



COASTAL'S MICRO/MINI SERIES OWNER'S MANUAL

COASTAL LEASING, INC.

179 Sidney Street
Cambridge, Massachusetts 02139
Telephone: 617-497-1122
Fax: 617-497-1188
E-mail: coastal@coastal-usa.com
<http://www.coastal-usa.com>

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Document Conventions

For help in identifying commands, information and warnings, this manual will use the following text formats and visual aids:

<u>Type Style or Symbol</u>	<u>Used for</u>	<u>Example</u>
<i>Italics</i>	Actual typing seen or message shown by Wizard program on your computer screen.	C:\PROG\COASTAL\ WIZARD
[word shown in brackets]	Keyboard key to press.	[Esc]
Bold Capital	Indicates that this is a Wizard command. All commands are described in Section 3.3.	Initialize
Bold	Used to emphasize important information. Used in conjunction with the following symbols:	It is very important...
	Warnings!! If this information is disregarded, serious errors may occur.	 Do NOT remove.
	Notes. Hints or reminders for the user.	 NOTE: The number used here should...
	Helpful information to aid the user.	 The help command list is available by...

Section Summaries

1 Introduction	Explains general information about Micro/Mini series instrumentation.
2 Getting Started	Step-by-step instructions on instrument deployment.
3 Software - Wizard	Installing and using the Wizard software.
4 Hardware - Building Blocks	Describes the various components of the Micro/Mini instrument.
5 Maintenance	Describes care and upkeep of your instrument.
6 Appendix - Data	Shows common equations for use with your data.
7 Appendix - Operation	Troubleshooting and technical modification directions.
8 Appendix - Software	Additional Wizard parameters and optional software instructions.
9 Appendix - Hardware	Hardware replacement instructions.
10 Appendix - Reference	Standard Coastal instrument configurations and special options.

1 Introduction

This manual describes the operation, maintenance, and general use of Coastal Leasing's Micro/Mini series of instrumentation. The information is correct at the date of completion, but is subject to change.

Coastal's instruments are built with simplicity of operation in mind. Highly integrated hardware and software create a generation of oceanographic, environmental, and meteorologic instrument systems. Micro/Mini instruments have been used to measure directional waves, wave height, tides, current flow, temperature, water level, turbidity, dissolved oxygen, acceleration, tilt, wind speed and direction, air pressure, and many other parameters. With so many possibilities of sensor configuration, this manual will describe the general uses and try to cover individual sensors separately.



fig 1. Standard MicroTide Exterior

1.1 Features

- Long deployments are possible thanks to power switching, efficient electronics, and high density storage media.
- Flexible sampling schemes can be set up to measure bursts of instantaneous measurements as well as average values.
- Reliability is improved by using solid-state electronics with a minimal component count. Solid-state memory or optional hard disk provide storage.
- Tapes and expensive readers are eliminated. A standard IBM-compatible personal computer (PC) downloads, processes, and reviews data from the Micro/Mini.
- Custom battery packs are eliminated by using standard alkaline cells in readily accessible battery clips.
- Human errors are greatly reduced by using Wizard - proprietary software running on a PC. Wizard is easy to use, provides a consistent interface for all instruments, and makes internal range and consistency checks to catch common user errors.
- Future expansion paths are possible by adding other sensors or more capacity.



fig 2. Standard MicroTide (w/ external temp) Interior

1.2 System Description

The Micro/Mini series of instruments was designed to be very flexible in meeting many different types of measurement applications. From the start it was determined that the flexibility should require minimum hardware differences as well as one software package which would work for the entire set of products. Power for the instrument was to be provided with readily available alkaline batteries. With those criteria in mind, the Micro/Mini was designed.

The Micro/Mini instruments all consist of a data logger, main battery pack, and sensors. These are housed in a pressure case with an external bulkhead connector which provides communication and, optionally, supplies external power. The units are microprocessor controlled, and the user communicates with the Micro/Mini instruments using Wizard software and an IBM-PC compatible computer.

The instrument measures the outputs from the various sensors, converts them to a digital format and stores them in its memory. Different modes of measurement can be recorded, such as averages or bursting data. If applicable, vector averaging can also be recorded. The sampling scheme is set by the user prior to deployment. Starting times can be minutes or months into the future with the program calculating deployment duration based on available memory and the available capacity left in the batteries.

The Wizard program handles all the programming, initializing, and data reading of the instruments. It uses windows, graphics, and menus to perform all necessary functions. It is an extremely user friendly program with built in Help available for any function at any time.

2 Getting Started

Note the following checklist of important items.

 **If you ignore these, data may be lost and equipment damaged or destroyed.**

A Typical Micro/Mini Shipment:



Micro/Mini Instrument	Your oceanographic gauge.
Micro/Mini Interface, Cable, & Bulkhead Adapter	Used to communicate between your gauge and your computer.
Envelope containing: Wizard Program Diskette Operations Instructions	Download our Wizard operations program onto your computer from this diskette.
Set of foam inserts	Save for use in returns or repairs.

Unpack the instrument. Notify Coastal immediately if the box contents and packing list do not agree.

Check out the instrument immediately after receiving it as shipping damages some instruments. Deploying a broken instrument only leads to frustration and additional expense. Report any malfunction to Coastal immediately.

Handle the sensors with great care, especially the Marsh-McBirney current sensor, the Falmouth Scientific CTD sensor, and Paroscientific pressure gauges. The current sensor probe has soft graphite electrodes which are easily gouged or damaged. The CTD sensor is encased in ceramic which can be easily chipped or broken. The Paros pressure sensor will be permanently damaged if overranged by 20%.

Sensor operation should always be verified prior to any deployment. Simple bench or field tests should be sufficient for most applications. This involves **M**onitoring the instrument under known conditions, and making sure that sensed parameters are consistent with ambient input or controlled excitation. This should always be done prior to deployment.

Carefully examine the data as soon as possible after data collection. If something goes wrong during the retrieval of data, or the data appear unreasonable, resolve the problem before reinitializing the Micro/Mini. Start by consulting the other chapters (e.g. 7.1 Troubleshooting) in this manual. If the problem is still unresolved, call Coastal. There may be some chance to retrieve the data.

Never modify the equipment.

 **Do not open or tamper with electronics, sensors or hard disk; these are not user serviceable.**

With all this in mind, you are now ready to deploy the instrument.

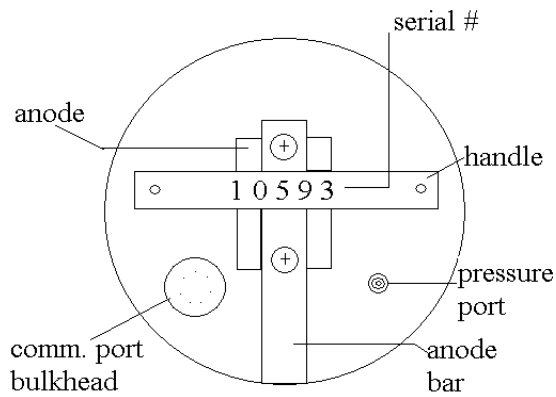


fig 4. Standard Top Plate Diagram

2.1 Quick Start

This section is intended to get the instrument working very quickly without going into a lot of detail in order to enable quick deployment in the field. This assumes that Wizard is already downloaded onto your PC computer. The following are basic steps to follow for instrument operation:

- Connect the instrument to the serial port of the computer using supplied cables.
- Make sure that the date and time set on your PC is correct.
- Move to the directory where the Wizard program resides.
- Run the program by typing *Wizard* [Enter]. Hit any key to get past the title page.
- Initialize instrument.
- Use the **M**onitor function now to verify sensor operation and deployment settings.
- Press [Esc] to exit Wizard program.
- The instrument will begin taking data according to your Initialization specifications.
- Reconnect the XSJ-7-DSP dummy plug into the bulkhead connector and deploy.

2.2 Pre-Deployment

This section assumes the instrument is being deployed for the first time, there is no data in the instrument to be read, and there is no maintenance required on the instrument. If this is not the case, refer to sections: 2.4 Recovering and Stopping Instrument, 3.3.2 Read, or 5 Maintenance.

When an instrument arrives from Coastal Leasing, Inc., the Startup Parameters have been set to start into the future. The battery capacity has been checked to verify that they will be sufficient for the planned deployment, or fresh batteries have been installed. Under most circumstances, the instrument does not need to be opened.

Setup your PC. You need an IBM PC or compatible with at least 512 kb of memory and a serial port. Note that if you are using a Coastal Mini-series instrument with a hard disk, your computer must also have a hard disk or other mass storage device with enough available disk space to hold data to be retrieved.

Copy the files on the Wizard disk to a subdirectory of your choice on your hard drive. See: 3.1 Installing Wizard.



fig 5. Micro/Mini Interface, Cable & Bulkhead Adapter

Connect the XSJ-7-CCP bulkhead connector end of the communication (Micro/Mini interface) cable supplied by Coastal to the Micro/Mini system. Connect the DB-9 connector end to the serial port (COM1) on the PC. If your PC does not have an available COM1, then COM2 can be used if necessary as described in Section 3.3.7 Utilities. **⚠ Do not connect to the parallel port of the PC.**

Use extreme care in aligning the keyway of the end cap's connector. Do not force insertion as you may irreparably damage the connector. Be sure that when reinstalling the XSJ-7-DSP dummy sealing plug or communications cable that the mating surfaces are clean and, if deploying, that a facial O-ring on the BCR is in place. See Section 5.2 Hardware Maintenance.

Check the PC clock. Wizard uses the PC clock to set the Micro/Mini clock. If necessary, change the PC clock by using the DOS TIME and DATE commands. If you are unfamiliar with these commands, consult your PC's user's manual.

On your PC, move to the directory where the Wizard program resides (i.e. C:\PROG\COASTALWIZARD). Run the program by typing *Wizard* [Enter]. Hit any key to get past the title page.

You will now want to Initialize the instrument with your specific sampling parameters. Once the instrument has been Initialized, you will want to Monitor to verify sensor operation and deployment settings. See: 3.3.4 Initialize and 3.3.5 Monitor for instructions on doing this. Exit Wizard by pressing [Esc], and disconnect the instrument from your PC. Reconnect the XSJ-7-DSP dummy plug onto the bulkhead connector. Your Micro/Mini instrument is now ready to be deployed.

2.3 Deploying Instrument

Before deploying your Micro/Mini instrument into water, make sure that the communications port is sealed with supplied dummy plug. Lubricate the O-ring on the plug with silicone grease and insert into port making sure that the key and keyway are aligned. **⚠ Do not force the plug into the port as this may irreparably damage port pins.**

The Micro/Mini instrument is calibrated to be deployed in an upright position, with the handle on top. It is possible to deploy it in other orientations, however an offset will need to be used in later calculations.

In deployment and recovery, it is essential to avoid all direct impact to any external sensor. For example, the carbon electrodes on the Marsh McBirney sensor which protrude from the sensor assembly are extremely delicate, and can be fractured or damaged by impact.

⚠ All dissimilar metal to metal contact must be avoided in order to minimize the risk of corrosion of the instrument's housing. Make sure that the zinc anode is attached to the top plate and has continuous electrical contact to the housing with either a metal bar or wire. In instruments which have an internal compass, such as the MiniFlow, nonferrous materials should be used near the instrument so that the compass measures accurately.

A Micro/Mini instrument can be moored inline, tripod mounted, suspended from a cable, or mounted to a platform. All deployments are generally site, instrument and project specific. For ideas on which type of deployment is right for your use, it is best to contact Coastal directly.

2.4 Recovering and Stopping Instrument

After taking the instrument out of the water, it should first be rinsed in fresh water. Note any possible damage to the case or top plate assembly.

