



# IDRONAUT OCEAN SEVEN 320Plus WOCE-CTD for Oceanography

PROFILER AND RECORDER EQUIPMENT - SMALL SIZE - FAST SAMPLING RATE: 40Hz  
O<sub>2</sub>, pH, ORP - ARCTICA, ANTARCTICA - FERRYBOX - BRINE - CCS - ROVs, AUVs

*The OCEAN SEVEN 320Plus WOCE-CTD multiparameter probe is the result of Idronaut's 35-year-old experience in the design and manufacturing of high-quality fast response CTDs. The OCEAN SEVEN 320Plus CTD well meets the WOCE programme accuracy, precision and resolution specifications. The CTD can be easily equipped with an additional redundant conductivity and temperature (CT) sensor pair without the need for underwater connectors. The CT redundant sensors permit the gathering of extremely precise data with a verifiable data quality. The OCEAN SEVEN 320Plus WOCE-CTD is equipped with the well-known IDRONAUT full ocean depth, pump-free and long-term stability 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 (46 mm) to guarantee self-flushing and no clogging after long-term deployment even in biologically active waters. Competitors' sensors, which present few mm only of cell orifice and very long cell length, are prone to clog even if protected by dangerous and poisonous antifouling devices. The OCEAN SEVEN 320Plus WOCE-CTD multiparameter probe does not require pumps or any other external device to flush the sensors, which minimizes its power consumption and allows the use in *Arctica* and *Antarctica*. However, pump is optional. Data telemetry available for on-line full ocean depth real-time data transmission. Other interfaces like RS422 and wireless Bluetooth® can be optionally installed. The OCEAN SEVEN 320Plus WOCE-CTD, because of an innovative 24-bit high-speed CT digitizer circuit, provides 40 Hz sampling rate. Furthermore, the highly precise pressure transducer enhances the pressure sensor accuracy/precision to 0.01 % Full Scale (FS). The OCEAN SEVEN 320Plus WOCE-CTD multiparameter probe can accommodate up to sixteen 16-bit sensor analogue inputs, which can be added at any time, making this Idronaut probe an investment for the future.*

## ■ **HIGHLY ACCURATE/PRECISE (0.01%FS) PRESSURE TRANSDUCER**

The high-precision 0.01%FS pressure transducer is based on a piezoresistive bridge, floating on oil, with drift-free sensor interface. Temperature dependency and nonlinearity are mathematically compensated by the interfacing electronics. Standard pressure transducers immediately available: 100, 1000, 2000, 4000, 6000, 10000 dbar.

## ■ **TEMPERATURE SENSOR**

Features a very fast platinum resistance thermometer (response time: 50 ms). Negligible self-heating effect.

## ■ **CONDUCTIVITY SENSOR**

The high accuracy seven-platinum-ring quartz conductivity cell (patented) can be cleaned in the field without the need for re-calibration. This unique quartz cell employs a large diameter (8mm) and a short length (46mm) to guarantee self-flushing and no clogging after long-term deployment even in biologically active waters. Furthermore, an optional UV LED (280 nm), integrated into the conductivity cell, sterilizes the sample under measurement, thus avoiding the early growth of biofouling inside the quartz measuring cell.

## ■ **REDUNDANT PAIR OF TEMPERATURE AND CONDUCTIVITY SENSORS**

More reliable operation at sea minimizing risk of data loss. The redundancy principle allows better control of any possible sensor drift during long field campaigns.

## ■ **OXYGEN SENSOR (7000 m operation)**

Features a pressure-compensated polarographic sensor with a replaceable cap or/and advanced optical dissolved oxygen sensor. Both sensor can be installed at the same time.

## ■ **pH GLASS SENSOR and SOLID GEL REFERENCE ELECTRODE (7000 m operation)**

High-pressure low impedance glass membrane pH electrode in conjunction with a unique KCl or NaCl gel double junction reference electrode and a differential pH preamplifier,  $10^{13} \div 10^{14}$  ohm input impedance.

## ■ **DATA TRANSMISSION**

Via RS232C interface. Optional interfaces are: long distance (10000 m) data telemetry, RS422 and Wireless Bluetooth.

## ■ **DATA MEMORY**

Allows storage of up to 16M dataset, for each of the 7 standard acquired parameters together with date & time, using the 4 GByte non volatile memory.

