

SEACAT C-T Recorder (Inductive Modem)

SBE 16*plus*-IM V2



The SBE 16*plus*-IM V2 (Version 2) SEACAT is a high-accuracy conductivity and temperature recorder (pressure is optional) with built-in Inductive Modem. The V2 is the most versatile successor in the line of SEACAT Recorders begun with the original SBE 16 SEACAT in 1987.

Compared to the previous 16*plus*-IM, the V2 incorporates an electronics upgrade and additional features. The V2 has two additional (six total) differentially-amplified A/D input channels, FLASH memory is increased from 8 to 64 MB, and one RS-232 data input channel is added. Data can be output in XML as well as ASCII and HEX formats.



The inductive modem provides reliable, low-cost, real-time data transmission using plastic-coated wire rope (typically 3 x 19 galvanized steel) as both the transmission line and mooring tension member. IM instruments clamp anywhere along the rugged mooring wire. Expensive and potentially unreliable multi-conductor electrical cables with fixed-position underwater connectors are not required. IM moorings are easily reconfigured for changing deployments (positions can be changed or instruments added or removed), by sliding and re-clamping sensors on the cable. Inductive modem systems are much less expensive and more power-efficient than acoustic modems, and offer reliable communication over greater distances.

In a typical real-time surface mooring, a Surface Inductive Modem (SIM) housed in the buoy communicates with the underwater IM instruments and is interfaced to a computer or data logger via an RS-232 serial port. The computer or data logger (not supplied by Sea-Bird) is programmed to poll each IM instrument on the mooring for its data, assemble all the instrument data into files, and send the files to a telemetry transmitter (satellite link, cell phone, RF modem, etc.). The 16*plus*-IM V2 simultaneously saves its data in memory for upload after recovery, providing a backup against lost data in the event real-time telemetry is interrupted.

The SBE 16*plus*-IM V2 uses the same temperature and conductivity sensors (and optional silicon strain gauge or Digiquartz® pressure sensors) proven in 10,000 SEACATs and MicroCATs. Calibration coefficients are stored in memory, permitting data output in ASCII engineering units (°C, S/m, decibars, salinity [PSU], sound velocity [m/sec], etc.). The sample interval, ranging from 10 to 14,400 seconds, is user-programmable in 1-second increments. Between samples, the 16*plus*-IM V2 powers down, drawing only 140 microamps. Alkaline D-cells provide power for approximately 290,000 samples of C and T, depending on the sampling and telemetry schedule. Six differentially amplified A/D input channels and one RS-232 channel provide conditioned power (500 ma) for, and obtain data from, optional auxiliary sensors (oxygen, turbidity, fluorescence, etc.).

COMMUNICATIONS AND INTERFACING

Both ends of the jacketed (insulated) wire rope connecting the buoy to its anchor are grounded to seawater via metal connection terminals (eyes) swaged to its steel core. This completes a conductive loop through the wire rope and the water. An Inductive Cable Coupler (ICC) serves as a coupling transformer similar to the one built into the SBE 16*plus*-IM V2, but clamped to the jacketed mooring wire just under the buoy, and connects to the SIM (SIM and ICC available separately). Commands and data are transmitted half-duplex between the SIM and 16*plus*-IM V2 using DPSK (differential-phase-shift-keyed) telemetry. DPSK telemetry provides a high degree of immunity from "fish bite" or other cable degradation and provides a maximum transmission distance of 8000 meters between the SIM and an underwater IM instrument. Lab diagnostics, setup, and data extraction are performed by looping an insulated wire through the inductive core on the 16*plus*-IM V2 and connecting the wire ends to the SIM.

Upon receipt of a wake-up command from a computer or data logger, the SIM sends a tone for 2 seconds, waking all IMs on the wire. Each 16*plus*-IM V2 has a programmable ID number (0-99). A 16*plus*-IM V2 only replies to a command containing its individual ID. After replying, it returns to listening mode, waiting for commands. A global power-off command returns all IM instruments to standby (sleep) state. The 16*plus*-IM V2 automatically returns to sleep state if there is no line activity for 2 minutes.

CONFIGURATION, OPTIONS, AND ACCESSORIES

A standard SBE 16*plus*-IM V2 is supplied with plastic housing for depths to 600 meters, 64 Mbyte FLASH memory, alkaline batteries, glass-reinforced epoxy bulkhead connectors, and expendable anti-foulant devices.

Options and accessories include:

- Titanium housing for depths to 7000 meters
- Semi-conductor strain gauge pressure sensor or Digiquartz® pressure sensor
- Wet-pluggable MCBH series connectors
- SBE 5M pump (conductivity only) or SBE 5P / 5T for pumped conductivity and pumped auxiliary sensors
- Auxiliary sensors for dissolved oxygen, fluorescence, turbidity, etc. (consult factory)
- Battery pack kit for lithium batteries (lithium batteries **not** supplied by Sea-Bird)

SOFTWARE

The SBE 16*plus*-IM V2 is supplied with a powerful Windows 2000/XP software package, SEASOFT®-Win32, which includes programs for communication and data retrieval, and data processing (filtering, aligning, averaging) and plotting of CTD and auxiliary sensor data and derived variables.