Once the instrument is recovered, the Wizard **Read** and **Examine** (Sections 3.3.2 & 3.3.3) functions are used to recover and review data. The best way to stop the instrument depends on the length of time the unit is to be out of service, as follows:

<u>Short</u>	For short term, Initialize instrument to start at a distant future time.
<u>Long</u>	For long term, (approx. 1 month), see: Section 7.5, Connect command !J.
<u>Extended</u>	If storing for an extended period of time, open housing and remove primary (D-cell) batteries.

Otherwise, the data remains in the instrument and the instrument keeps sampling until the memory is full, the batteries are drained, or the unit is reinitialized.

3 Software - Wizard

The Wizard software that accompanies the instrumentation is a menu driven, PC compatible program complete with on-line Help, accessible by pressing the [F1] key at any time. The Wizard software runs all of Coastal Leasing's Micro/Mini series of instruments. Only one copy of Wizard is required.

3.1 Installing Wizard

Before you can run the Wizard program, it must be installed onto the hard drive of a PC. It is recommended that the Wizard software be installed into its own sub-directory. To install the Wizard software, insert the supplied floppy disk into the drive and enter the following command:

```
INSTALL S: D:\[PATH]
where S : is the source floppy drive (usually A: or B:).
D: is the destination drive.
PATH is the optional full directory path on the destination drive.
(Directory must already exist on drive).
```


Example: INSTALL A: C:\PROG\COASTAL

- ☒ **NOTE:** If no path is specified, the install routine will create a directory: C:\PROG\COASTAL\WIZARD and install all of the files into it. This is the standard default and is the usual pathway used.

The file format of the Wizard program is:

<u>Wizard</u>	Executable files
<u>Wizard\Prm</u>	Parameter files
<u>Wizard\Doc</u>	Help files
<u>Wizard\Dat\Raw</u>	Raw data files
<u>Wizard\Dat\Prs</u>	Processed data files


3.2 Running Wizard

 **It is very important that the Date and Time of the PC is correct as the Wizard program uses these to set the start of the deployment. Check them before running Wizard and if they are wrong, change them.**

To begin using the Wizard software (after it has been installed), first switch to the directory containing the Wizard program. For example, if the program resides in a directory called C:\PROG\COASTAL\WIZARD, type: *CD\PROG\COASTAL\WIZARD* and press [Enter]. Then type *Wizard* and press [Enter].

Once loaded, Wizard will display a title page. Press [Enter] to start using the program.

When running the Wizard software, remember the following:

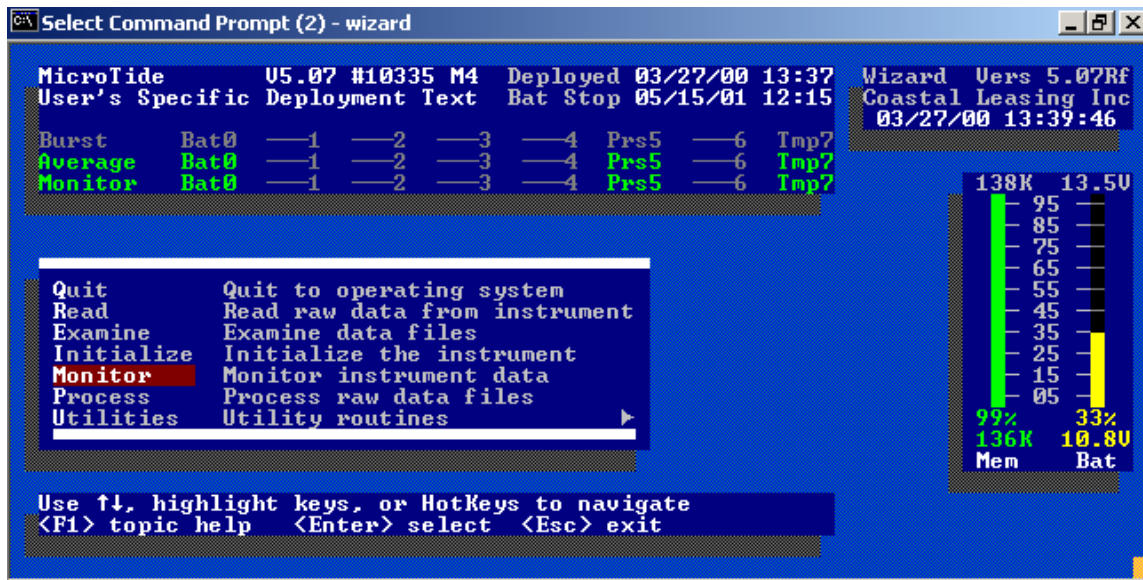
 Wizard is user friendly, with some on-line help to answer questions. If unclear about a Wizard prompt, press the [F1] key to retrieve any available help.

Wizard makes extensive use of menus. Making a menu selection can be done in two ways: press the key of the first letter of the desired selection, or move the highlight using arrow keys. Once your selection is highlighted, press [Enter]. Wizard will follow a standard sequence of **Read**, **Examine**, and **Initialize**, so in most cases you can proceed through the menus by simply pressing [Enter]. However, the first time an instrument is used, start with the **Initialize** function.

Pressing [Esc] generally aborts a step and returns to the previous menu or question.

The standard screen has several windows:

<u>I</u> nstrument	Top left	Summarizes instrument configuration and deployment.
<u>M</u> ain	Center left	Shows key menu function accessed by highlighting.
<u>F</u> unction	Bottom left	Reports function, status; defines required inputs.
<u>V</u> ersion	Top right	Reports Wizard version and computer date and time.
<u>G</u> auges	Center right	Shows battery and memory status.
<u>A</u> lert	Bottom right	Prompts for input.



3.3 Wizard Commands

QUIT	Exit program and return to system prompt.
READ	Download raw data from the instrument into files on the PC.
EXAMINE	Display raw data files as plots or as a listing.
INITIALIZE	Start or restart your deployment. Erases old data making all memory available.
MONITOR	Display instrument's readings in a real time mode.
PROCESS	Convert raw data files into ASCII files with engineering units.
UTILITIES	Support functions and information.

3.3.1 Quit

This option will **Quit** the Wizard program and return to the system. A yes/no question is asked prior to **Quitting** of the Wizard program.

3.3.2 Read

This option is used to download any raw data that resides in the instrument's memory. Once selected, the program will ask the instrument for its settings. Then it will verify the downloading of the data with a yes/no question. If [Y]es, the data will be loaded into memory and then offloaded into a file on the PC. The first 3 Characters of that file name will be the calendar day the instrument was Initialized, followed by the 4 least significant numbers of the instrument's serial number, followed by an "R". The file extension will be the file number of the raw data file. Example: 2653122R.001 means that it is the first (001) (R)aw data file for instrument number 1(3122) which was Initialized on the (265)th day of the year. With multiple files, the extension will change to show the file number. Example: 2653122R.002. Disk based instruments can have file numbers from 001 to 927, so their extensions will reflect that, while diskless instruments will only have one file number and file extension, 001.

The program will alert you if a file with the same name already exists in the directory. It will overwrite the old files, so if the old files are important, select [N]o, press the [Esc] key, and **Quit** the program. Then either rename the old files, or move them into another directory.

Once all the raw data has been offloaded from the instrument, the Wizard program will automatically select the **Examine** option.

3.3.3 Examine

The **Examine** option uses two ways to display the raw data.

The **Plot** option shows graphs of the data, and the **List** option lists data as a time series.

Plot Displays auto-scaled graphs of average and/or burst data. Each page can display up to 256 data points. The deployment title, type of data, instrument name, software version, and serial number are displayed at the top of each page. The channel number, sensor type and engineering units are displayed for each channel. Bursts are referenced by minute:second and averages are referenced by hour:minute.

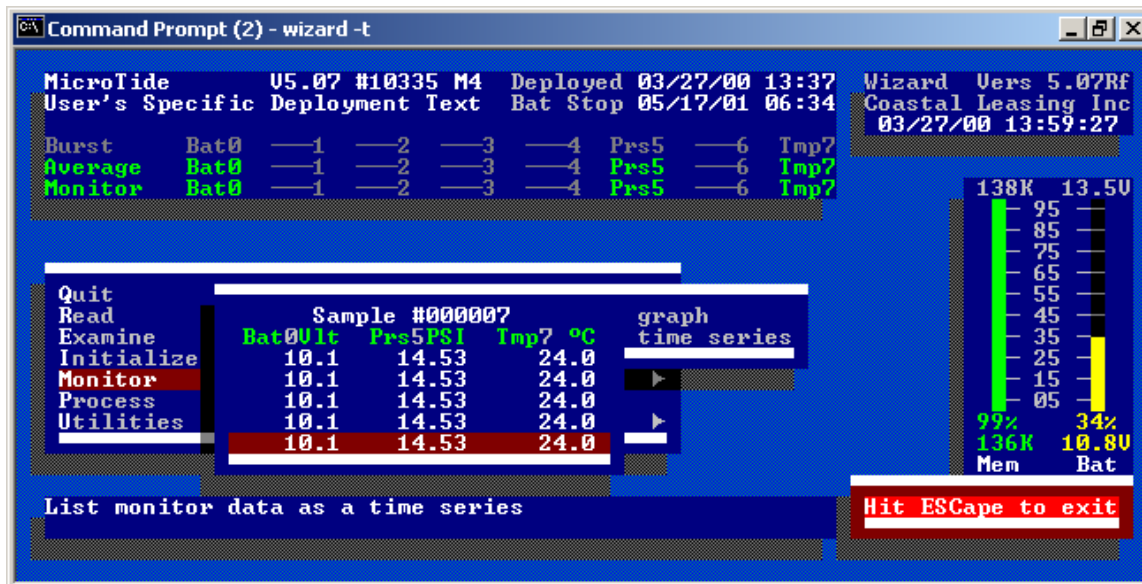
These special keys control the plot window:

[Esc]	Exits display mode.
[Enter]	Displays next page of data.
[Space]	Displays next page of data.
[Other keys]	Pause or resume automatic paging.

List Lists average or burst data as a time series. The date/time and data type (sequence and year, if the window is big enough), are displayed at the window top. If there is room on the screen, the time is displayed to the left of each sample. Bursts are stamped with seconds and hundredths. Averages are stamped with hours and minutes.

These special keys control the listing window:

[Esc]	Exits data listing mode.
[Enter]	Scrolls a line and then pauses.
[Space]	Scrolls a window, and the pauses.
[Other keys]	Pause or resume scrolling.



3.3.4 Initialize

This option is used to set and start your next deployment. It will erase any previous data stored in the instrument, so **never Initialize an instrument until all previously collected data has been Read.**

It is very important that the Date and Time of the PC is correct as the Wizard program uses these to set the start of the deployment. Check them before running Wizard and if they are wrong, change them.

Once selected, Initialize will request the instrument's attention, and then load the settings from the instrument into the program. The Deployment Settings window will then be displayed.

- Enter a Deployment Title of a maximum of 31 characters. Then enter a start date and time for averages (and/or bursts if supported). This is the date and time of the very first sample to be taken.
- Enter an average (and/or burst if supported) Interval in Minutes. This is the interval of how often you want to acquire a new set of average (or burst) data. A new set of data will be initiated every time this many minutes has elapsed.
- Enter the average (and/or burst if supported) Sample Period (.01sec). This is how often you want to sample the sensors during an average or burst acquisition. This number is in hundredths of seconds, so a entry of 50 represents 1/2 second.

