



# IDRONAUT OCEAN SEVEN 316 PROBE

## ADVANCED SENSORS AND DEVICES FOR 7000 m DEPTH PROFILING

*The OCEAN SEVEN 316 Multi-Parameter Probe is the result of fifteen years of experience in designing high-technology probes for scientific, research and monitoring applications. Long-term stability, combined with high resolution and accuracy, makes this probe the ideal multi-purpose (on-deck or profiling) instrument for oceanographers and limnologists. It is equally suitable for inshore operation from small outboards or from large ocean vessels.*

### TEMPERATURE SENSOR

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

### FLOW CONDUCTIVITY SENSOR

Features a large diameter, seven-ring quartz cell which does not require platinum black deposition and which can be cleaned without re-calibrating. No external pump is necessary even for high accuracy measurements.

### OXYGEN SENSOR

Features an innovative pressure-compensated polarographic sensor, with a replaceable cap for membrane support. Because stirring effects are negligible, no external pump is necessary.

### pH GLASS SENSOR (7000 m operation)

Cylindrical, high-pressure glass membrane pH electrode in conjunction with a special differential amplifier system.

### SOLID GEL REFERENCE ELECTRODE

A reference electrode for pH and oxidation-reduction potential measurements. Use of a special ceramic junction-less design guarantees operation to 7000 m and very long life.

### DATA TRANSMISSION

Via RS232C interface and long distance ASK or FSK (10000 m) telemetry systems.

### INTERNAL MEMORY

Permits storage of up to 32,000 data sets, for each of the seven standard parameters together with date & time.

### DIMENSIONS AND WEIGHT

75 mm diameter x 685 mm length; 4 kg in air. (1500 m depth housing)

### OPTIONAL PROBES

These are the sensors, probes and measurement systems which can, at present, be interfaced:

- GENERAL OCEANICS - Rosettes mod. 1014, 1015 and 1016.
- WET Labs - WETStar Miniature Fluorometer.
- SEAPOINT - Fluorometer and Turbidity Meter.
- SEA TECH - Fluorometer and Blue LED Fluorometer.
- SEA TECH - Transmissometer and Dual Range Transmissometer.
- D & A INSTRUMENT COMPANY - OBS-3B Sensor.
- CHELSEA - Aquatracka Fluorometer.
- BIOSPHERICAL INSTRUMENTS - Quantum Scalar PAR Sensor QSP-200L.
- NE SENSORTEC - UCM 60 DL - Current Meter.
- SATLANTIC - Ocean Colour Radiometer System.

### BATTERY OPERATION

Internal or external submersible battery packs permit continuous probe operation, for 20 or 100 hours respectively. Moreover, the internal battery pack can be used as a backup energy system whenever the probe operates in the real-time data acquisition mode. This feature minimizes the micro-interruption of telemetry due to problems with slip rings and/or cable terminations thus avoiding spikes during real-time data acquisition.



**TECHNOLOGY  
IN SEARCH OF  
NEW DEPTHS**

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The standard measurement sensors (see table for SENSOR SPECIFICATIONS) installed in the OCEAN SEVEN 316 Probe 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 time constants: 50 milliseconds for physical parameters (CTD) at 100 cm/sec profiling speed and 3 seconds for chemical parameters. A high-precision resistor acts as a reference for the accuracy of the sensor electronic amplifiers which are temperature-compensated. There are no trimpot adjustments inside the probe.

The OCEAN SEVEN 316 is controlled by the internal advanced electronics (32-bit MCU) and can measure, store and transmit sensor data by various different methods. The most significant ones are:

- Real time data acquisition.
- Unattended data acquisition as a function of time.
- Unattended data acquisition as a function of depth increments.

The unattended acquisition can be activated by means of a magnetic ON/OFF switch. Acquired data is uploaded at the end of the measuring cycles. Extension of the internal battery life is obtained through an automatic power management procedure that switches the probe OFF between the data acquisitions. The internal battery pack consists of ten batteries: 1.5 V, 1.8 A/h, type AA cells which allow continuous probe operation for about 20 hours. Rechargeable or lithium batteries can also be used. The probe is equipped with an internal non volatile SRAM able to store up to a maximum of 32,000 data sets, each data set being composed of date and time and measurement of the standard sensors. Anyhow, the Probe can integrate data from third-party sensors and perform data acquisition of up to 16 analog channels in less than 50 ms.

