

SPECIFICATIONS

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SEACAT C-T Recorder

SBE 16plus



The SBE 16plus SEACAT is a Temperature and Conductivity recorder (pressure optional) intended for moorings and other long-duration, fixed-site deployments. Compared to the original SBE 16 SEACAT, the 16plus offers the improved C, T, and pressure specifications of MicroCATs, and also includes larger memory (8 Mbyte vs 1) and four differentially-amplified A/D input channels (14-bit resolution vs 12). The 16plus is more power-efficient than old SEACATs: 9 alkaline D-cells will record 380,000 samples of C and T. Conditioned power (500 ma) is available for auxiliary sensors (dissolved oxygen, turbidity, fluorescence, PAR, etc); their cabling is simpler and more reliable because there are two auxiliary input bulkhead connectors.



Standard plastic and optional titanium housing shown

The SBE 16plus uses the same temperature and conductivity sensors proven in 5000 SEACATs and MicroCATs, and (optionally) a silicon strain gauge or quartz pressure sensor. Improvements in design, materials, and signal acquisition techniques yield a low-cost instrument with superior performance that is also easy to use. Calibration coefficients, obtained in our computer-controlled high accuracy calibration baths, are stored in EEPROM memory. They permit data output in ASCII engineering units (degrees C, Siemens/m, decibars, salinity [PSU], sound velocity [m/sec.], etc.).

The SBE 16plus sample interval is soft-programmable in 1-second increments ranging from 10 to 14,400 seconds. Between samples, the 16plus powers down, drawing only 30 microamps of current. Data is recorded in non-volatile FLASH memory for 38.4K baud upload after recovery.

Real-time monitoring is practical using the SBE 16plus 3-wire RS-232C data output. The 16plus is well suited to networked sensor arrays where its operation can be triggered by satellite, radio, or hardwire telemetry equipment. Optional RS-485 (2-wire) and inductive modem (1-wire loop) interfaces allow multiple SEACATs to share a simple and robust telemetry cable.

CONFIGURATION AND OPTIONS

A standard SBE 16plus is supplied with:

- Plastic housing for depths to 600 meters
- 8 Mbyte FLASH RAM memory
- 9 D-size alkaline batteries
- Impulse glass-reinforced epoxy bulkhead connectors: 4-pin I/O, 2-pin pump, and two 6-pin (two differential auxiliary A/D inputs each)
- Anti-foul attachments and expendable anti-foulant devices

Options include:

- Titanium housing for depths to 7000 or 10,500 meters
- Druck strain gauge pressure sensor or Quartz pressure sensor
- RS-485 interface in place of RS-232
- Inductive modem interface in place of RS-232 (see SBE 16plus-IM datasheet for details)
- Additional bulkhead connector: 4-pin for RS-232 sensor (SBE 38 secondary temperature sensor) or 3-pin for PAR sensor
- Sensors for oxygen, fluorescence, light (PAR), light transmission, and turbidity
- SBE 5M or 5T pump for use with pumped sensors
- MCBH *Micro* connectors in place of glass-reinforced epoxy connectors
- Battery pack kit for lithium batteries (lithium batteries not supplied by Sea-Bird)

SOFTWARE

The SBE 16plus is supplied with a powerful Windows 95/98/NT/2000/XP software package, SEASOFT®-Win32, which includes:

- SEATERM® — communication and data retrieval
- SBE Data Processing® — filtering, aligning, averaging, and plotting of CTD and auxiliary sensor data and derived variables