- Enter the Average Samples to Average (and/or Number of Samples to Burst, if bursts are supported). This is the number of sample sets of the sensor you want to average together, (or the number of burst sensor sets you want to record). If 60 is entered for an average mode and its Sample Period is 50 (1/2 second), the instrument will stay on averaging the sensors every 1/2 second, and stay on for 30 seconds (60 x 1/2 second). If 512 is entered for a burst mode, and the Sensor Period is set to 50 (1/2 seconds), then the instrument will stay on for 256 seconds (512 x 1/2 seconds), recording each of the 512 sensor samples in memory.
 - NOTE:** Wave spectral analysis programs require the Number of Samples to Burst to be a power of 2. (64, 256, 1024...)

```

Command Prompt (2) - wizard

MicroTide #10335
Deployment Settings

Deployment title User's Specific Deployment Text

Bursts start date (mm/dd/yy) 01/01/01
Bursts start time (hh:mm:ss) 12:00:00
Burst interval (minutes) 60
Burst sampling period (.01 sec) 50
Burst samples to record 1024
Bst Chan 5: ICS Pressure Y

Averages start date (mm/dd/yy) 01/01/01
Averages start time (hh:mm:ss) 12:00:00
Average interval (minutes) 10
Average sampling period (.01 sec) 50
Average samples to average 60

Wizard Vers 5.07Rf
Coastal Leasing Inc
03/27/00 14:08:21

Deployment limit is
Memory: 136K
Ends 01/05/01 03:13

75
65
55
45
35
25
15
05
99% 34%
136K 10.8U
Mem Bat

Initialize the instrument
<F1> topic help ^<Enter> to accept form <Esc> exit
  
```

```

Command Prompt (2) - wizard

MicroTide #10335

Averages start time (hh:mm:ss) 12:00:00
Average interval (minutes) 10
Average sampling period (.01 sec) 50
Average samples to average 60
Avg Chan 0: CLI Battery Voltage Y
Avg Chan 5: ICS Pressure Y
Avg Chan 7: CLI Int Temperature Y

Monitor interval (seconds) 2
Monitor sampling period (.01 sec) 25
Monitor samples to average 4
Mon Chan 0: CLI Battery Voltage Y
Mon Chan 5: ICS Pressure Y
Mon Chan 7: CLI Int Temperature Y

[ End of form ]


Wizard Vers 5.07Rf
Coastal Leasing Inc
03/27/00 14:08:58

Deployment limit is
Memory: 136K
Ends 01/05/01 03:13

75
65
55
45
35
25
15
05
99% 34%
136K 10.8U
Mem Bat

Initialize the instrument
<F1> topic help ^<Enter> to accept form <Esc> exit
  
```

If both bursts and averages are enabled, and both a burst and an average are to occur at the same time, the burst takes priority.

You also have the option of turning on or off each individual sensor that is available in either average mode or burst mode.  **Be careful not to disable any parameter that you want to record.**

The **M**onitor mode parameters can also be changed, however the default settings are usually adequate as these settings only affect the real time monitoring of the instrument.

As any of the parameters are changed, the Deployment Limit is recalculated based on memory or battery, whichever is the limiting one. When all of the settings are correct, hold the [Ctrl] key down and press [Enter] to accept the settings and send them to the program. The program will ask if you want to continue with Initialization by saving the parameters. Enter **Y** and press [Enter].

It will then ask you to write these parameters to a file with a name of the instrument serial number and extension of .PRM. This file name will most likely already exist on your PC's hard drive and the program will warn you of this. There is very little reason to not overwrite this file if the data from the instrument has already been read. Even if this is the first deployment of the instrument, the file on the disk has no real deployment settings, so it is safe to overwrite.

Once the file has been written to disk, the program will ask you to **I**nitialize the instrument. There is a warning about losing any existing data at this point, so if the data in the instrument are important, and have not been **R**ead yet, enter **N** and **R**ead it, otherwise enter **Y**.

The instrument is now set, and will start recording data based on the parameter settings. Use the **M**onitor function now to verify sensor operation and deployment settings.

3.3.5 Monitor

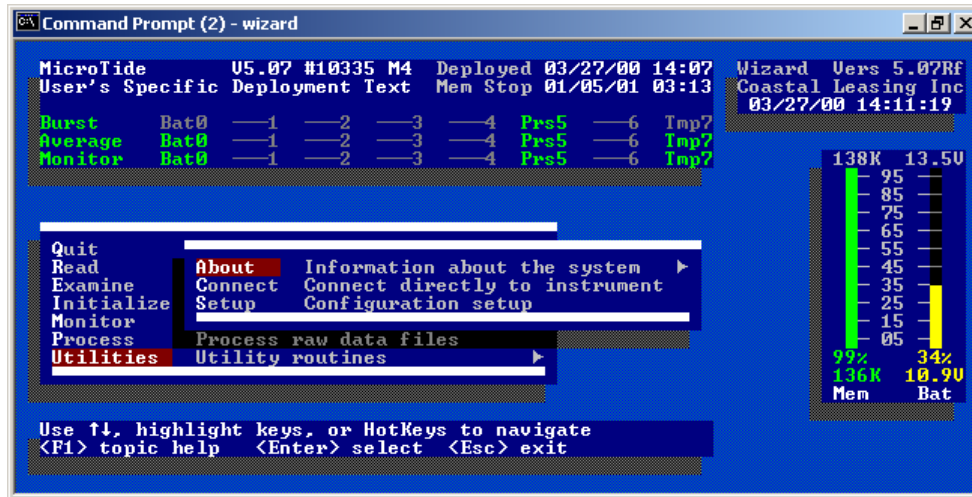
This option shows the real-time readings of the instrument's sensors. It is helpful in checking to see if the instrument is operating correctly. All data are displayed in the engineering units selected for the deployment.

3.3.6 Process

This option converts raw data files into processed ASCII files in engineering units. Data file names look very similar to the raw data file names. The first 3 characters of the file name will be the calendar day the instrument was initialized, followed by the 4 least significant numbers of the instrument's serial number, followed by an "A" for an average file or a "B" for a burst file. The file extension will be the file number of the processed file. Example: 2653122A.001, 2653122B.001. With multiple files, the extension will change to show the file number. Example: 2653122A.002, 2653122B.002. Disk based instruments can have file numbers from 001 to 927, so their extensions will reflect that, while diskless instruments will only have one file number and file extension, 001. All processed data files are comma delimited ASCII type files, so they are easily imported into many spreadsheet programs. These processed files will be located at ...\\WIZARD\\DAT\\PRC. See Section 6.1 Processed Data File Format for explicit details regarding the processed data file's specific numeric output.

3.3.7 Utilities

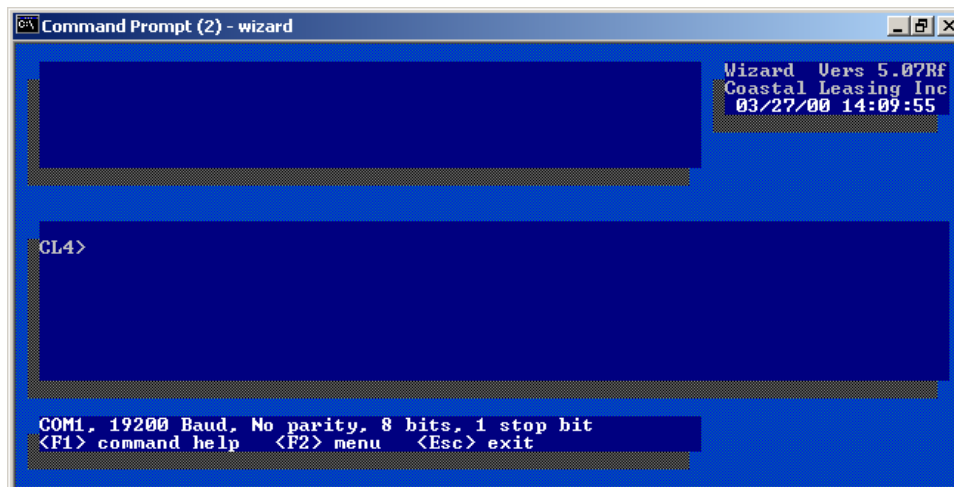
A few Utilities are available with this option.



About Useful for finding out about the instrument's deployment settings, Wizard program, and Coastal Leasing, Inc.

Connect This Utility will allow you to check on many functions of your instrument. It is most commonly used to change the serial port settings of the PC. Go to Connect and press [Enter]. If the instrument is communicating properly with the PC, a CL4> or a CL6> prompt, depending on instrument type, will be displayed.

In most cases, the settings should be: Com1:, 19200 Baud, No Parity, 8 bits, 1 stop bit. To change any of these communication parameters, press the [F2] key, and the Communication menu will be displayed. Select and change any settings that may be incorrect. Use the up/down arrow keys to select changes and the [Enter] key to make them. Press the [Esc] key to get back to the prompt. Pressing [Esc] at the prompt, and answering Y, will escape the Connect option and bring you back to the Main Menu.



For information on the other functions which you are able to use in this Connect screen, see: 7.5 Connect Mode Commands.

4 Hardware - Building Blocks

Coastal's new building block approach to state of the art field data collection uses completely modular hardware architecture. This versatile approach simplifies production of both standard and custom configurations. Coastal's hardware blocks can be characterized by:

<u>Capacity</u>	Storage of tens of thousands to millions of samples.
<u>Sensors</u>	Wide range of field proven sensors determine function.
<u>Sampling</u>	Microprocessor runs sampling, averaging, and storage.
<u>Communications</u>	Internal recording, telemetry, or networked options.
<u>Power</u>	Units run for months or longer using alkaline batteries.
<u>Housing</u>	Self-contained equipment suitable for a range of environments.

4.1 Capacity

Data capacities range from 128K RAM to 200 MB hard disk. Data storage requirements are a function of the parameters to be measured, the sampling frequency, the stored resolution, and the instrument's service interval. At normal sampling rates, Coastal's instruments can be deployed for months or up to year or longer. The most limiting factor, either actual data or battery capacity, determines deployment duration. Coastal's two classes of Micro/Mini data recorders are:

RAM Recording Systems 128K to 2 MB RAM - Store 85,000 to 1.3 million samples. Lower capacities are for averaging, such as tides or temperatures. Higher capacities are for bursting, for example: nondirectional wave gauges.

Hard Disk Systems 20 MB to 500 MB - Store 13 to 333 million samples. Lower capacities are for bursting, such as directional wave gauges. Higher capacities are for intensive, multi-parameter data collection, for example: Acoustic Doppler Current Profilers.

4.2 Sensors

The sensors characterize what an instrument measures. Selecting sensors requires choice of parameters to sample, over what ranges, and how accurately. Coastal's Micro/Mini instruments currently have seven (7) external sensor channels. An internal channel monitors battery voltage.

Currently supported sensors include a complete range of oceanographic, environmental and meteorological parameters including: air and water temperature, pressure, wind velocity, water velocity and water quality. The integration of other sensors can be quoted on request. Mechanical packaging considerations and power limitations generally limit the numbers and types of sensors that can be combined. Sensor types supported include:

<u>Unipolar or bipolar analog</u>	2 bit resolution or higher with averaging.
<u>Frequency</u>	Up to 20 bit resolution.
<u>Event measurement</u>	To detect events such as contact closures.

Coastal's hardware and software embed all of the required hookup and measurement requirements to operate a particular sensor. Coastal supplies serialized parameter files for each instrument that include sensor specific calibration information. Always use the supplied parameters and software, as these are matched to a specific instrument.

4.3 Sampling

Hardware and software considerations dictate the possible sampling schemes. Frequency of sampling is fully programmable by the user. Measurement, processing, and accuracy of stored results are functions

of instrument type. Coastal's standard sampling schemes include:

<u>Average</u>	Stores averaged or vector averaged processed results.
<u>Burst</u>	Stores sampled, individual sensor measurements.
<u>Monitor</u>	Displays present averaged or vector averaged results.

The average mode filters out short term variations, for example, eliminating waves when measuring tides. The burst mode captures short term variations. This is useful for measuring waves, directional waves, or other highly dynamic events. Not all instruments include the bursting capability. Monitor mode provides only real time output for testing and normally does not need to be changed from the default values. Conditional sampling and specialized processing are also available.

