



Getting Started Guide

for the Ocean Sensor Systems

Wave Staff

Introduction: The Ocean Sensor Systems Wave Staff has been designed to provide a high-resolution measurement of liquid surface height at a data rate of up to 30Hz. Uses include the measurement of waves, wakes, tides, sinkage, lake levels, pond levels, tank levels, pool levels. Additionally, the programmable alarms/switches allow use for control applications. The Wave Staff is very robust with solid-state electronics sealed in a waterproof housing. The staff can be ordered in a variety of lengths and are interchangeable. Please see the data sheet available on our web site at www.oceansensorsystems.com for detailed information.

This manual is designed for the user who is unfamiliar with the details of RS232 communications and instrumentation science. In addition to the web site, please call 1-954-796-6583 for personal assistance by one of our application engineers. We at Ocean Sensor Systems are dedicated to making your use of our equipment as easy and rewarding as possible.

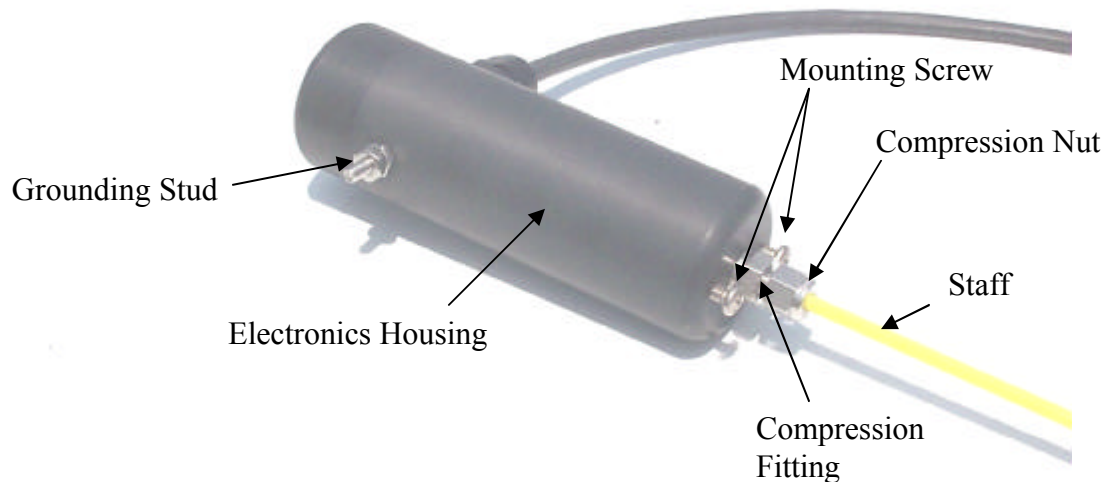


Figure 1. The parts of the Wave Staff.

Mounting: The physical mounting of the unit at the measurement site requires no special protection from spray, rain or sun though it should not be mounted underwater. The Wave Staff may be used in any fluid compatible with glass, PTFE, stainless steel, and ABS plastic. The unit is mounted with the electronics head on the top and the staff projecting down into the fluid. An optional tank mount is available that allows the unit to be screwed into a 1"NPT female receptacle. The output is a relative measurement of the

height of the air/fluid interface. Order a unit long enough to measure over the full vertical range of the surface without the electronics housing coming in contact with the fluid.

The base of the black housing has two 10-24 (3/4" deep) mounting holes on the bottom (see Figure 1). These may be used to mount the unit securely to either the optional mounting bracket or a user supplied mount. Additionally, the unit may be mounted with clamps around the body of the black electronics housing. The housing wall is over 0.25" thick but care must be exercised so as to not crush the housing and the electronics inside. The cable is a weather-proof neoprene jacketed cable. The cable should be rigidly secured and not be allowed to hang unsupported for distances greater than 24". The staff projects into the fluid and may require additional support for anything but small waves and short staffs. The supports should cover as little of the vertical section of the staff as they will create distortion in the measurements. The supports should hold the staff securely without crushing the yellow PTFE plastic cover. Specially designed supports are available from OSSl.

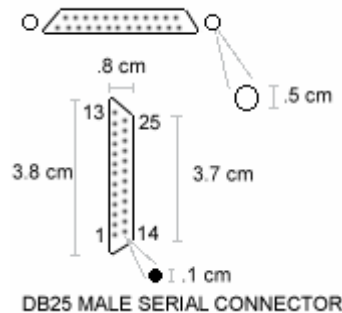
When mounting the Wave Staff, a level should be used to assure it is vertical. The yellow part of the staff should be mounted at least 4" away from any metallic or grounded surface. Accuracy can be greatly improved by performing an in-situ calibration on the unit after it is mounted.

Grounding: An electrical connection must be made from the ground stud on the side of the electronics housing to the fluid to be measured (see Figure 1). The support structure may be used for this purpose if it is conductive and extends into the fluid. Another simple solution is to take a length of solid copper wire (2 to 18 gauge) and strip the insulation back one foot to create a good surface area for contact with the fluid. The other end of the wire is then stripped and looped around the stud on the electrical housing of the Wave Staff. The nut is then tightened against the wire to hold it securely. The grounding wire should be held securely along its length to prevent it from coming within 4" of the staff.