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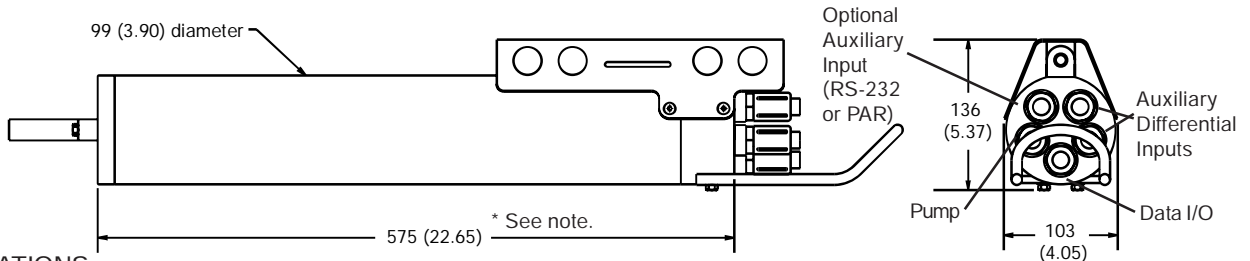
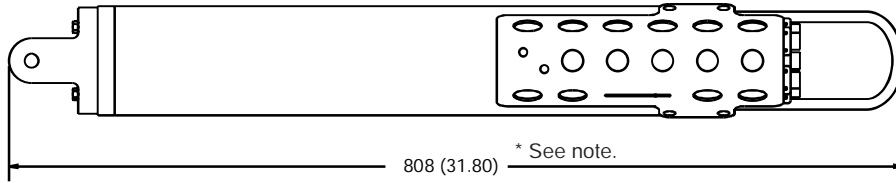
E-mail: seabird@seabird.com

Telephone: (425) 643-9866

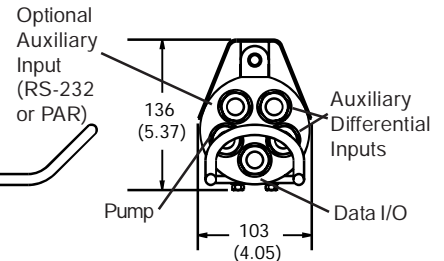
Fax: (425) 643-9954

SEACAT C-T Recorder

SBE 16plus

Dimensions
in millimeters
(inches)

Note: 16plus with optional
Quartz pressure sensor is
190 mm (7.5 inches) longer
than shown in drawing.



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 meters Quartz 0 to 20/60/130/200/270/680/1400/2000/4200/7000/10,500 meters

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 (per month)

Temperature	0.0002 °C
Conductivity	0.0003 S/m
Pressure (optional)	Strain-gauge 0.004% of full scale range Quartz 0.002% of full scale range

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

Data Storage	Recorded Parameter	Bytes/Sample
	T + C	6
	strain-gauge pressure	5
	Quartz pressure	6
	each external voltage	2
	SBE 38 secondary temperature	3
	date and time	4

Real-Time Clock

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

Internal Batteries

9 alkaline D-cells

External Power Supply

9 - 28 VDC; consult factory for required current

Battery Endurance ¹

CT only	380,000 samples
CTD only	260,000 samples
CTD & 5M pump	145,000 samples

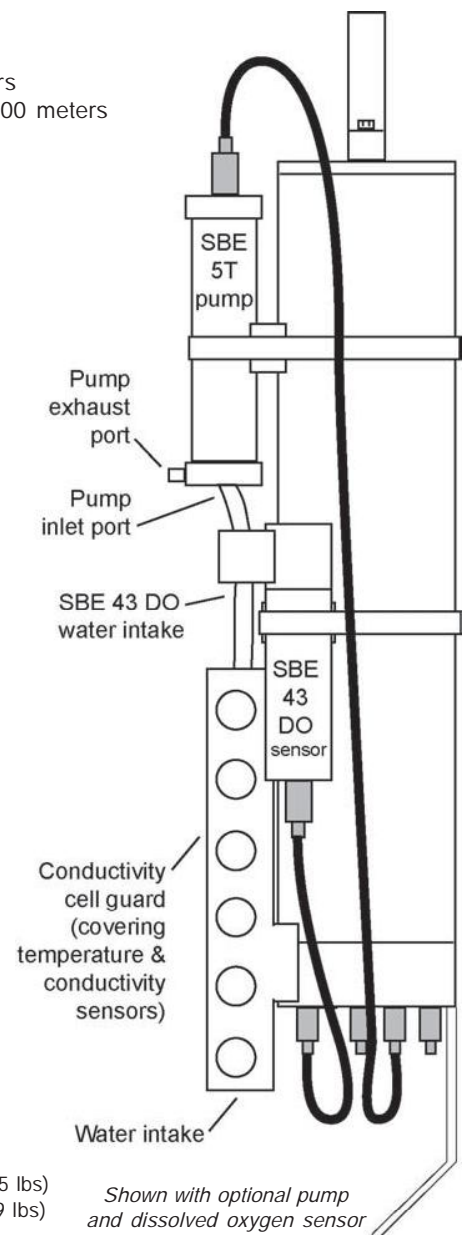
¹ With Duracell MN1300 cells. Dependent on sampling scheme.