The Initialize (3.3.4) function of Wizard allows the user to set:

<u>Start</u>	Date and time at which sampling begins.
<u>Interval</u>	Time between start of sampled measurements.
<u>Period</u>	Rate at which samples are taken, input in hundredths of seconds.
<u>Duration</u>	Number of samples to average or store in a burst.
<u>Sensors</u>	Allow enabling or disabling of recording of connected sensors.

4.4 Communication

Coastal's instruments communicate serially (RS-232). The computer typically attaches by a short cable (less than 50 feet) to enable the user to control the instrument through Wizard software. In the normal bi-directional mode, the instrument listens for and responds to commands. With unidirectional communication, the instrument echoes status or data to the user. Coastal supplies a communications (Micro/Mini interface) cable with a DB-9 connector for the computer end, and an XSJ-7-CCP for the instrument housing end, which mates with the XSJ-7-BCR bulkhead connector.

Transmission options replace or augment the serial cable link to extend the range and circumstances for communications. Some alternatives include:

<u>Acoustic</u>	Subsea acoustic telemetry; possibly bidirectional.
<u>RS-422 or RS-485</u>	Serial cable with 1000 m range; fully bidirectional.
<u>Modem</u>	Conventional or cellular phone links; fully bidirectional.
<u>Radio</u>	UHF, VHF or 900 mHz radio or packet radio; possibly bidirectional.
<u>Argos Satellite</u>	Very limited data transmission, optional instrument locating.
<u>GOES Satellite</u>	Limited data transmission with conditional alert messaging.

New communications technologies are being developed and are easily integrated. In addition, Coastal's auxiliary Reporter software and hardware allow real time voice reporting, display, and alerting of sensed field measurements.

4.5 Power

Coastal's instruments are usually battery powered and take at least one stack of (9) alkaline D-cells; many of the Mini-series instruments accept additional stacks. The standard configurations include alkaline D-cell battery holders. Thus, the user can easily replace batteries without soldering and without the expense or difficulty of custom battery packs.

Many instruments have sufficient power for multiple deployments at standard sampling rates. Thus, the instruments can safely remain sealed in the field between deployments. Battery voltage monitoring at Initialization and during deployment ensures sufficient capacity and voltage levels for proper measurements. The projected deployment end depends on actual available battery or data capacity, whichever is more limiting. Batteries only need be replaced if a deployment is battery limited, the deployment duration is too short, and the installed batteries are not at or close to 100 percent capacity.

All instruments can be wired to accept external power from power mains or solar panels. External supply must be less than 14.5 VDC, and normally around 12 VDC.

4.6 Housing

Coastal's instruments can be housed in a variety of ways, but are generally fully self-contained and submersible. A bulkhead communications and power connector located on the outside of the housing eliminates the need to open the instrument for data retrieval.

A variety of plastic, fiberglass, aluminum, stainless, titanium or other metal housings are available. These are durable, waterproof, and suitable for a wide range of environments.

Coastal sizes its standard housings to be compact, yet with ample battery capacity for most sampling schemes. The typical instrument package is a cylindrical pressure housing (type 316L stainless) with a 5.5 inch diameter. Most Micro-series instruments have a length of less than 13 inches, a convenient handle, and weigh under 20 pounds. The Mini-series instruments have the same diameter, but are typically longer and heavier.

5 Maintenance

Your Micro/Mini instrument must be serviced periodically to provide maximum efficiency in performance. This consists of cleaning the housing, checking the hardware, checking the batteries, and cleaning the sensors.

5.1 Housing

After each deployment of the pressure case, the housing should be cleaned to better allow you to observe any potential corrosion. Soaking the instrument in a CITRANOX solution is recommended for cleaning the external housing of any of Coastal's equipment. This solution, when diluted with water, is an effortless and environmentally-friendly way to remove barnacles or other sea growth from the housing. CITRANOX is available from leading laboratory and industrial supply dealers. For your nearest dealer contact:

Alconox, Inc.	Phone: 212-532-4040
9 East 40th Street	Fax: 212-532-4301
Suite 200	
New York, NY 10016	

 **Do not use anything abrasive to clean the pressure case.**

5.2 Hardware: O-rings, & Anodes

It is recommended to use fully cleaned or new O-rings for every deployment. Be sure to carefully clean not only the O-rings, but also the O-ring mating surfaces on the pressure case and end cap with isopropyl alcohol. Lubricate the O-rings lightly with silicone grease, (silicone grease such as Dow Corning DC-4 or Parker O-ring lubricant is recommended), being sure in the process to check that the rings are clean and free of surface defects (cuts, hair, dirt, etc.) which would prevent proper sealing. Suggested O-ring sizes are as follows:

<u>Size</u>	<u>Location</u>
250	Outside rim of endcap
058	Face seal, bulkhead connector (communications port)
013	Dummy plug

Once the O-rings have been seated, the pressure case should be closed. Carefully slide the electronics into the housing and secure the screws. Make sure that the zinc anode is attached to the top plate and has continuous electrical contact to the housing with either a metal bar or wire. This can be done with an ohmmeter, making sure that there is negligible resistance between the anode and the case. Replace zinc anode (CAMP 34762) when it has lost as much as a half of its mass - or earlier if the rate of deterioration of the anode so indicates.

5.3 Batteries

Prior to replacing batteries, make sure that any existing data has been **Read** from the instrument. Next, open the MicroMini instrument pressure case by taking out the screws and sliding the electronics carefully out of the case. Each battery board consists of 9 alkaline 'D' cells. Paper tubes are used to hold individual 'D' cells in stacks. Alternately, Bright Star Battery Company Model 7542 triple 'D' cells are also suitable. Remove all batteries from the board and check the battery contacts for any signs of corrosion. If all looks good, replace one stack at a time, securing with thick elastic bands.

☒ **NOTE:** When changing the batteries, remove **all 3** stacks from the battery board before replacing any 1 stack.

The 'AA' cells, located in the plastic electronics box, will not need to be replaced as often as the 'D' cells as they are only used as a backup power device. **DO NOT remove both the 'D' cells and the 'AA' cells at the same time** or the whole instrument will have to be entirely reprogrammed.

After replacing batteries, note the battery voltage displayed in the lower corner of the Wizard screen. For the Micro series, the voltage should read at least 12 V. For the Mini series, the voltage should read 13.0V, accounting for a 0.5V drop because of the diode protection.

5.4 Sensors

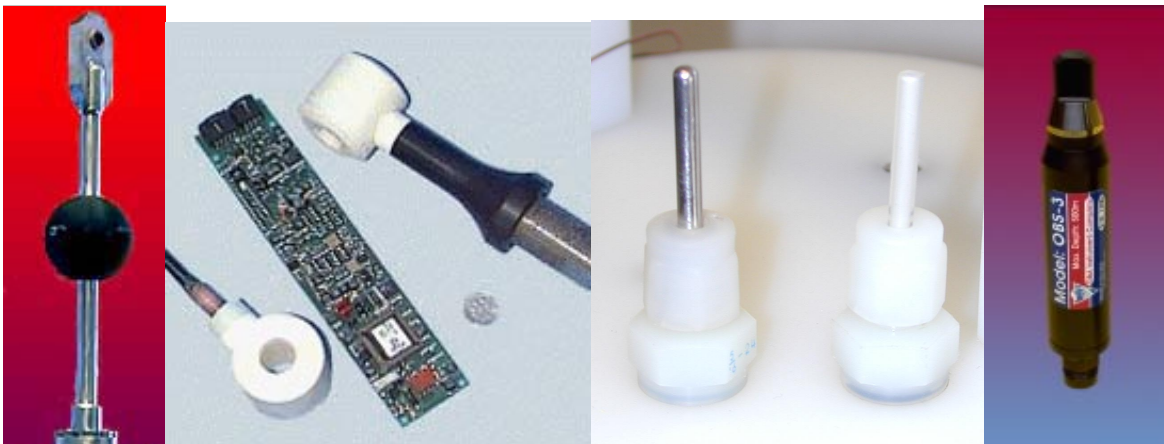



fig 6. Marsh McBirney Velocity, FSI Conductivity, Standard Temp & Pressure, D&A OBS-3 Turbidity

A few of the sensors require care as follows:

Conductivity, Always store with tube filled with distilled water.
SeaBird

Conductivity, Be sure that the borehole is cleaned before reuse or storage. Use care not to
FSI chip or crack external ceramic housing.

Dissolved Oxygen, Always store in tube filled with distilled water.
UMS GmbH

<u>Pressure Standard</u>	To clean and refill fluid, remove the upper swagelok fitting with the extension tube on top of the top plate with a 9/16" wrench. Check this fitting and extension tube and, if dirty, clean it. Make sure that the hole in the top plate is filled to the top with silicon fluid; if not, top off the hole with Dow Fluid 200, viscosity 350 cSt for wave gauges and 10K cSt for tide gauges. Wait until all air bubbles have vented up; this could take some time, as the silicon fluid is quite viscous. Take the clean fitting and extension tube assembly and screw it into the hole. As it screws in, air and then silicon fluid will be pushed out through the top of the extension tube. Tighten fitting with 9/16" wrench.  <u>Be sure that all air bubbles have vented out before deployment.</u>
<u>Pressure Paroscientific</u>	Maintain the same as a standard sensor, but with Dow Fluid 200, viscosity 60K cSt. Never exceed rated pressure range or expose sensor to shock as irreparable damage can result.
<u>Temperature SeaBird</u>	The thermister probes are delicate; use extreme care. For a cabled thermister assembly, use all plastic cable ties to secure probes to a kevlar strain member.
<u>Temperature Thermister</u>	The sensor may be cleaned with soap and water. Do not use any abrasive cleansers.
<u>Turbidity D&A OBS</u>	The sensor can be cleaned with mild detergent applied with a soft cloth or sponge. For further maintenance, see OBS manual.
<u>Turbidity Wet Labs</u>	The sensor surface may be cleaned with soap and water or alcohol. Clean the optical window before and after use.
<u>Velocity Marsh McBirney</u>	Use extreme care in handling sensor. Electrodes are fragile and cannot be repaired if damaged. Keep electrodes clean with mild soap.

6 Appendix - Data

6.1 Processed Data File Format

Text inside (PARENTHESIS) below is explanatory here and does not appear in the actual output file. Text inside "Quotes" below is replaced with application specific wording. All other text below is replaced with application specific numeric data. Indentations, white spaces, newlines and comma separations are used in the actual output file exactly as shown below, except for continuation lines in this document. The notation (CONT) below means that there is not a newline here in the output file, and that data would actually continue on the same line. The notation (SPACE) or (SP) means there is a space character here in the output file. Blank lines appear in the output file only where indicated by (BLANK LINE) below.