The OCEAN SEVEN 316 Probe can be configured to be directly connected to a personal computer by means of the RS232C serial port or by a telemetry interface. The telemetry interface remedies the limitations of the RS232C serial interface (cable length and number of conductors). When using the FSK telemetry interface, the additional deck unit (PORTABLE DECK UNIT) is required to convert serial, RS232C type signals (coming 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 probe cable. The armoured cable also supports the probe mechanically.

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



## PERSONAL COMPUTER

- Real time data gathering
- Real time bi-dimensional plots
- Upload of data stored in the Probe memory

## PORTABLE DECK UNIT

deck interface and power supply unit.

TELEMETRY

RS232C

## OCEAN SEVEN 316 PROBE

**Telemetry / operating depth:**  
 ASK : 0 .. 1,500 metres  
 FSK : 1,500 .. 10,000 metres  
 (single conductor armoured cable)

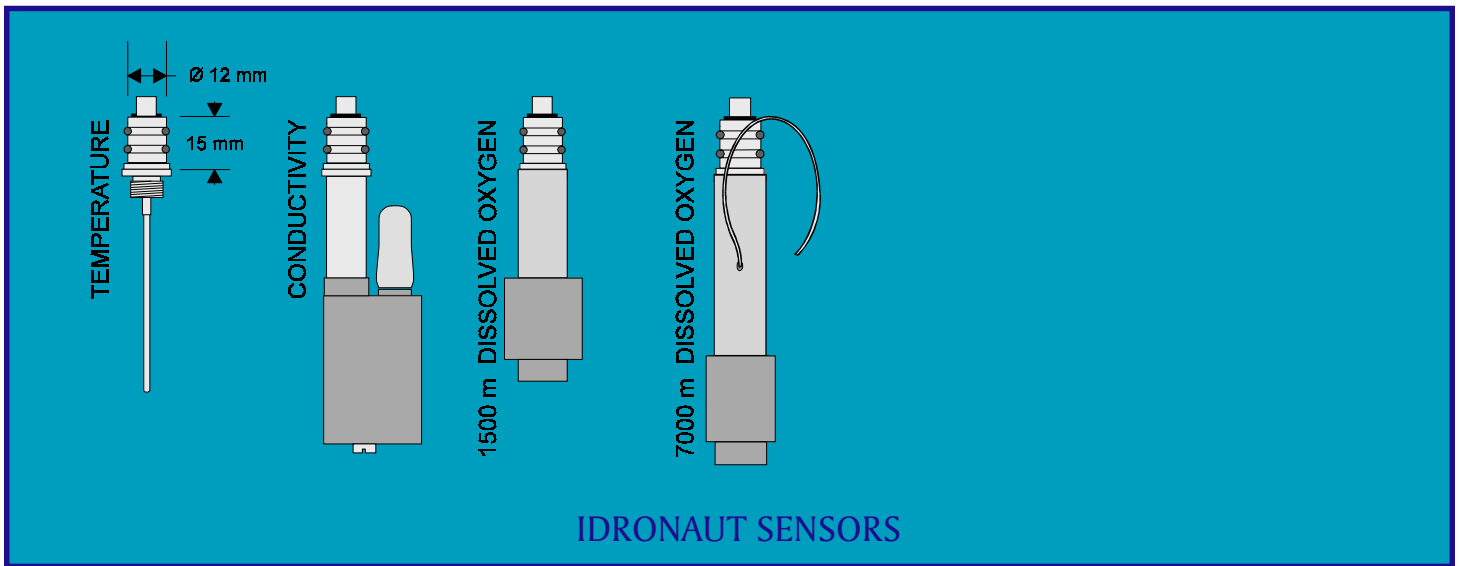
**RS232C interface**  
 0 .. 50 metres cable length,  
 4 wire cable

