine
Underwater Hydroacoustic Modem

The device is intended for transmitting data using a hydroacoustic channel, without limitations to complex hydrologic environment and shallow water. **This device is unique and unrivalled in the world based on the ration of size — maximum operating range — data transmission rate.**

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Size (diameter and height)	64 x 62 mm
Weight (dry)	260 g
Maximum depth	400 m
Maximum distance	8000 m
Coded division of users	24 code channels
Data transmission rate	88 bit/s
Power voltage	5 V
Current consumption	70 mA / 1700 mA
Interface	RS-232, transparent channel + NMEA
Modulation	PSK

Natrix
Underwater Hydroacoustic Modems

This device is intended for transmitting data using a hydroacoustic channel, without limitations to complex hydrologic environment and shallow water. **This device is unique and unrivalled in the world based on the ration of size — maximum operating range — data transmission rate.** It is suitable for use in small artificial reservoirs with strong reverberation (steel and concrete technical pools, various docks, etc).

Size (diameter and height)	64 x 62 mm
Weight (dry)	360 g
Maximum depth	400 m
Maximum distance	2500 m
Data transmission rate	562 / 1200 bit/s up to 2400 bit/s is planned for future versions of the firmware
Power voltage	12 V
Current consumption	70 mA / 1700 mA
Interface	RS-232, transparent channel + NMEA
Modulation	OFDM
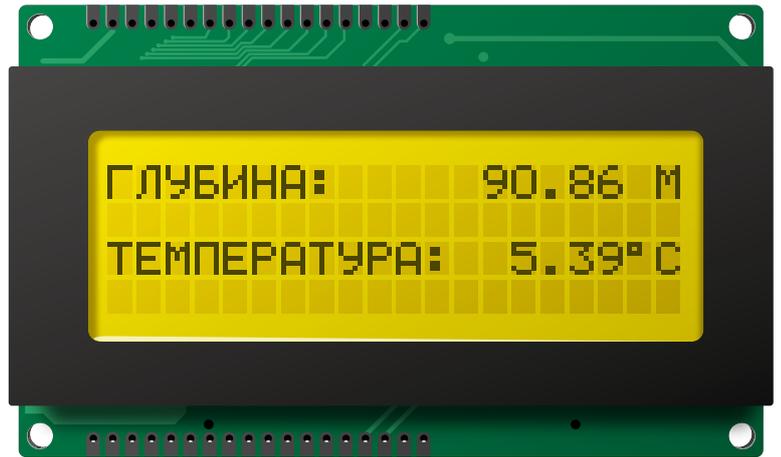
Crimea-300
Depth and Temperature Data System

Intended for underwater technical work as a part of the informational support complex.

Consists of two units: measuring (underwater) and above-water. The measuring unit includes an integrated pressure sensing and temperature device and a miniature processor, both of which are installed in a solid waterproof case. The above-water unit has a screen which shows all data of the measuring unit in real time operation mode. Twisted-pair cable connection allows to make zero-calibration on-site (air-pressure follow-up) and water density. Open protocol is used during data transmission between the units. That is the reason why it is so simple to integrate Crimea-300 into any personal equipment.

Depth operating range (for measuring unit)	0.. 300 m
Operating temperature range	0.. +50 °C
Interface	Twisted pair, RS-485 + open protocol
Screen	Character LCD screen, 4 lines, 20 characters
Update frequency	4 Hz
Accuracy of depth calculation	0.1 m
Accuracy of temperature calculation	0.2 °C