(CALIBRATION BLOCK BEGINS HERE)

```
@INSTRUMENT(SP)"InstrumentName", (SP)"Vcccc-sssssss-mmmmmmm-t-bb-pp", (SP)program.version, compiled.mm/dd/yy
(SPACE)calibrated.mm/dd/yy, (SP)calibrated.hh:mm:ss, (SP)master.version, master.serial, software.version, software.mm/dd/yy, (CONT)
interface.version, interface.serial, logger.version, logger.serial, disk.version, disk.serial, casing.version, casing.serial
(SPACE)datafile_bytes, total_bytes, max_file, amp_hours, min_battery, reference, mode_flags, disk_delay, converter, bipolar, (CONT)
crystal, memobanks, config_info, baud_code, warmup, transmit_code, nibbles, consumption, battery_stack
```

(SENSOR BLOCK BEGINS HERE, +/- INDICATES ENABLED/DISABLED CHANNEL)

```
+channel0, "label", version, serial, burst.logger, burst.pc, average.logger, average.pc, monitor.logger, monitor.pc, (CONT)
threshold, mode, cycles, timeout, prescale, enabled, power, warmup, port, cal_units, exp_units, nibbles, consumption, "format"
(SPACE)calib0, calib1, calib2, calib3, calib4, calib5, calib6, offset, multiplier, divisor
```

(CHANNELS 1 THROUGH 7 APPEAR HERE AS ABOVE)

(SENSOR AND CALIBRATION BLOCKS ENDS HERE WITH 1 BLANK LINE)

(DEPLOYMENT BLOCK BEGINS HERE)

@DEPLOYMENT(SP)"User's Deployment Specific Text" (SP)deployment.mm/dd/yy,(SP)deployment.hh:mm:ss,(SP)sys_clock ,start_delay,data_pointer,disk_bytes,ram_bytes,next_file,events

(+/- INDICATES MODE ENABLED/DISABLED FOR THAT CHANNEL)**(BURST MODE)**

@BST(SP)-0,(SP)-1,(SP)-2,(SP)+3,(SP)-4,(SP)+5,(SP)+6,(SP)-7 (SP)bst.start.mm/dd/yy,(SP)bst.start.hh:mm:ss,(SP)ID_value,last_time,next_time,ram_size,interval,period,number,warmup,ID_adjust

(AVERAGE MODE)

@AVG(SP)+0,(SP)+1,(SP)+2,(SP)+3,(SP)+4,(SP)+5,(SP)+6,(SP)-7 (SP)avg.start.mm/dd/yy,(SP)avg.start.hh:mm:ss,(SP)ID_value ,last_time,next_time,ram_size,interval,period,number,warmup,ID_adjust

(MONITOR MODE)

@MON(SP)+0,(SP)+1,(SP)+2,(SP)+3,(SP)-4,(SP)+5,(SP)+6,(SP)+7
(SP)mon.start.00/00/00,(SP)mon.start.00:00:00,(SP)ID_value,last_time,next_time,ram_size,interval,period,number,warmup,ID_adjust


(DEPLOYMENT BLOCK ENDS HERE WITH 1 BLANK LINE)**(IN AVERAGE FILES, AVERAGE BLOCK FOLLOWS AS BELOW)****@ AVERAGES**

average.mm/dd/yy,average.hh:mm,0.00,1.11,2.22,3.33,4.44,5.55,6.66 (AVERAGE 1)
average.mm/dd/yy,average.hh:mm,0.00,1.11,2.22,3.33,4.44,5.55,6.66 (AVERAGE 2)
(OTHER AVERAGES, TO END OF FILE)

(IN BURST FILES, BURST BLOCK FOLLOWS AS BELOW)**@BURSTS**

burst.mm/dd/yy,burst.hh:mm (BURST 1)
3.33,5.55,6.66 (FIRST ELEMENT OF BURST 1)
... (OTHER ELEMENTS OF BURST 1)
3.33,5.55,6.66 (LAST ELEMENT OF BURST 1)
burst.mm/dd/yy,burst.hh:mm (BURST 2)
3.33,5.55,6.66 (FIRST ELEMENT OF BURST 2)
... (OTHER ELEMENTS OF BURST 2)
3.33,5.55,6.66 (LAST ELEMENT OF BURST 2)
(OTHER BURSTS, TO END OF FILE)

6.2 Calculating Depth

 **NOTE:** To calculate depth, you must have concurring barometric pressure readings to use. Otherwise, you will need to use the nominal 14.7 PSIA.

Data recorded by the MicroTide, in addition to date and time tagging, are battery voltage (volts DC), pressure (PSIA), and temperature (°C). Conversion to depth of water is relatively straightforward. The pressure data recorded is total pressure, measured in pounds per square inch absolute (i.e. PSIA), and includes both atmospheric and hydrostatic pressure components. Then the depth of water above the pressure port can be calculated as:

$$D = (P - A) * K$$

Where:

- D = depth, in meters
- P = total pressure, from MicroTide, in PSIA
- A = atmospheric pressure, either the nominal 14.7 PSIA, or actual measured barometric pressure from an independent source.
- K = pressure-to-depth conversion factor, which is a function of temperature and conductivity

The conversion from pressure-to-depth can be derived from the density of water as follows:

$$K = 0.703242 \text{ m/psi} * 1/\text{Rho} (T) * 1/\text{Rho} (S)$$

Where:

- 0.703242 m/psi = Corresponding depth of pure water at 4°C
- 1/Rho (T) = Relative Volume, function of Temperature
- 1/Rho (S) = Relative Volume, function of Salinity

The latter two quantities are tabulated and shown in Table A:

Table A: Relative Volume of Water as a Function of Temperature (°C)

°C	Volume	°C	Volume	°C	Volume	°C	Volume
-10	1.00186	0	1.00013	10	1.00027	20	1.00177
-9	1.00157	1	1.00007	11	1.00037	21	1.00198
-8	1.00131	2	1.00003	12	1.00048	22	1.00221
-7	1.00108	3	1.00001	13	1.00060	23	1.00244
-6	1.00088	4	1.00000	14	1.00073	24	1.00268
-5	1.00070	5	1.00001	15	1.00087	25	1.00294
-4	1.00055	6	1.00003	16	1.00103	26	1.00320
-3	1.00042	7	1.00007	17	1.00120	27	1.00347
-2	1.00031	8	1.00012	18	1.00138	28	1.00375
-1	1.00021	9	1.00019	19	1.00157	29	1.00405

Relative Volume of Water as a Function of Estimated Salinity (PPT)

S	Volume	S	Volume	S	Volume	S	Volume
0	1.00000	15	0.98912	30	0.97828	45	0.96740
5	0.99631	20	0.98542	35	0.97466	50	0.96386
10	0.99275	25	0.98184	40	0.97097	55	0.96034

NOTE: Derived from Specific Gravity at 20°C

6.3 Calculating Salinity

The conductivity measured in situ is first converted to a conductivity ratio defined by :

$$R(S, T, P) = \frac{C(S, T, P)}{C(35\%, 15^\circ\text{C}, 0)}$$

where:

$$C(S, T, P) = \text{conductivity at salinity (S\%), temperature (T }^\circ\text{C), and pressure (P dbar)}$$

$$C(35\%, 15^\circ\text{C}, 0) = 42.914 \text{ mmho/cm}$$

Second, correct for the effect of pressure on conductivity by the formula:

$$R(S, T) = \frac{R(S, T, P)}{(1 + F)}$$

$$\text{where: } F = \frac{(1.60836 \times 10^{-5}) P - (5.4845 \times 10^{-10}) P^2 + (6.166 \times 10^{-15}) P^3}{1 + (3.0786 \times 10^{-2}) T + (3.169 \times 10^{-4}) T^2}$$

Third, correct for the effect of temperature by the formula:

$$R(S) = \frac{R(S, T)}{r_T}$$

where:

$$r_T = 0.6765836 + 2.005294 (T/100) + 1.11099 (T/100)^2 - 0.726684 (T/100)^3 + 0.13587 (T/100)^4$$

Finally, the salinity is obtained by putting R (S) into the formula:

$$S = \frac{[-0.08996 + 28.8567R + 12.18882R^2 - 10.61869R^3 + 5.9862R^4 - 1.32311R^5 + R(R-1)] * [0.0442T - 0.46 \times 10^{-3} T^2 - 4 \times 10^{-3} RT + (1.25 \times 10^{-4} - 2.9 \times 10^{-6} T) P]}{1}$$

6.4 Calculating Speed of Sound

Once the calculation for conversion to depth in meters, salinity in parts per thousand, and temperature in degrees Celcius have been done for a sample point, the sound velocity in water is as follows:

$$C = 1449.2 + 4.6 T + 5.5 \times 10^{-2} T^2 + 2.9 \times 10^{-4} T^3 + (1.34 - 1 \times 10^{-2} T) * (S-35) + 1.6 \times 10^{-2} D$$

where:

C = Velocity of sound in water (m/s)

D = Depth in meters

S = Salinity in parts per thousand

T = Temperature in degrees Celcius

6.5 Calculating Speed & Direction

Conversion to polar coordinates of speed and direction from the cartesian x and y component velocities is documented below.

Speed can be calculated as:

$$\text{SPEED} = \sqrt{X*X + Y*Y}$$

Direction in degrees relative to the sensor can be calculated as:

$$\text{DIR} = \text{ARCTAN}(X / Y)$$

If $Y < 0$, then:

$$\text{DIR} = \text{DIR} + 180$$

If θ is the compass heading (magnetic or magnetic + declination) of the instrument relative to the +Y axis, then:

$$\text{DIR} = \text{MODULO}(\text{DIR} + \theta, 360)$$

This all can readily be incorporated into a spreadsheet.

7 Appendix - Operation

7.1 Troubleshooting

When an instrument is initially connected to the computer and the Wizard program is started, if no response is received, an error message will be displayed: *The instrument is not responding, check connection.*

Although not all of these problems can be solved in the field, there are some short procedures which can be used to quickly resolve the occasional problems of a Micro/Mini series instrument.

1. The first thing to do is to check the physical cable connections. Next, try using a different computer and/or a different instrument to see if the problem is a bad serial port. If these initial steps produce no results, you should use the built in communication program in the Wizard software to continue troubleshooting.
2. From the main menu of Wizard, select **Utility** and then **Connect**. Along the bottom of the **Connect** screen, the communication parameters are displayed. In most cases, the settings should be: COM1, 19200 Baud, No Parity, 8 bits, 1 stop bit. To change any of these communication parameters, press the [F2] key, and the Communication menu will be displayed. Select and change

any settings that may be incorrect. Use the up/down arrow keys to select changes and the [Enter] key to make them. Press the [Esc] key when finished to get back to the Connect screen.

3. After parameter verification, you should have one of five outcomes:
 - a) *CL4>* or *CL6>* prompt is the normal response.
 - b) *lobat*, (will only appear after waiting at least 60 seconds), indicates that the main batteries are below operating levels.
 - c) *OK>* prompt means that the instrument has become deprogrammed.
 - d) *Z* or *Zzz* means the instrument's memory is full.
 - e) The screen will remain completely blank.
4. If there is a *CL4>* or *CL6>* prompt and the instrument is still not responding, (which is unlikely), please call Coastal and we will suggest additional tests.
5. If the *CL4>* or *CL6>* prompt is displayed, and then a *lobat* appears after 60 seconds, the instrument is working correctly, but the main batteries are below normal operation levels.

If there is data in the instrument that needs to be downloaded, first check to see if the two 'AA' batteries (Micro logger), or the 9 volt battery (Mini logger), both located inside the white electronic box, are okay before any main 'D' battery stacks are removed. When changing the batteries, remove all 3 stacks from the battery board before replacing any stack. After the 'D' stacks are replaced, you may then also replace the smaller batteries if needed. You should also take this time to check the battery contacts.

6. If an *OK>* was detected during any of these procedures, the data logger program has been lost, (or in extremely rare cases it has stopped running). This can be caused if the instrument has had its batteries removed, or if the power supplies are somehow shorted by the user. To check, type: **RUN* and press [Enter]. If an *OK>* comes back, the logger program has been lost, and the instrument needs to be reprogrammed. See Section 7.2: Reprogramming the Micro/Mini Logger.
7. If a *Zzz* appears (Wizard versions 5.05 and 5.07), the data capacity of the instrument's memory has been reached, and the instrument has gone into a sleep mode in order to preserve the data. This is a normal function. Simply exit the Connect screen and choose **Read** from the main menu. The data will download. You may then reInitialize the instrument.

If a *Z* appears (Wizard version 5.06), the data capacity of the instrument's memory has been reached, and the instrument has gone into a sleep mode in order to preserve the data.

- ☒ **NOTE:** If there is critical data to be recovered, you might want to contact Coastal before attempting to troubleshoot this problem on your own!