### OCEAN SEVEN 316 Telemetry Systems Performance Chart

| Telemetry Type | Max cable length | Max transfer rate |
|----------------|------------------|-------------------|
| RS232C         | 50 metres        | 19200 bps         |
| ASK            | 1500 metres      | 9600 bps          |
| FSK            | 1500 metres      | 38400 bps         |
| FSK            | 3000 metres      | 19200 bps         |
| FSK            | 6000 metres      | 9600 bps          |
| FSK            | 10000 metres     | 4800 bps          |

The above performances are obtained using the 6.4 mm diameter Rochester cable 1-H-255 which has an electrical resistance of 23 ohm/km and a capacity of 138 pF/m.

## PROBE INTERFACING



## IDRONAUT SENSORS

### Sensor specifications

|              | Range              | Accuracy         | Resolution  | Time Constant                   |
|--------------|--------------------|------------------|-------------|---------------------------------|
| Pressure     | 0....1500 dbar*    | 0.2 % full scale | 0.03 %      | 50 ms                           |
| Temperature  | -3 ... +50 °C      | 0.003 °C         | 0.0005 °C   | 50 ms                           |
| Conductivity | 0.... 64 mS/cm     | 0.003 mS/cm      | 0.001 mS/cm | 50 ms (at 1 m/second flow rate) |
| Oxygen       | 0.... 50 ppm       | 0.1 ppm          | 0.01 ppm    | 3 s (in air)                    |
|              | 0... 500% sat.     | 1% sat.          | 0.1% sat.   | 3 s                             |
| pH           | 0.... 14 pH        | 0.01 pH          | 0.001 pH    | 3 s                             |
| Redox        | -1000 to + 1000 mV | 1 mV             | 0.1 mV      | 3 s                             |

\* other standard pressure transducers, immediately available, have 10, 40, 100, 200, 500, 1000 dbar ranges.

The calculated parameters are:

**SALINITY, SOUND SPEED IN SEA WATER DENSITY (Sigma), PRESSURE TO DEPTH CONVERSION, POTENTIAL TEMPERATURE (Theta);** according to: UNESCO 1983, "Algorithms for computation of fundamental properties of sea water".

### Electronic specifications

|                                |  |
|--------------------------------|--|
| Sampling frequency:            | 20 Hz.   |
| Real time data output rate:    | 5 samples per second.  |
| Communication ports:           | RS232C, up to 19200 bps;<br>ASK telemetry, up to 9600 bps, over cables up to 1500 meters long;<br>FSK telemetry, up to 4800 bps, over cables up to 10000 meters long.          |
| Communication protocol:        | proprietary byte-oriented message protocol.  |
| Operator interface:            | friendly menu-driven user interface.   |
| Data memory:                   | 1 Mbyte non volatile CMOS memory (data retention > 10 years).  |
| Firmware memory:               | 256 Kbyte 5V flash memory, built-in automatic updating function allows easy, non intrusive, firmware upgrading.  |
| A/D Converter:                 | 16 bit 76 $\mu$ V/bit successive approximation with built-in autocalibration capabilities.   |
| Analogue inputs:               | 6 multiplexed analog input channels allows interfacing of additional sensors.  |
| Telemetry system power supply: | 10 .. 30V, 95 mA @ 12 V, 1.1 W power consumption.  |
| Battery power supply:          | 9 .. 18 V, 95 mA @ 12 V. The internal battery package consists of 10 (ten) batteries: 1.5 V, 1.8 A/h, type AA cells which allow continuous probe operation for about 20 hours. |

### Software

Real time data may be displayed and permanently archived using an IBM PC compatible software. Archived data may be easily converted into ASCII files for easy data transfer to other PC based data analysis software.

