Buoy Instrument Cage

21. INSTRUMENT: SBE-37-SM Microcat - CTD 1.3m

Manufacturer: Sea-Bird Electronics
Model Number: SBE-37-SM w/pressure
Datasheets: \\tornado\engineering\MOOS_MSE_2003-4\surface-node\datasheets\instruments\
Description: The Microcat - CTD is a high-accuracy conductivity, temperature and pressure recorder with internal battery and non-volatile memory, which includes a standard RS-232 serial interface.

Calibration coefficients stored in EEPROM allow the MicroCAT to transmit data in engineering units. The MicroCAT retains the temperature and conductivity sensors used in the SBE 16 SEACAT C-T Recorder, but has improved acquisition electronics that increase accuracy and resolution, and lower power consumption. The MicroCAT's aged and pressure-protected thermistor has a long history of exceptional accuracy and stability (typical drift is less than 0.002 °C per year). Electrical isolation of the conductivity electronics eliminates any possibility of ground-loop noise.

The MicroCAT's internal-field conductivity cell is immune to proximity errors and unaffected by external fouling. A plastic cup with threaded cover at each end of the cell retains the expendable AF24173 Anti-Foulant Device.

The MicroCAT's optional pressure sensor, developed by Druck, Inc., has a superior new design that employs a micro-machined *silicon diaphragm* into which the strain elements are implanted using semiconductor fabrication techniques. Unlike metal diaphragms, silicon's crystal structure is perfectly elastic, so the sensor is essentially free of pressure hysteresis. Compensation of the temperature influence on pressure offset and scale is performed by the SBE MicroCAT's CPU. The pressure sensor is available in the following pressure ranges: 20, 100, 350, 1000, 2000, 3500, and 7000 meters.

The MicroCAT is available with an *optional* pump, which isn't used. The submersible pump could come on for 0.5 seconds each time the MicroCAT wakes up, providing the following advantages:

- Improved conductivity response – The pump flushes the previously sampled water from the conductivity cell and brings a new water sample quickly into the cell.
- Reduced fouling – Water does not freely flow through the conductivity cell between samples, minimizing fouling. The MicroCAT's I/O bulkhead connector is used to power the pump during deployment. With the standard pump cable attached to the bulkhead connector, commands cannot be sent to the MicroCAT during deployment – all setup must be done before deployment. A Y-cable, for data I/O and pump power, is available for applications where communication during deployment is required.

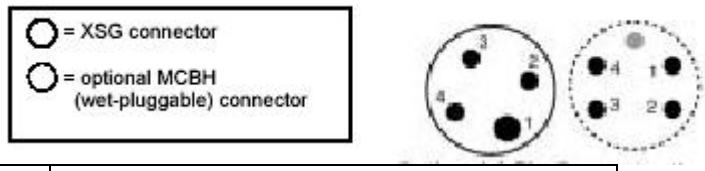
Power: The Microcat - CTD is ALWAYS ON sampling.

Optional Battery: Nominal 7.2 Ampere-hour pack consisting of six 9-volt lithium batteries. Provides sufficient capacity for more than 175,000 samples (80,000 with optional pump). When removed from MicroCAT and battery pack, and batteries packed separately, batteries can be shipped without hazardous material restrictions. To avoid draining the internal batteries, use an external voltage greater than 10 VDC.

Acquisition Time: 3 seconds per sample
The Microcat - CTD uses the following current at an input voltage range of $9V_{DC}$ to $24V_{DC}$:

Quiescent	0.010 mA_{ave}
Typical	40 mA_{ave}
Sampling	100 mA-sec_{ave}
Sampling with pump	148 mA-sec_{ave}

Interface: Communication with the MicroCAT is over a 3-wire, RS-232C link. The default baud rate is 9600 8-N-? with no handshaking, although it can be configured to run between 1200 and 38400baud.