However, if you are in the field and need to attempt recovery, do so according to the following directions:

- a) Hold [Ctrl-C] keys down until you see the *CL4>* prompt.
- b) **Quickly** press [Esc], then [Y], then [Enter]. The main menu will appear. Press [R], then [Y], then [Enter]. If this procedure takes more than 3 seconds, you will end up back at the *Z* and will need to try again.

c) Once the data has been **Read** by completing step b), you will need to reInitialize the instrument. Go back to the Connect screen. Repeat step a).

d) **Quickly** press [Esc], then [Y], then [Enter]. The main menu will appear. Press [I] to Initialize.

If your instrument is running Wizard 5.06, we highly recommend that you contact Coastal to upgrade to version 5.07 in order to avoid the above procedure in the future.

8. A blank screen could indicate one of a few problems:

a) The battery voltage could be below 6 volts (the minimum needed to produce the *lobat* message); measure the battery stacks with a DC volt meter to determine that case. If so, replace batteries according to step 5 above.

b) There could be a problem with the wiring in the external bulkhead connector. To check this, first disconnect the bulkhead adapter from the Micro/Mini interface cable. Next, disconnect the modular phone plug that connects the bulkhead communications port (on top of instrument) to the in-line coupler (underneath the top plate). Replace with the modular phone plug at the end of the interface cable. Retry Connecting to the instrument.

9. If there is still no response from the logger, and there is no required data in the instrument, it can easily be reprogrammed according to the following directions:

a) Disconnect the instrument from the computer.

b) Open up the white electronic box and remove the yellow shunt that connects the back-up batteries to the electronics (remember where this shunt goes!). This shunt is located near the right hand edge of the electronic board about 2 inches down on the right side.

c) Disconnect the main battery supply by disconnecting the modular phone plug on the battery board. (In instruments with multiple battery boards, disconnect the modular plug on the battery board whose cable comes through the white electronic box, usually the top most battery board.)

e) Wait approximately one minute, then reconnect the main batteries by reconnecting the modular plug.

f) Reinstall the yellow shunt.

g) Reprogram the instrument according to Section 7.2 Reprogramming the Micro/Mini Logger.

10. If none of the above steps restores communications, the remaining options would be:

a) Obtain or have Coastal send a replacement MAX220 or MAX232 serial line driver.




b) Coastal could possibly send an exchange set of electronics.

c) To be absolutely sure the problem is solved, consider sending the entire system back for checkout and service.

7.1.1 Technical Assistance

If the above procedures do not result in a properly operating instrument, please contact:

Coastal's Technical Department

 ph: (617) 497-1122 x125
 fax: (617) 497-1188
 email: coastal@coastal-usa.com

Our technical operating hours are from 8 am - 3 pm Eastern Standard Time. When calling, please have ready your Coastal account number, instrument name and serial number, your pc information, and specifics relating to the problem. Preferrably, have your instrument hooked up and running with your pc.

If it is recommended that you return the instrument to Coastal, please include a packing list stating your company's name, the instrument number, and the reason for the return. Don't forget to insure the instrument while shipping.

7.2 Reprogramming the Micro/Mini Logger

From the directory in which you will start the WIZARD program, (example, C:\), enter the following to start WIZARD in the Programming & Calibration mode: (ex. C:\) *Wizard -PROgram* [Enter]

The title page will appear showing information such as Wizard version and the start time of this session, but most importantly it indicates that the Wizard Programming and Calibration Utility is in use.

[Hit any key to continue]

A four item Main menu will appear, with the Program option highlighted. Press [Enter] to select this option.

WARNING! This discards stored data. Reprogram instrument? N

If there is any data in the instrument that has not been **Read**, and is needed, press [N], **Quit** the Programming & Calibration Utility, run Wizard as you normally would (type: *Wizard* [Enter]) and **Read** the data. You can use the new version of Wizard to do this as it will convert the data as it **Reads** it. When done, go back to the same point in the Programming & Calibration Utility where you left to **Read** the data.

Press [Y] to reprogram the instrument. The following messages will be displayed by the program automatically.

First, Requesting the instrument's attention. Then it will start Preparing the instrument for programming. Next, Sending the program to the instrument.

The instrument is now reprogrammed and the Main Menu will be displayed. The Calibrate option will now be highlighted. To continue with Calibration of the reprogrammed instrument, see: Section 7.3 Recalibrating the Micro/Mini Logger.

7.3 Recalibrating the Micro/Mini Logger

From the directory in which you will start the Wizard program, (example, C:\), enter the following to start Wizard in the Programming & Calibration mode: (ex. C:\) *Wizard -PROgram* [Enter]

The title page will appear showing information such as Wizard version and the start time of this session,

but most importantly it indicates that the Wizard Programming and Calibration Utility is in use.

[Hit any key to continue]

A four item Main menu will appear, with the Program option highlighted. Arrow down to the Calibrate option and press [Enter].

Select from files matching: prm.prm*

Press [Enter]. A list of parameter files will be displayed. Use the up/down arrow keys to highlight the correct serial number. Press [Enter] to checkmark the file and hold the [Ctrl] and [Enter] down together to send the parameter file to the instrument.

WARNING! This discard stored data. Calibrate instrument? N

Press [Y] to continue.

Note! M4 deployment will start immediately. To alter, reinit after cal.

This message means the instrument will start to take data almost immediately after Calibration is complete. (You should, after quitting the Programming & Calibration mode of Wizard, run Wizard and Initialize the instrument with real deployment settings.)

[Hit any key to continue]

The instrument will now wait for the clock synchronization. Once synchronized, the instrument's attention will be requested, and the parameter file will be sent to the instrument. It will then digest the parameters. The program will then request the instrument's attention and load the settings from the instrument.

The four item Main Menu will appear. Select **Quit** and **Quit** the Programming & Calibration Utility of Wizard. Start Wizard as you normally would, (type: *Wizard* [Enter]) and Initialize the instrument.

7.4 Modifying Data for New Parameters

In order to use the following to modify old data, you must have Coastal send you a MODPARAM.EXE file.

- Run WIZARD. Go to Calibrate - File, and specify the data file you want to make changes in. Make the required changes. Multiple changes are supported, but only changes to the following fields will be used by MODPARAM, regardless of any other changes you make:

General parameters

Crystal speed type

Sensor parameters

PC calibration parameters 0-6
 Logger compression offset
 Logger compression multiplier
 Logger compression divisor
 Average data processing
 Burst data processing
 Calibration engineering units
 Deployment engineering units
 Output format specifier
 Period prescaler / AD polar mode

- Save the parameter file under a new name. This new file can be used as a template in

the next step, for any data files which need the same set of changes.

- Run MODPARAM OLDFILE NEWFILE TEMPLATE

This reads in the old file, makes the (allowable) changes found in the template, and writes the modified version out to the new file. There is nothing to prevent you from making sequential changes to the same data file, so if you need to re-edit a file, you don't necessarily have to start over with the original. Just pass the current version through the above directions again.

7.5 Connect Mode Commands

[!B]	Reports the battery voltage.
[!D]	Starts detach mode. Allows user to spy on what the logger is doing. Will display a data string after each recorded data set is stored. Will display the clock count each minute if no data is being recorded. For more info, see: 7.4.1 Using the Detach command.
[!J]	Puts instrument in sleep mode. Sampling stops, but clock remains active. Use to save power while shelving instrument for a long period of time.
[!M]	Starts the raw Monitor mode. Same data that is displayed when Monitor is selected under main menu, but not every channel is displayed in engineering units.
[!N]	Shows display of deployment settings.
[Alt-W]	Wake up instrument. Use after a !D is issued to get out of detach mode. Use after a !J is issued to get out of sleep mode.
[Ctrl-C]	Escape Monitor mode.
[Alt-Z]	Zooms screen out and in.

7.5.1 Using the Detach (!D) Command

The Detach command can be used to observe the storage of data in the Micro/Mini logger prior to a deployment. This is the same command issued to the Micro/Mini when exiting any menu item in the Wizard program which communicates with the logger. By issuing it directly to the logger, you can "spy" on the operation of the instrument.

Prior to issuing the Detach command, the instrument must first be Initialized with a start date and time that causes the instrument to be currently, or soon to be, logging data.

From the Main Menu, select the **Utilities** option.

Select Connect and press the [Enter] key until the program responds with:

Requesting Instrument's Attention

A CL4> will then be displayed. (Each time the [Enter] key is pressed, CL4> will be displayed.)

Enter the Detach command: `!D [Enter]` (will not be shown on the screen)

This will force the logger to ignore the connection between itself and the computer.

Every minute after Initialization, the instrument will wake up and follow a set of instructions. The first is to determine if the instrument is connected to the computer. Since the !D command makes the computer invisible, it determines from its sampling schedule if it needs to turn on and take a data sampling. If it is required to take a sampling, the logger turns on, samples the required sensors, and stores the averaged values. At the same time it stores the averaged data, it also sends the data string out the serial port, giving us the ability to see it on the screen. The format of the data string is as follows:

10484A000210 1214:0 :1 :2 :3 :4 -1937:5 :6 2134:7

The first 5 numbers are the serial number of the instrument. The next character is an A, B, or N.

A = an average data set follows

B = a bursted data set follows (only last burst values are displayed)

N = no data was scheduled to be taken

The six digits after the letter represent the number of minutes since the instrument was Initialized. The numbers that follow are the raw data that represent the stored data. The reading for each stored channel is followed by a colon(:), then its channel number. If a channel is not used, then just the colon and channel number are displayed. Channel :0 is the battery voltage and the only channel that can be read directly as anything meaningful. Its readings are in millivolts. All other channel readings can only be used to confirm that the data is being acquired. Verifying proper operation of all channels should be done using Monitor from the main Wizard menu.

This operation confirms proper storage of the data. To continue with deployment, disconnect the instrument from the serial port. To get the instrument's attention, type [Alt-W].

7.6 Running Multiple Wizards

To run multiple copies of Wizard in Windows:

1. Make sure you are using the supplied WIZARD.PIF to start each copy of Wizard.
2. Clear the "Execution-Exclusive" checkbox of WIZARD.PIF using PIFEDIT.EXE.
3. If you need to specify unique parameters, (for instance, communication parameters), for each invocation, make a copy of WIZARD.PIF for each, (WIZARD1.PIF, WIZARD2.PIF, etc.), and use PIFEDIT.EXE to separately specify the parameters for each one.
4. If you are having communication troubles, (missed characters, etc.), insert the following two lines into your Windows SYSTEM.INI file:

```
COM1Buffer=2048 (default is 128)   OR   COM2Buffer=2048
COMBoostTime=20
```

To run two Wizards, one on COM1 and the other on COM2:

```
COM1Buffer=2048
COM2Buffer=2048
COMBoostTime=20
```

5. If you are still having communication problems:

```
Run Control Panel-Enhanced.
Clear the "Exclusive in Foreground" checkbox.
Set the "Windows in Foreground:" value to 100.
Set the "Windows in Background:" value to 50.
Set the "Minimum Timeslice (in msec):" value to 20.
Set the "Device Contention" for each of your COM ports to "Always Warn."
```

Run Control Panel-Ports-Settings for each of your COM ports. Verify that the settings for address and irq reflect your actual hardware situation. Make sure that you don't run any other foreground DOS applications that have their "Execution-Exclusive" parameter checkbox filled.

6. Due to file-sharing issues, if you want to be actively operating multiple Wizards AT THE SAME TIME

(for instance, start the Initialization procedure on one Wizard, the IMMEDIATELY do the same thing on another copy of Wizard), you MAY have to install multiple copies of the Wizard software in separate directories. Normally, you will not have to do this.