| Physical characteristics for  | 1500 dbar   | 1500 dbar | 7000 dbar | 7000 dbar |
|-------------------------------|---|-----------|-----------|-----------|
| Dimensions: housing diameter: | 100 mm  | 75 mm     | 100 mm    | 100 mm    |
| total length:                 | 710 mm  | 685 mm    | 710 mm    | 710 mm    |
| Weight: in air:               | 6 kg  | 4 kg      | 15 kg     | 9 kg      |
| in water:                     | 3 kg  | 1,8 kg    | 12 kg     | 6 kg      |
| Materials:                    | plastic, white PPS  | AISI 316L | AISI 316L | TITANIUM  |
| Diameter of protective cage:  | 260 mm, titanium  |           |           |           |
| Cable connectors:             | 2-pole connector (Brantner RMG-2-FS) for ASK telemetry output;<br>4-pole connector (Brantner RMG-4-FS) for RS232C output.   |           |           |           |
| Cable characteristics:        | The 316 Probe operates with standard Rochester coaxial armoured cables (1/8, 1/4, 1/2 inch) installed in oceanographic vessels. Sea cable conductors resistance: 0 to 250 ohms. |           |           |           |

## ACCESSORIES

- PORTABLE DECK UNIT**  
The function of the PORTABLE DECK UNIT is to power and interface, by telemetry, the 316 Probe with a portable Personal Computer. This unit contains a rechargeable lead battery (12V - 6.5 A/h) which allows about 32 hours of continuous operation even without external power (100, 110 or 220V AC, 50/60 Hz). The external power input is selectable from 100/230 V AC and 47/63 Hz. The PORTABLE DECK UNIT is provided with an adjustable power supply to power the 316 Probe, an internal power supply to recharge the 12 V internal battery and a transceiver able to transform commands coming from the PC and data coming from the probe into an RS232C asynchronous transmission format, HALF-DUPLEX mode. Dimensions: 275 x 250 x 75 mm. Weight: 4.5 kg.
- MANUAL PORTABLE WINCH.** Includes slip-ring and up to 180 meters of 7 mm cable.
- COAXIAL ARMoured CABLE - Ø 2,56 mm - STEEL**  
Non-jacketed coaxial armoured cable type Rochester 1-H-100A, diameter: 2,56 mm - breaking strength: 450 kg - working load: 180 kg - weight per km: 28 kg.
- 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.
- COAXIAL ARMoured CABLE - Ø 7 mm -POLYURETHANE**  
A strain relieved 7 mm polyurethane jacketed armoured cable type Idronaut - breaking strength: 350 kg - weight per km: 65 kg.
- STRAIN RELIEF CABLE CONNECTING KIT.** Composed of waterproof connector, deck unit connector, quick-connector system for the probe.

## OPTIONS

- AISI316L or TITANIUM HOUSING** for 7000 m operation.
- HIGH-ACCURACY PRESSURE SENSOR**  
Ranges 700, 1500, 4000, 7000 dbar
- GENERAL OCEANICS ROSETTE INTERFACE**  
This option enables the user to interface and manage GENERAL OCEANICS Rosettes mod. 1014/1015/1016 in order 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.
- ASK/FSK TELEMETRY OUTPUT**, in addition to the RS232C output. Real time data transmission to the Portable Deck Unit. Up to 5 sets of data per second can be transferred.
- TRANSPARENT FLOW CELL**  
Easily connectable to a pumped source of seawater this option converts the Ocean Seven 316 Probe from a profiling CTD to an on-board Thermosalinograph.

- EXTERNAL SUBMERSIBLE BATTERY PACK**  
An external battery pack containing 10 batteries 1.5 V, 10 A/h, type D cell, extends the continuous probe operation to 100 hours. Dimensions are: ø 75 mm, length 385 mm. The external battery pack is fixed to the probe by means of two plastic flanges. For 1500 m max depth operation.
- TITANIUM CAGE** to house, for instance, the 316 Probe, a Fluorometer and a Transmissometer.



## SOFTWARE

- SOFTWARE FOR DATA TRANSFER AND MANAGEMENT**  
The IDRODAC software allows display, printing and recovering of data received from the probe. It controls manual, linear and timed profiles. Data can be displayed on the PC and exported in ASCII format.
- REAL-TIME GRAPHIC SOFTWARE**  
This software is an extension of the above package and allows creation of real-time bi-dimensional plots of up to six parameters versus depth or time.