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 meter (1950 feet) — in air 7.3 kg (16 lbs); in water 2.3 kg (5 lbs)
3AL-2.5V Titanium housing	— 7000 meter (22,900 feet) — in air 13.7 kg (30 lbs); in water 8.6 kg (19 lbs)
6AL-4V Titanium housing	— 10500 meter (34,400 feet)



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Submersible Pump

SBE 5T

The SBE 5T pump module is a compact unit consisting of a centrifugal pump head and a long-life, brushless, DC, ball-bearing motor contained in a titanium pressure housing useable to 10,500 meters. The pump impeller and electric drive motor are coupled magnetically through the housing, providing high reliability by eliminating moving seals.



APPLICATIONS

The SBE 5T is a primary component in the SBE *9plus* CTD Underwater Unit and SBE 25 SEALOGGER CTD. It is also used as optional equipment on SBE *16plus*, *16plus-IM*, and *19plus* SEACAT CTDs. The pump flushes water through the conductivity cell at a constant rate, independent of the CTD's motion, improving dynamic performance. The pump may also be suitable for custom applications, where pressure heads are less than 300 cm of water and flow rates are less than 100 ml/sec.

CONFIGURATION

The SBE 5T is configured for various applications by selecting standard or low voltage options, and one of several motor speed options. Speed options of 1300, 2000, 3000 or 4500 rpm have been established to meet various flow rate requirements. Other speeds can be set by adjusting a potentiometer.

- #3 winding, low voltage, 2000 rpm – typical for SBE 25
- # 3 winding, standard voltage, 2000 rpm – typical for SBE *16plus*, *16plus-IM*, or *19plus* with pumped auxiliary sensor(s)
- #3 winding, standard voltage, 3000 rpm – typical for SBE *9plus*

OPERATION

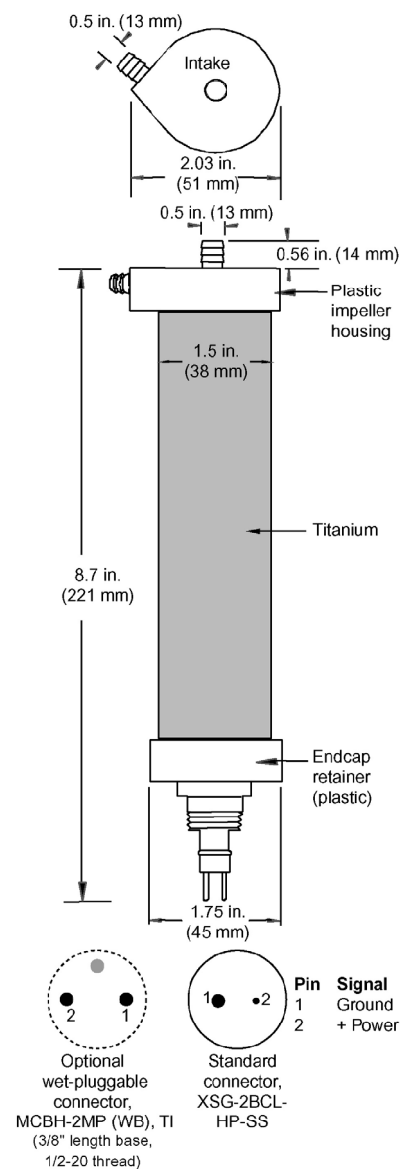
Motor speed and pumping rate remain nearly constant over the entire input voltage range (less than 1% change in speed for a 1 volt change in supply voltage). The unrestricted flow rate with no head is approximately 100 ml/second at 2000 rpm. Flow changes are nearly linear with changes in speed. With unlimited power supply current, turn-on surge is approximately 1.8 amperes (maximum), which drops to steady state in approximately 0.25 seconds. If power supply current is limited to approximately 200 milliamps, the motor comes up to speed in approximately 0.30 seconds. A series diode is installed in the input power line to prevent damage if the wires are accidentally reversed. Pumping rates and motor current for various applications are shown on the next page.