7. To simultaneously display multiple Wizard graphics screens, you must:

Run Windows in one of its "standard" graphics modes, for example:
640x480x16 VGA mode
800x600x256 SuperVGA mode

Run each copy of Wizard in the same graphics mode as Windows, for example:
"Wizard /Plot:18" is 640x480x16 VGA mode
"Wizard /Plot:259" is 800x600x256 SuperVGA mode

8 Appendix - Software

8.1 Wizard

8.1.1 Upgrading Wizard

The following assumes an upgrade from Wizard 5.06 to 5.07, however, these same steps can be followed to upgrade from other Wizard versions as well.

Before installing the new version of Wizard to your hard drive, please take some time to either backup your data files in the Wizard\Dat\Raw subdirectory or move them to another directory. You could also rename your Wizard directory to save the older version of Wizard, preserving all your old data files and Wizard files until you are satisfied that the new version of Wizard is running properly.

To install the new Wizard program, place the disk in the A: drive, then type: *Install A: C:* [Enter]. This will create a Wizard subdirectory, if it does not already exist, and install all Wizard program files from the file Wizardsx.exe. If you want the files to be installed onto another path, enter the path name when requested. Use the following syntax to place Wizard onto a different path:

Install S: D:[path]

where: S: is the source floppy drive, usually A:

D: is the destination drive

[path] is the optional FULL directory path on D: (which must already exist.)

Example: *Install A: C:\Coastal\Program*

This installation would put all the Wizard files in the directory:

C:\Coastal\Program\Wizard

If you have both the old and the new versions of Wizard on different directories, copy all the parameter files from the old version PRM subdirectory to the new version PRM subdirectory.

Example: *Copy C:\WizOld\Prm*.Prm C:\WizNew\Prm*

where: WizOld is subdirectory of old Wizard

WizNew is subdirectory of new Wizard

If you installed the new version of Wizard onto the same directory as the old Wizard program, overwriting the old version, the parameter files are already in the PRM subdirectory. Any instrument that you want to upgrade should have a copy of its parameter file in the Wizard\Prm subdirectory. Verify that a parameter file does exist on that directory before attempting to upgrade an instrument. If so, continue with the instructions in Section 7.2 Reprogramming the Micro/Mini logger. If it does not exist, follow the next set of instructions before continuing.

Connect the instrument to the computer's serial port using the Micro/Mini interface cable. Run the new Wizard program as you normally would (Type *Wizard* [Enter]). Once the instrument responds, the program will request the instrument's attention, then load the settings from the instrument. It will then give you a message:

NOTE! you're running V5.07, but default.inp appears to be a V5.06 file

This verifies that the instrument is running with an older version of the software, and the computer is running a newer version.

[Hit any key to continue.]

Do you want to convert default.inp from V5.06 to V5.07 format? N

Press [Y] to do the conversion. This will also store the converted file to the Wizard\Prm subdirectory.

NOTICE! To avoid possible conflicts, reprogram the instrument with V5.07

This is just a reminder and this will be done in a few more steps.

[Hit any key to continue]

The Main Menu will appear. Select the **Quit** option and **Quit** to the operating system. To continue upgrade, follow the instructions in Section 7.2 Reprogramming the Micro/Mini Logger

8.1.2 Startup Parameters

The following is a list of parameters which may be used when starting up your Wizard program in order to modify its functions. When starting the Wizard program, simply add on these commands after the Wizard command. ☺ **This list of startup parameters can be viewed on your PC by entering Wizard /HELP.**

Example: Wizard /BAUD:2400 COM:2 /Q /MON

This starts Wizard with modifications that: sets the com port to 2400 baud, selects COM port 2, runs in quiet mode (no sound), and in monochrome display mode.

/BAUD:rate Use BAUD rate to set com port at startup. (1200 2400 9600 19200)
[default is 19200]

/CFG:file Specifies configuration file.

/COLor Run in COLor mode. [default is color]

/MONo Run in MONochrome mode.

/LCd Run in LCD mode.

/COM:port Specifies COM port being used. (0-4) [default is 1]

/ADR:adr Specifies address for COM port. (2e8-3f8) [default is 3f8]

/IRQ:irq Specifies interrupt. (3-15) [default is 4]

/DEMO:file DEMONstration mode.

/DETail Output tracking DETails.

/Help (or ?) Display this Help screen, then exit.

<u>/LOG</u>	Log processed data.
<u>/MODem</u>	Enable modem functions.
<u>/NOIsy</u>	The program will include sounds at prompts. [default is noisy]
<u>/Quiet</u>	The program will have no sounds at prompts.
<u>/NOConn</u>	The initial request for instrument's attention will be eliminated.
<u>/NOLimits</u>	There will be no sampling interval limits. (requires password)
<u>/NOSync</u>	The instrument will not sync up to the PC clock.
<u>/NOTemp</u>	The temperature gauge will not be displayed.
<u>/PASS:password</u>	Supply programming password.
<u>/PLOT:mode</u>	Graphics PLOT display mode.
<u>/PRM:file</u>	Specify instrument parameter file.
<u>/PROgram</u>	Runs the Wizard program in the Program and Calibrate mode.
<u>/UPGrade</u>	Runs the Wizard Auto-Upgrade mode.
<u>/Tabular</u>	Allow tabular data displays.
<u>/WAIT:minutes</u>	Wait (2-240) minutes for connection.
<u>/Yes</u>	Yes/No questions will default to Yes. [default is N]

8.2 PC Spec

PC Spec is a stand-alone program that performs a spectral analysis of the time series data created by Wizard. Output includes significant wave height; zero-crossing and peak period; zeroth, second, and fourth spectral moments; peakedness parameter; spectral width parameter; and 1-D spectra for 32 frequency bins. If the instrument is a MiniSpec, then PCSpec also provides the peak wave direction, and 2-D spectral information.

8.2.1 Theory

To derive the 1-D spectra, PCSpec uses a standard FFT. Before applying the FFT, the pressure time series is demeaned and a cosine taper is applied to the end points. After the FFT, the 1-D spectra is smoothed with a "box car" filter over 32 adjacent points with no overlap. The 1-D spectral energy is also compensated for water column attenuation using linear wave theory. More specifically, the 1-D spectra is calculated, then each of the discrete 1-D spectral values is multiplied by a transfer function, $T(f)$ where T is the lesser of the attenuation factors specified in the PCSpec.DAT file or the expression:

$$T = \cosh^2 kd / \cosh^2 k (d-z)$$

where k is the wave number of the discrete spectral value and z is the sensor depth. The user may also specify a cutoff frequency in the PCSpec.DAT file so that the transfer function is set to zero for frequencies greater than the cutoff frequency.

For the direction analysis, PCSpec uses a discrete spectral approach, except that the steady current is neglected. A directional spreading function is derived from the demeaned velocity time series. This function is multiplied by the 1-D spectra derived from the pressure time series to form the directional spectra.

8.2.2 Running PCSpec

Four files are needed to run PCSpec; PCSpec.BAT, PCSpec1.EXE, PCSpec2.EXE, and PCSpec.DAT. To execute PCSpec, simply type from the DOS prompt:

(ex: C:\) *PCSpec dddssss .nnn*

where *dddssss* is the burst output filename (day of the year and serial number)
nnn is the file number (001, 002...)

The PCSpec batch file invokes the two executable files. PCSpec1 reads the *dddssss .Bnnn* file(s) and: 1) does a unit conversion from pressure units to height of water, 2) calculates the 1-D spectra and associated moments and parameters and 3) stores the results in an intermediate file called *dddssss.Pnnn*. The latter is a temporary work file and is erased upon successful completion of PCSpec.BAT.

PCSpec2 reads *dddssss .Pnnn*, and outputs to the screen and the file *dddssss .Snnn*. If the number of direction bins specified in PCSpec.DAT is greater than zero then PCSpec2 also does a directional analysis and includes this in its output.

8.2.3 Input File

PCSpec reads initialization data from a file named PCSpec.DAT containing one line with six constants separated by commas. These constants are:

1. Maximum factor to use for compensation of water column attenuation.
2. Nominal distance from the sea floor to the pressure and current meter sensors (in meters).
For a MiniSpec/620, this is 1 m.
3. Frequency cut-off above which all spectral bins are set to zero.
4. Output type as explained below.
5. Number of direction bins. This should be greater than zero if using a MiniSpec, and zero for all other Micro/Mini instruments.
6. Constant to convert from units of psi to units of water depth. This constant should include the specific gravity of water, e.g. to get mks units in standard sea water, the constant is 0.72416 assuming a specific gravity of 1.03. Note that the PCSpec energy units will be m²s. The three output options are as follows:

"0" - Only summary statistics are printed, such as significant wave height, peak period, etc.

"1" - Summary statistics and the unidirectional discrete spectra are printed for 32 frequency bins. If the specified number of direction bins is greater than five, then the output also includes the directional spreading coefficients for each frequency bin. The coefficients can be used to generate the discrete direction spectra, $D(f,\theta)$, using equation 1.

"2" - Summary statistics and the entire discrete directional spectra are printed for specified number of direction bins and 32 frequency bins.

Equ. 1:
$$D(f,\theta) = \pi / 2 S(f) / C_5 (1 + 2 A \cos (\pi / 2 - \theta - \psi_1) + 2 B \cos (\pi - 2\theta - \psi_2))$$

where: $\psi_1 = \tan^{-1} (C_2 / C_1)$; $\psi_2 = \tan^{-1} (C_4 / C_3)$
 $A = \sqrt{(C_1^2 + C_2^2)}$; $B = \sqrt{(C_3^2 + C_4^2)}$
 and the C_i ($i = 1...5$) are given in the out put file for each frequency bin, $S(f)$ is the discrete 1-D spectra for frequency bin f , and θ is the compass heading.

8.2.4 Output File

The various abbreviations which appear in the PCSpec output file are as follows. M_n is the n th spectral moment, H_s is the significant wave height, T_z is the zero crossing period, T_p is the period of the peak in the spectra, "Peak dir" is the direction (degrees counter clockwise from north) of the peak in the spectra, "Peakedness" (q_p) is the spectral peakedness parameter, and "Spec width" (w) is the spectral width. All parameters are derived from the spectral results, not the time series. The length units are determined by the sixth constant in the PCSpec.DAT file. The time units are seconds. The terms are defined below.

$$\begin{aligned}
 M_n &= \int S(f) f^n df \\
 H_s &= 4 \sqrt{M_0} \\
 T_z &= \sqrt{(M_0 / M_2)} \\
 q_p &= 2 / M_0^2 \int S^2(f) f df \\
 w &= \sqrt{(1 - M_2^2 / (M_0 M_4))}
 \end{aligned}$$

The directional matrix shows the spectral energy, $S(f, \theta)$ for discrete values of f and θ . $S(f, \theta)$ has units of L^2 seconds where the length units are dictated by the sixth constant in the PCSpec.DAT. $S(f, \theta)$ has been divided by the factor listed at the bottom of the matrix (1×10^3).

8.3 Reporter

The Reporter program is a program for an IBM-PC or compatible computer which acquires data from a Micro/Mini instrument, displays the data, and optionally voices the information to an incoming caller. The program can communicate with the Micro/Mini instrument either serially by wire connection, or to a remote instrument by radio modem connection. The Reporter provides a monitoring function to display and report

9 Appendix - Hardware

9.1 Replacement of Pressure Sensors

Remove the swaglok fitting with the extension tube on the top of the top plate with a 9/16" wrench, and inspect inside the hole for any silt or sand that may be suspended in the silicon fluid. If the fluid is dirty, it will have to be replaced. This is covered in a later step.

Disconnect the wire leading to the pressure sensor from the white electronic enclosure. Using a 5/8" wrench on the larger fitting that is glued into the bottom of the top plate, and a 1/2" wrench on the nut of the pressure sensor, loosen the 1/2" nut in a clockwise direction but don't allow the 5/8" wrench to turn. Once loosened, turn the nut by hand until the sensor can be removed.