Pin	Signal
1	Common
2	RS-232 data receive
3	RS-232 data transmit
4	Power 9-24VDC (or 6VDC pump power)

Commands: Refer to the User's manual for details on the following commands. Over 50 different commands can be sent to the MicroCAT to provide status display, data acquisition setup, data retrieval, and diagnostic tests. User-selectable operating modes include:

- **Autonomous sampling** – At pre-programmed intervals, the MicroCAT wakes up, samples, stores the data in its FLASH memory, and powers off. If desired, real-time data can also be transmitted.
- **Polled sampling** – On command, the MicroCAT takes one sample and transmits the data. Polled sampling is useful for integrating the MicroCAT with satellite, radio, or wire telemetry equipment.
- **Serial line sync** – The MicroCAT wakes up, samples, transmits real-time data, and powers off in response to a pulse on the serial line. This provides an easy method for synchronizing MicroCAT sampling with other instruments such as Acoustic Doppler Current Profilers (ADCPs) or current meters, without drawing on their battery or memory resources.

*Example: **Polled Sampling*** (user input in bold)
Wake up MicroCAT.

```
(click Connect on Toolbar to wake up.)
```

Command MicroCAT to take a sample, and send converted data to computer (do not store data in MicroCAT's memory).

```
S>TS
```

Send power-off command to MicroCAT.

```
S>QS
```

*Example: **Autonomous Sampling*** (user input in bold).
Wake up MicroCAT.
Set sample number to 0 to overwrite previous data in memory.
Set up to sample every 10 seconds,
store data in MicroCAT's memory, store time and date with samples,
and not transmit real-time data to computer.
Set up to automatically start logging on 10 January 2000 at 12:00:00.
Send power-off command to MicroCAT after all parameters are entered – system will automatically wake up and power down for each sample.

```
(click Connect on Toolbar to wake up.)
S>SAMPLENUM=0
S>INTERVAL=10
S>STORETIME=Y
S>TXREALTIME=N
S>STARTMMDDYY=011000
S>STARTHHMMSS=120000
S>STARTLATER
S>QS
```

After logging begins, look at data from last sample to check results, and then power down:

(click Connect on Toolbar to wake up.)
S>**SL**
S>**QS**

When ready to upload all data to computer, wake up MicroCAT, stop sampling, upload data, and then power down:

(click Connect on Toolbar to wake up.)
S>**STOP**
(Click Upload on Toolbar – program leads you through screens to define data to be uploaded and where to store it)
S>**QS**

Data: The MicroCAT should be configured for 10-minute sample periods.

Notes (for **FORMAT=1** or **2**)**:** t = temperature (°C, ITS-90) c = conductivity (S/m) p = pressure (decibars); sent only if optional pressure sensor installed dd mmm yyyy = day, month (Jan, Fe, Mar, etc.), year; sent only if **STORETIME=Y** mm-dd-yyyy = month, day, year; sent only if **STORETIME=Y** hh:mm:ss = hour, minute, second; sent only if **STORETIME=Y** • There is a comma but no space between temperature and conductivity. All other data is separated with a comma and space. • When **TXREALTIME=Y**, real-time data transmitted to the computer is preceded by a # sign and a space. • The MicroCAT s pressure sensor is an absolute sensor, so its **raw** output includes the effect of atmospheric pressure (14.7 psi). As shown on the Calibration Sheet, Sea-Bird s calibration (and resulting calibration coefficients) is in terms of psia. However, when outputting pressure in **decibars**, the MicroCAT outputs pressure relative to the ocean surface (i.e., at the surface the output pressure is 0 decibars). The MicroCAT uses the following equation to convert psia to decibars: pressure (db) = [pressure (psia) - 14.7] * 0.689476	Each scan ends with a carriage return <CR> and line feed <LF>. • **FORMAT=0 -** raw hex data, intended only for diagnostic use at Sea-Bird • **FORMAT=1** (default) ttt.tttt,cc.ccccc, pppp.ppp, dd mmm yyyy, hh:mm:ss Leading zeros are suppressed, except for one zero to the left of the decimal point. • **FORMAT=2** ttt.tttt,cc.ccccc, pppp.ppp, mm-dd-yyyy, hh:mm:ss Leading zeros are suppressed, except for one zero to the left of the decimal point. *Example:* Sample data output when pressure sensor is not installed, **STORETIME=Y**, and **FORMAT=1**: **23.7658,0.00019, 26 Jun 1997, 16:30:43** (temperature,conductivity, date, time)

The MicroCAT is supplied with a powerful Windows software package, SEASOFT-Win32, which includes:

- **SEATERM** –terminal program for easy communication and data retrieval.
- **SBE Data Processing** - program for calculation and plotting of conductivity, temperature, pressure (optional), and derived variables such as salinity and sound velocity