## ■ **OPTIONAL PROBES, SENSORS**

- |  |   |
|--|---|
| ○ WATER SAMPLER – IDRONAUT MISS, GO 1018, GO 1015, SBE 32C.  | ○ CHELSEA – MINITracka, Unilux and Trilux Fluorometers.           |
| ○ IDRONAUT – High Precision 0.01 % Pressure Transducer.      | ○ WET Labs - C-Star Transmissometer and ECO Fluorometers.         |
| ○ IDRONAUT - String and Weight Bottom Sensor.                | ○ SEAPoint - Fluorometers and Turbidity Meter.                    |
| ○ IDRONAUT – Optical dissolved oxygen sensor                 | ○ TURNER DESIGNS – CYCLOPS-7F™, C-FLUOR™, C3™, C6P™ Fluorometers. |
| ○ VA500 Sonar Altimeter, 6000 m.                             | ○ BIOSPHERICAL INSTRUMENTS - QSP-2200 - QSP-2300 PAR Sensors.     |
| ○ LI-COR - LI-192SA and LI-193SA Underwater Quantum sensors. |   |



## BATTERY-OPERATED SELF RECORDING MODES

The internal and the optional external submersible battery packs permit continuous probe operation for about 7 and 70 hours respectively. Rechargeable or lithium batteries can also be used. Twelve batteries: 1.2 V, 2.85 Ah, NiMH cells are installed in the internal battery pack.

- **Pressure:** Data is sampled at regular pressure intervals. Multiple profiles can be obtained by switching the CTD ON and OFF.
- **Timed:** OS320Plus collects a series of samples and then sleeps for the configured time interval before waking up again and repeating the acquisitions. Time interval can be configured from 0.1s up to 1 day. Battery power is conserved while the probe is in sleep mode.
- **Conditioned:** Data is sampled at configurable sampling rates starting when the selected parameter overcomes the configured boundary. Sampling continues until the selected parameter falls below the configured boundary. Whenever the acquisition cycle starts, a configurable sampling rate 0.1..20 Hz is used. Monitoring of the selected parameter occurs at the configurable interval between 0.1s up to 1 day.
- **Continuous:** Data is sampled at configurable sampling rates starting when the operator switches on the probe. Sampling continues until the probe is switched off. Multiple cycles can be obtained by switching the CTD ON and OFF.
- **Real-time:** Data is sent to the control system at sampling rates of: **20, 30 and 40 Hz using REDAS-5 software.**

The unattended acquisition can be activated by means of a magnetic switch present on the probe top cover. Extension of the internal battery life is automatically obtained through a power management procedure that switches the probe OFF between data acquisitions. The probe is equipped with an internal non-volatile memory which can store up to a 16M dataset, each data set being composed of date, time and measurement of the standard sensors. Stored data is uploaded at the end of the measuring cycles.

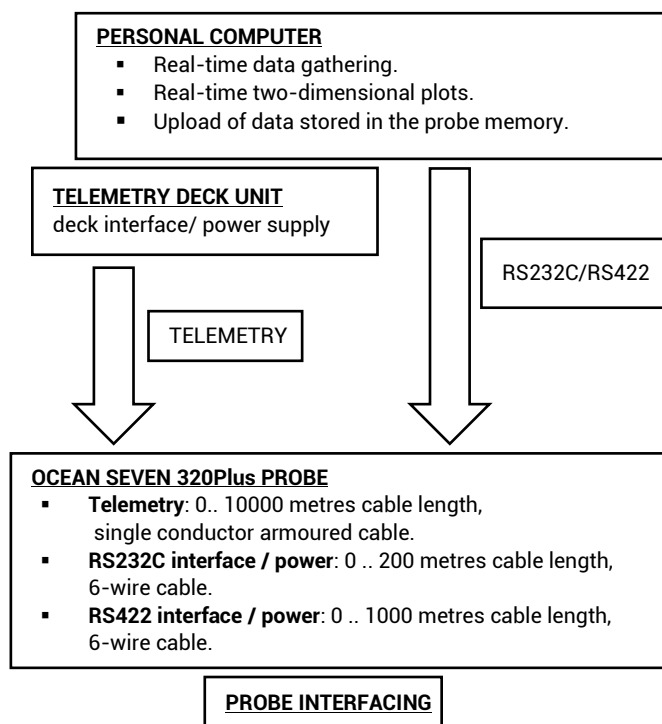
The OCEAN SEVEN 320Plus CTD can be configured to be directly interfaced to a personal computer by means of the RS232C serial port or by telemetry. The telemetry and RS422 interfaces remedy the limitations of the RS232C serial interface (cable length and number of conductors). When using the telemetry interface, the Telemetry Deck Unit is required to convert serial, RS232C type signals from a PC communication port, into telemetry signals (and vice versa) which must flow superimposed on the probe power supply along the armoured single conductor coaxial cable.