If the silicon fluid in the top plate / large fitting needs to be replaced, allow it to drain out, catching it with a paper towel. Once all the dirty fluid has drained out, (it could take several minutes) replace the fluid using the syringe provided. Because the fluid is so thick, it is usually easier to remove the needle from the syringe and fill from the bottom. (The cover of the electronic enclosure must be removed to do so.)

To install the sensor, allow a drop of silicon fluid to start to form at the bottom of the large fitting, and slowly mate the sensor to the fitting. Secure the nut using the two wrenches. Reconnect the wire from the white electronic enclosure.

Allow any air bubbles to vent up through the silicon fluid in the hole. This could take upwards of an hour or more if a lot of air got in during the mating of the pressure fittings. Meanwhile, check the top fitting and tube extension and, if dirty, clean it.

Make sure that the hole is filled to the top with silicon fluid, and that all air bubbles have vented up. With the clean fitting and tube extension assembly connected together, screw it into the hole. As it screws in, air and then silicon fluid will be pushed out through the top of the extension tube.

 **Be sure that all air bubbles have vented out before deployment.**

The calibration coefficients for the new sensor are provided in a new parameter file for that particular instrument. To install them in the instrument, first copy from the provided disk, the new parameter files to the Wizard\prm subdirectory. See: Section 7.3 Sending a New Parameter File.

9.2 Replacement of XSJ-7-BCR

1. Remove the old plug.
 2. Clean the threads in the top plate and apply a small amount of waterproof epoxy to those threads. Wrap the modular phone plug with tape to prevent epoxy from getting on it when inserted through the hole.
- ☒ **NOTE:** The epoxy will prevent the connector from accidental loosening up during usage, thereby preventing leakage into the instrument.
3. Thread new connector into the top plate and tighten. Do not over tighten, as the connector will crack. Remove tape from the modular phone plug. If epoxy gets on the modular plug, clean it off with isopropyl alcohol.
 4. Connect modular phone plug to in-line coupler.

10 Appendix - Reference

10.1 Standard Configurations

Coastal optimizes for commonly required field measurements. The table below illustrates our standard configurations. Please note:

- Additional memory or battery capacity is available.
- Optional sensors and sampling strategies are possible.
- Sample rates are fully programmable.

Micro Series These units are RAM recording, use standard precision sensors, have small length housings, and run on replaceable alkaline D-cell batteries.

Mini Series These high capacity RAM or hard disk recording units use primarily high precision sensors. Housing length is a function of required battery capacity.

<u>Name</u>	<u>Function</u>	<u>Sensor</u>	<u>Range</u>	<u>Accuracy</u>
<u>MicroAccl</u>	acceleration meter	EG&G ICS accelerometer	as required	1.0%
<u>MicroCTD</u>	conductivity temperature pressure	Falmouth Scientific C-T YSI thermistor Foxboro pressure	0->64 mmho/cm -5 to 35°C 30,50,100,250psia	.025 mmho/cm 0.1°C 0.1%
<u>MicroFlow</u>	current speed direction	Marsh-McBirney OEM 585 Aanderaa compass	+/- 300 cm/s 0-360 deg. M	2% cms 2°
<u>MicroGage</u>	groundwater level	Foxboro pressure sensor	30 psia	0.1%
<u>MicroLite</u>	turbidity	OBS-3 turbidometer	2000 NTU	2%
<u>MicroQual</u>	temperature DO	YSI thermistor UMS GmbH DO sensor	-5 to 35°C 0-100% saturation	0.1°C
<u>MicroRain</u>	rainfall gauge	EML tipping bucket	n/a	0.2 mm
<u>MicroTemp</u>	temperature	YSI thermistor	-5 to 35°C	0.1°C
<u>MicroTide</u>	tide gauge	Foxboro pressure sensor	30,50,100,250psia	0.1%
<u>MicroTilt</u>	horizontal tilt	Lucas AccuStar II	+/- 20°	0.2° typical
<u>MicroSpec</u>	current speed direction pressure (wave)	Marsh-McBirney OEM 585 Aanderaa compass Foxboro pressure sensor	+/- 300 cm/s 0-360 deg. M 30,50,100,250psia	2% cms 2° 0.1%
<u>MicroWave</u>	pressure (wave) temperature	Foxboro pressure sensor YSI thermistor	30,50 psia -5 to 35°C	0.1% 0.1°C
<u>MicroWind</u>	wind speed wind direction	RM Young wind sensor RM Young wind sensor	0-60 m/s 0-360°	2% of reading 5°
<u>MiniCTD</u>	conductivity temperature pressure	SeaBird conductivity SeaBird temperature Paroscientific pressure	0-70 mmho/cm -5-35°C 900 psia	.003 mmho/cm 0.004°C 0.015%
<u>MiniFlow</u>	current speed direction	Marsh-McBirney OEM 585 Aanderaa compass	+/- 300 cm/s 0-360 deg. M	2% cms 2°
<u>MiniSpec</u>	current speed direction pressure (wave)	Marsh-McBirney OEM 585 Aanderaa compass Paroscientific pressure	+/- 300 cm/s 0-360 deg. M 100, 200, 900 psia	2% cms 2° 0.015%
<u>MiniTide</u>	tide gauge	Paroscientific pressure	100, 200, 900 psia	0.015%
<u>MiniWave</u>	pressure (wave) temperature	Paroscientific pressure YSI thermistor	100, 200, 900 psia -5 to 35°C	0.015% 0.1°C

10.2 Special Configurations

10.2.1 Master/Slave

The Master/Slave clock option requires special software. Although the Master instrument uses the normal Wizard software, the Slave instrument which is scheduled from the master instrument clock requires modified software for the Micro/Mini instrument.

Accordingly, first install one copy of the Wizard software normally, using the supplied Wizard 5.07 disk. See: 3.1 Installing Wizard.

After the initial install, Wizard must be reinstalled to a separate directory, for example *Wizslave*. Then, copy the two files from the *Wizslave* subdirectory on the Wizard install disk to the *Wizslave* directory on your computer. These two files incorporate all differences between the Wizard and the *Wizslave* programs.

☒ **NOTE: The Wizslave version is only required when an instrument needs to be reprogrammed, i.e. only after power loss, or other malfunction, or if a Master instrument is to be converted into a Slave version. Instruments supplied for either Master or Slave operation are normally shipped in that configuration, and can have all other operations aside from reprogramming done using the conventional Wizard program.**

In Master/Slave operation, the Slave instruments require a Master clock signal to synchronize sampling. A clock pulse from the Master synchronizes the Slaved instrument clocks, and triggers the start of sampling. As a result, all instruments operating in a Master/Slave environment must be interconnected. All supplied instruments have a connector labeled MS, and another labeled COM. Connect the COM of the Master to the MS of the first Slave. Connect the COM of the first Slave to the MS of the second Slave. This pattern continues as more Slaves are added.

Since the Slave instruments have had their external console sense line disabled to prevent accidental triggering, special procedures for **I**nitializing and **R**eading the data are required.

For both **I**nitialization and **R**ead procedures, the Slaves will not respond until they get a clock signal from the Master node. Therefore, we suggest that the Master be **I**nitialized at least fifteen (15) minutes into the future, so that the Slaves can be **I**nitialized with the same starting time. It takes longer for a Slaved instrument to be **I**nitialized, because they require a clock trigger from the Master unit for each step of the procedure.

If a Slave does not respond within the default one (1) minute wake-up time, restart the Wizard program with the following startup parameter: *Wizard -wait:5*, which will allow five (5) minutes for a response. The example that follows is for a three (3) instrument system.

Initialize procedure:

- Disconnect the cable from the COM of the Master to the MS of Slave 1.
- Disconnect the cable from COM of Slave 1 to the MS of Slave 2.
- Initialize the Master.
- Connect the cable from the COM of the Master to the MS of Slave 1.
- Initialize the Slave 1.
- Connect the cable from the COM of the Slave 1 to the MS of Slave 2.
- Initialize the Slave 2.

Read procedure:

- **R**ead the data from Slave 2.
- Disconnect the cable from MS of Slave 2 to the COM of Slave 1.
- **R**ead the data from Slave 1.
- Disconnect the cable from MS of Slave 1 to the COM of Master.
- **R**ead the data from the Master.

10.2.2 Real Time

The MicroModem allows any Micro/Mini series instrument to be used as a remote real time logging instrument for distances of up to 20 miles (site specific). All of the functions of the Wizard program will operate as if the instrument is connected directly to the computer. There are some small procedural changes noted below which must be followed for proper operation of the instrument.

Setup:

The MicroModem is equipped with an adapter labeled *Radio Modem Receive End*. This is connected to the modem through its 9 pin serial port. A cable connects this modem adapter to a Micro/Mini interface adapter which is plugged into the serial port of the computer. A 9-volt transformer is supplied to power the radio modem. The transformer plugs into any AC wall outlet and then plugs into the input labeled *6-9V DC* on the radio modem. Use only the supplied transformer. Once the radio modem is supplied power, the red PWR light on the unit will light up.

Connect the YAGI directional antenna to the modem using the supplied cable.

The MicroModem is sent with an instrument cable that connects the Micro/Mini instrument to the MicroModem with the input labeled *sensor* on the MicroModem. The MicroModem is also equipped with an additional input labeled *external power* which is used to supply external power to both the MicroModem and the Micro/Mini instrument. Additionally, both the Micro/Mini instrument and the MicroModem have internal power, consisting of 9 'D' batteries, which powers both the instrumentation and the radio modem.

Connect the OMNI directional antenna to the modem using the attached antenna cable.

WIZARD Software:

Copy the supplied WIZ.BAT file to the directory which contains your Wizard program. Start Wizard using this batch file by typing: *Wiz* [enter]. This batch file will start the Wizard program with startup parameters that allow the radio modem connection to work correctly. For an explanation of any of these startup parameters, type: *Wizard -Help*.

Once the program has started, you will want to **Initialize** the Micro/Mini instrument to set the startup time and date and the sampling parameters of your choice. It may take a few minutes for the instrument to respond. The delay is caused by the power switching of the transmitting radio modem. The modem is turned on only after either an Average data set or a Burst data set of the Micro/Mini instrument occurs. If these data sets are infrequent or of a long duration, the wait could be long. Average data sets take up very little memory, so it might be wise, if the bursting data sets are far apart in time, to take a short average data set every 5 minutes or so.

Initialize and **Monitor** as described in Sections 3.3.4 and 3.3.5, respectively.

After deployment, **Read data** as described in Section 3.3.2.

After **Reading**, you should go back and **Initialize** the instrument again with a new starting time. This will make all of the memory available for new data. Be sure to **Monitor** the instrument after each time you **Initialize**.

The Wizard program is equipped with a built in Reporter mode which will start 1 hour after no action is performed in the program. Reporter will report, in a graphical mode, the latest average data set from the instrument. Burst data sets are not reported. This one hour delay may be decreased by changing the */REPORT:##* parameter in the WIZ.BAT file. Use a file editor to edit this file (MSDOS EDIT works fine).

A bulkhead adapter is supplied with this equipment. This will allow direct connections between the computer and the Micro/Mini instrument using the instrument cable. Disconnect the instrument cable from the MicroModem and attach the bulkhead adapter to the cable. The cable from the PC to the Radio modem should be disconnected at the modem end and then plugged into the open end of the bulkhead adapter.

11 Warranty

Solely for the benefit of the original buyer, Coastal Leasing, Inc. (Coastal) warrants the products of its manufacture to be free from defects in material and workmanship. Coastal will replace or repair free of charge, FOB its offices in Cambridge, Massachusetts or other location designated by Coastal, any part or parts returned to it (with the exception of the instrument housing, or any damage as a result of any failure of the housing) within one year of the initial shipment by Coastal, and which Coastal's examination shall show to have failed under normal use and service.

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