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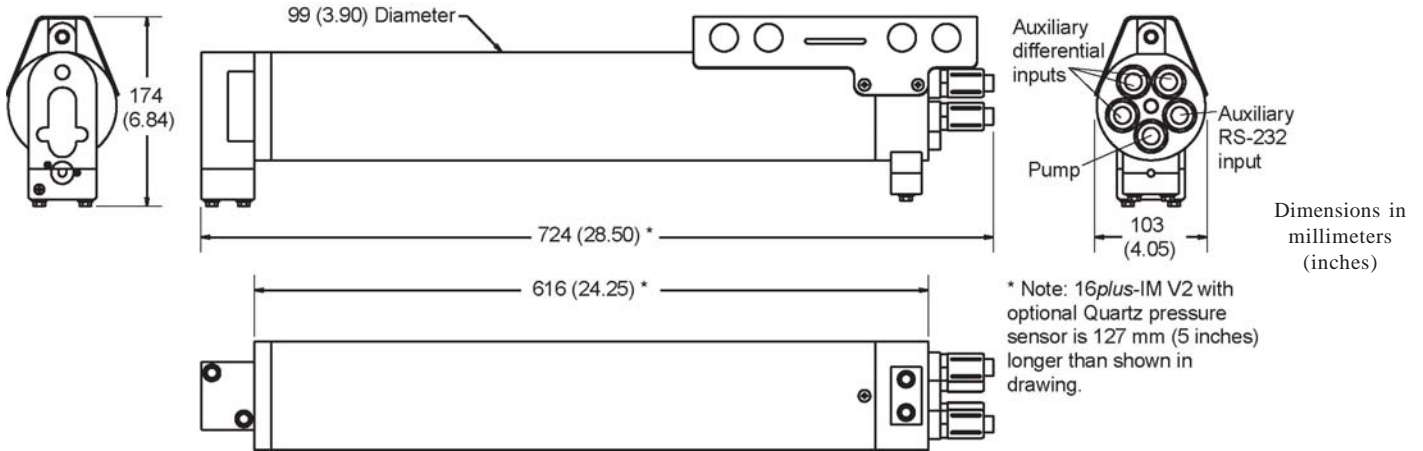
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SPECIFICATIONS

Measurement Range

Temperature	-5 to +35 °C
Conductivity	0 to 9 S/m
Pressure (optional)	Strain-gauge — 0 to 20/100/350/600/1000/2000/3500/7000 m Quartz — 0 to 20/60/130/200/270/680/1400/2000/4200/7000 m

Initial Accuracy

Temperature	0.005 °C
Conductivity	0.0005 S/m
Pressure (optional)	Strain-gauge — 0.1% of full scale range Quartz — 0.02% of full scale range

Typical Stability

Temperature	0.0002 °C/month
Conductivity	0.0003 S/m/month
Pressure (optional)	Strain-gauge — 0.1% of full scale range/year Quartz — 0.025% of full scale range/year

Resolution

Temperature	0.0001 °C
Conductivity	0.00005 S/m typical
Pressure (optional)	Strain-gauge — 0.002% of full scale range Quartz — depends on sample integration time; consult factory

Memory

64 Mbyte non-volatile FLASH memory

Data Storage

Recorded Parameter	Bytes/Sample
T + C	6 (3 each)
Pressure - strain gauge or Quartz	5
each external voltage	2
auxiliary RS-232 sensor	sensor dependent
date and time	4

Real-Time Clock

32,768 Hz TCXO accurate to ±1 minute/year

Internal Batteries

9 alkaline D-cells

Battery Endurance ¹

CT only — 290,000 samples
CTD only — 200,000 samples
CTD & 5M pump — 110,000 samples

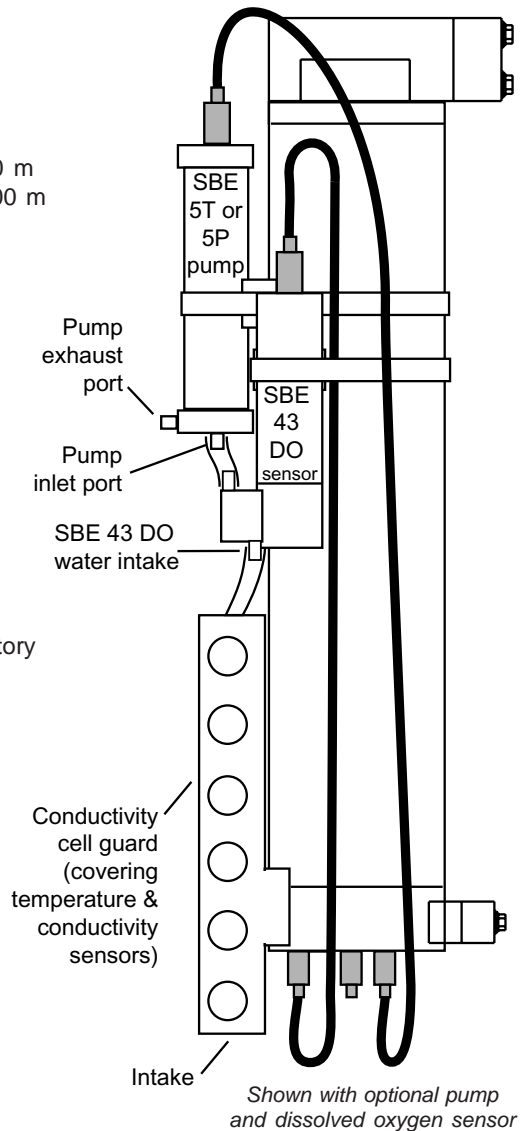
¹ With Duracell MN1300 cells. Dependent on sampling scheme.

Auxiliary Voltage Sensors

Auxiliary power out	up to 500 mA at 10.5 - 11 VDC
A/D resolution	14 bits
Input range	0 - 5 VDC

Housing Materials — Depth Rating — Weight

Acetal Copolymer Plastic housing — 600 m (1950 ft) — in air 9 kg (20 lbs), in water 4 kg (9 lbs)
3AL-2.5V Titanium housing — 7000 m (22,900 ft) — in air 17 kg (38 lbs), in water 12 kg (27 lbs)



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