Probe communication is achieved through one of the two male connectors installed on the top end cap of the probe. A six-pole connector is used for the RS232C and RS422 interfaces and for the power input, while, a two-pole connector is used for the telemetry interface.

## IDRONAUT REDAS-5 Windows Software

REDAS-5 software, through a simplified and friendly operator interface, allows taking full control of the OCEAN SEVEN 320Plus CTD and facilitates real-time data acquisitions, configuration of unattended acquisition cycles and uploading of data stored in the probe memory. REDAS-5 program is a true 32-bit Windows application, which flawlessly runs on Windows. REDAS-5 shows the acquired data graphically and numerically thus allowing the operator to dynamically change the graphical and numerical set-up during data acquisition. Post-processing functions and data extraction procedures, in function of time, pressure or numerical intervals can be applied to acquire data in real time or on data retrieved from the probe memory. Among the operations that REDAS-5 can perform, it is worth mentioning: automatic start and stop of data acquisition; management of the bottle sampling (Rosette); processing and filtering of acquired data in real time (time lag compensation, smoothing etc.); acquisition of geographical coordinates from a GPS device; acquired data conversion into text files; automatic scaling of the graphical window X and Y axis.

**REDAS-5 software allows 20, 30 and 40 Hz sampling rate.**



OCEAN SEVEN 320Plus Telemetry System Performance Chart

<u>Telemetry Type</u>	<u>Max cable length</u>	<u>Max transfer rate</u>
RS232C	200 metres	38400 bps
RS422	1000 metres	38400 bps
Telemetry (*)	10000 metres	9600 bps

(\*) The above performance is obtained using the 6.4 mm diameter (1/4inch) Rochester cable 1-H-255 which has an electrical resistance of 23  $\Omega$ /km and a capacity of 138 pF/m. The Ocean Seven 320Plus CTD operates with the standard Rochester coaxial armored cables (1/10, 1/8, 1/4, 1/2 inch) present in oceanographic vessels having a total resistance up to 250 ohms.

## SENSOR SPECIFICATIONS

All the sensors installed in the OCEAN SEVEN 320Plus CTD (see table for SENSOR SPECIFICATIONS) are manufactured by IDRONAUT and are exported all over the world. They are used by several other multiparameter probe manufacturers. All sensors have extremely low response time: 50 milliseconds for physical parameters (CTD) at 1 m/s profiling speed and 3 seconds for chemical parameters. CTD sensor high resolution and accuracy are obtained because of the advanced sensor conditioning circuits and the 24-bit Sigma Delta A/D Converters. The OS320Plus multiparameter CTD can be equipped with the following sensors to measure:



	Range	Initial Accuracy	Resolution	Response Time
Pressure	0.. 1000 dbar (1)	0.01 % full scale	0.002 % full scale	15 ms
Temperature 1	-5.. +45 °C	0.001 °C	0.0001 °C	50 ms
Conductivity 1	0.. 70 mS/cm	0.001mS/cm	0.0001 mS/cm	50 ms (3)
Temperature 2 (2)	-5.. +45 °C	0.001 °C	0.0001 °C	50 ms
Conductivity 2 (2)	0.. 70 mS/cm	0.001mS/cm	0.0001 mS/cm	50 ms (3)
Oxygen Polarographic	0.. 50 ppm	0.1 ppm	0.01 ppm	3 s (4)
	0.. 500 % sat.	1 % sat.	0.1 % sat.	3 s (4)
Oxygen Optical	0..44 mg/l	±0.1 mg/l	0.025 mg/l	3 s (5)
	0..500 % sat.	±1 % sat.	0.25 % sat.	3 s (5)
pH	1.. 13 pH	0.01 pH	0.001 pH	3 s
Redox	-1000.. +1000 mV	1 mV	0.1 mV	3 s
Auxiliary inputs (6)	0.. 5000 mV	1 mV	0.1 mV	50 ms

(1) Other standard pressure transducers, immediately available, have 10, 40, 100, 200, 500, 2000, 4000, 6000, 10000 dbar ranges. **Optionally, the IDRONAUT Highly Accurate Precise (0.01%FS) Pressure Transducer can be installed instead of the standard pressure transducer.**

(2) Optional. (3) At 1 m/second flow rate.

(4) From nitrogen to air. (5) A **special FAST membrane, with response time 1s**, is available upon request.

(6) Through the auxiliary inputs, optional sensors like: Fluorometer, Turbidity Meter, Transmissometer, Altimeter, Par, can be interfaced. Ten auxiliary analogue inputs are available inside the probe.

The fundamental properties of seawater, like: **Salinity, 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.