SPECIFICATIONS

Input Voltage:

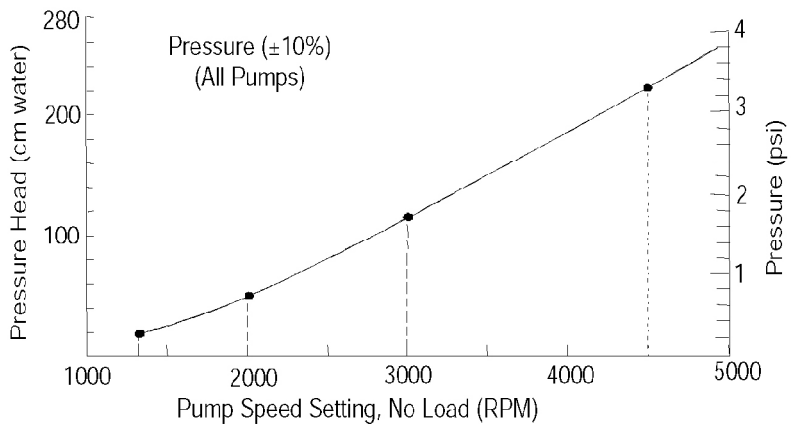
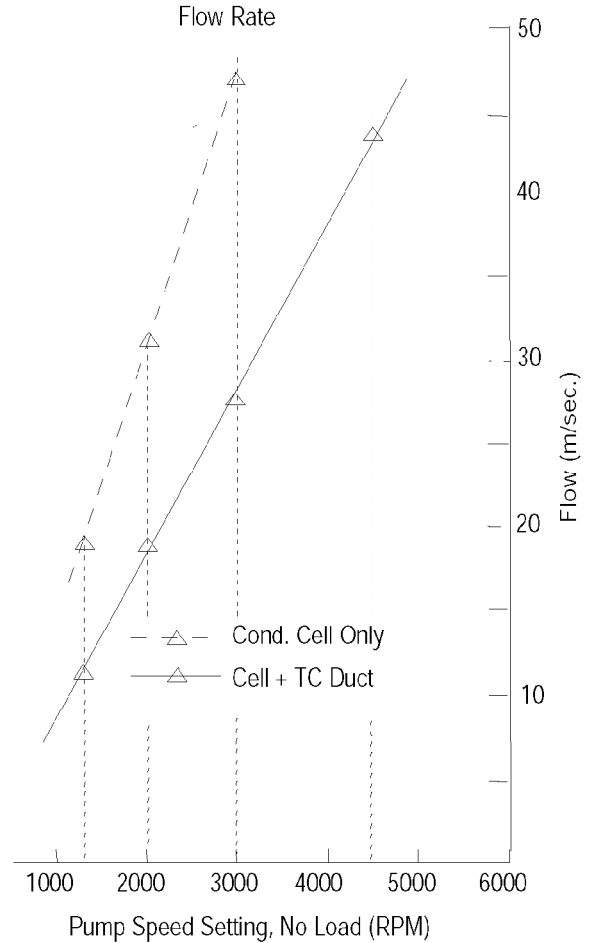
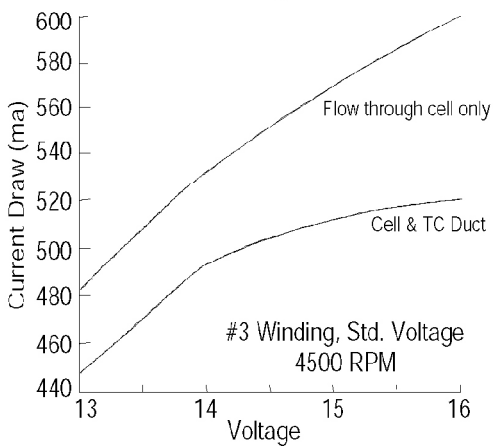
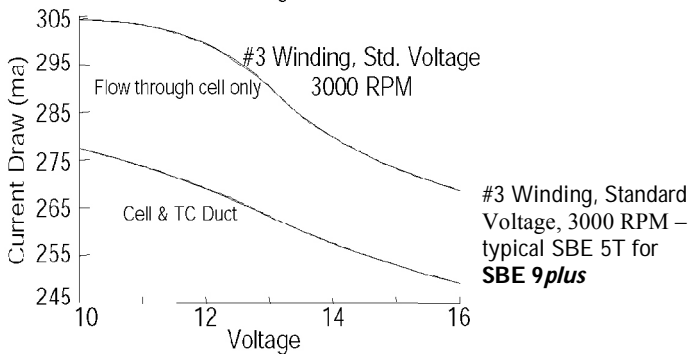
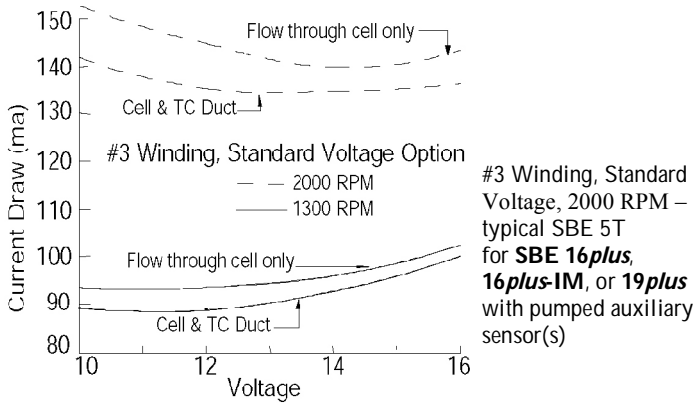
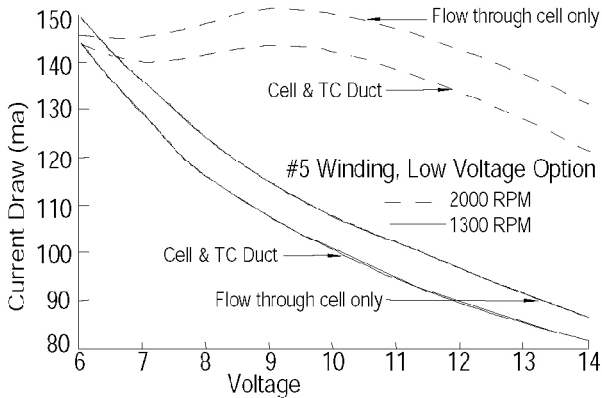
Standard input range (#3 winding, 1300 - 3000 RPM):	10 - 18 VDC
Standard input range (#3 winding, 4500 RPM):	13 - 18 VDC
Low input range (#3 or #5 winding - 1300, 2000 RPM only):	6 - 16 VDC

Weight: 0.7 kg (1.5 lbs) in air, 0.3 kg (0.65 lbs) in water



Submersible Pump

SBE 5T



01/07