## ELECTRONIC SPECIFICATIONS

**Sampling rate:**

User selectable: 20, 30 and 40 Hz raw data CTD using REDAS-5 software.

**Communication protocol:**

Proprietary byte-oriented, binary and plain message protocol.

**Operator interface:**

Friendly menu-driven user interface.

**Data memory:**

4 GByte SD card non-volatile memory.

**Battery power supply:**

9 .. 30 V, 150 mA @ 12 V.

## PHYSICAL SPECIFICATIONS

Housing	1500 dbar	2000 dbar	7000 dbar
Diameter	100 mm	105 mm	89 mm
Length	710 mm	710 mm	720 mm
Weight in air	4,2 kg	4,2 kg	8,0 kg
Weight in water	2,2 kg	2,2 kg	4,3 kg
Materials	White POM	White POM	Titanium

## ACCESSORIES

### ■ TELEMETRY ON-BOARD MKPlus DECK UNIT:

The MKPlus Deck Unit powers and interfaces the OS320Plus CTD with an auto-adaptive V32/V32bis modem to optimize the full-duplex communication in real time, depending on the connection conditions. The communication speed of 14.400 bps over the oceanographic cable allows obtaining a higher transfer rate from the interfaced CTDs. Visual feedback is provided to the operator during communication to indicate the line quality and speed automatically selected by the MKPlus modem. The MKPlus Deck Unit provides high voltage telemetry power supply (220 VDC) to allow the CTDs to interface and power several additional probes. The MKPlus Deck Unit is housed in a 19" rack-mountable metallic box and is designed for on-board operations. The MKPlus Deck Unit operates with: 115/220 VAC +/-10%, 50-60 Hz +/- 5%. Telemetry power supply: 220 VDC (max 1A@12V). Dimensions: 80x160x90. Weight: 3 Kg.

### ■ MANUAL PORTABLE WINCH:

Includes 2-way or 5-way slip ring and it can hold up to 350 m of 5 mm polyurethane jacketed armoured cable or 100 m of 8.3 mm polyurethane multi-conductor shielded cable.

### ■ COAXIAL ARMoured CABLE

- Ø 5 mm -  
POLYURETHANE:

A strain relieved 5 mm polyurethane jacketed armoured cable type Idronaut - breaking strength: 200 kg - weight per km: 40 kg.

### ■ RS232C/RS422 CABLE - Ø 8.3 mm - POLYURETHANE:

Multi-conductor shielded cable - Kevlar armoured - type Idronaut Ø 8.3 mm - specifically designed for RS422 or RS232C interface. Composed of 2 pairs: one 2x24 AWG twisted together and one 2x19 AWG - breaking strength: >250 kg. RS232C data transmission limits this cable length to 200 metres. RS422 data transmission enables this cable length to 1000 metres. Weight: 3,6 kg/100 m in water; 9.6 kg/100 m in air.

### ■ TITANIUM PROTECTIVE CAGES:

For sensor and/or upper connector protection: Ø 260 mm. Mooring frame to house the CTD and two additional probes: on custom request.

### ■ EXTERNAL SUBMERSIBLE RECHARGEABLE BATTERY PACKS:

The following battery packs, 14.4VDC (no. 12 NiMH cells), 4.5Ah are available:

- Ø 75 x 315 mm, 1500/7000 m max depth operation;

The external battery pack is held by the probe by means of one or two POM flanges.

### ■ TRANSPARENT FLOW CELL:

Easily connectable to a pumped source of seawater (water volume 200÷300 ml), this option converts the Ocean Seven 320Plus CTD from a profiling CTD to a very accurate FerryBox thermosalinograph.

## OPTIONS

### ■ BLUETOOTH® WIRELESS ADAPTER:

The IDRONAUT Wireless Adapter allows full duplex communications between the OCEAN SEVEN 320Plus probe and a personal computer or PDA devices equipped with a Bluetooth® device. The Wireless Adapter provides an interface conforming to the Bluetooth® class 1 (100 m) connectivity SPP protocol.

### ■ RS422 INTERFACE:

Instead of the RS232C interface, allows real-time communication with the probe using cables long up to 1000 m.

### ■ REDUNDANT PAIR OF TEMPERATURE AND CONDUCTIVITY SENSORS:

More reliable operation at sea minimizing the risk of data loss. The redundancy principle allows better control of any possible sensor drift during long field campaigns.

### ■ GENERAL OCEANICS ROSETTE INTERFACE:

General Oceanics Rosettes are interfaced to perform attended and unattended bottle firing in function of time and/or depth variations. The latter is obtained through user's configurable depth profiles or depth steps. Furthermore, bottle firing can be accomplished in real time whenever the probe operates with the telemetry system.



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