Power Requirements: The power supply requirement for the Wave Staff is very flexible requiring 5.5 to 40 volts dc. A simple solution is to connect a 9volt transistor radio battery to the unit with a single battery providing enough power for several days of operation. It is important to exercise caution when working with electricity around water. It is recommended that the supply voltage be kept below 16 volts to reduce the electrical hazard. Any connections to 110volts AC must be ground fault protected. The red and black wires from the wave staff are connected to the positive and negative of the power supply respectively.

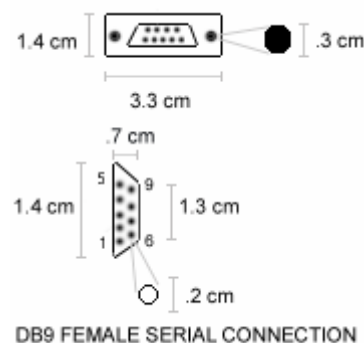
Serial Communications: The Ocean Sensor Systems Wave Staff is an intelligent device and allows for data exchange and reconfiguration through RS232 communications to a computer. There are two commonly used types of RS232 ports on computers: the DB9 and the DB25 where the number refers to the number of pins. Only three conductors are needed to connect to the computer; transmit, receive and ground.

RS232 Connections, and wiring up serial devices



RS232 Pin Assignments (DB25 PC signal set) To Wave Staff cable	
Pin 1	Protective Ground
Pin 2	Transmit Data ----- Green
Pin 3	Received Data ----- Orange
Pin 4	Request To Send
Pin 5	Clear To Send
Pin 6	Data Set Ready
Pin 7	Signal Ground ----- Black
Pin 8	Received Line Signal Detector (Data Carrier Detect)
Pin 20	Data Terminal Ready
Pin 22	Ring Indicator

The connector on the PC has male pins, therefore the mating cable needs to terminate in a DB25/F (Female pin) connector.



RS232 Pin Assignments (DB9 PC signal set) To Wave Staff cable	
Pin 1	Received Line Signal Detector (Data Carrier Detect)
Pin 2	Received Data -----Orange
Pin 3	Transmit Data -----Green
Pin 4	Data Terminal Ready
Pin 5	Signal Ground -----Black
Pin 6	Data Set Ready
Pin 7	Request To Send
Pin 8	Clear To Send
Pin 9	Ring Indicator

The connector on the PC has male pins, therefore the mating cable needs to terminate in a DB9/F (Female pin) connector.

Once the Wave Staff is connected to the computer, open the Hyperterminal Program in the accessories programs of your PC. Configure the baud rate to 9600 with no flow control. Next, power up the Wave Staff and you should see either one or three dots appear in the Hypertext window. If one dot appears, the unit is programmed to operate in sync mode. If three dots appear, the unit is programmed to run in free-run mode and within 4 seconds, data will begin to stream to the window (please see the data sheet for more information on modes of operation).

Analog Output: If analog output is preferred, the unit should be configured with the analog output on and the RS232 communications off. Turning off the RS232 communications improves the signal to noise ratio dramatically in the analog signal. Configuration of the Wave Staff can be accomplished using the interface software described below.

Maintenance: The Ocean Sensor Systems Wave Staff should require no maintenance other than wiping any slime buildup off of the yellow PTFE staff. The PTFE offers a very slippery surface and any attached material will be easily removed. The only other maintenance is to check the electrical connections for corrosion.

Replacing the staff: The staff may be separated from the electronics housing. This feature allows for replacement of the staff should it become damaged and also allows for different length wave staffs to be used for different applications. Replacement staffs in a variety of lengths are available from Ocean Sensor Systems. The staff is held to the electrical housing by a stainless steel compression fitting. To remove the staff, use a ½” wrench to loosen and slide the compression nut down the staff (see Figure 1). The staff may then be unscrewed (CCW) from the housing. The staff should only be screwed into and removed from the housing hand tight. Do not use any tools to clamp onto the staff as this will damage the soft Teflon cover.

A new staff may be installed by screwing the staff into the housing hand tight (about 4 to 6 turns). The compression nut is then slide up to the furrel and screwed onto the compression fitting. Using a 1/2" wrench, tighten the nut snug (about 20 to 30 inch-pounds of torque).

Wave Staff Interface Board: Ocean Sensor systems has available an interface board that simplifies powering and communicating with the Wave Staff. This small highly integrated module has connections for communications to a PC, a 9volt battery receptacle and connections/LEDs for monitoring the alarm and analog outputs. This board is highly recommended for those unfamiliar with electronics or interfacing to an RS232 port.

Data Analysis: The output of the Wave Staff is the actual level of the surface of the liquid being measured in *count* units. Counts can be converted to millimeters with the simple formula: $\text{counts} * (\text{staff length in millimeters}) / 4096$. If this is the surface of an open body of water, the significant wave height may be estimated with $4 * (\text{standard deviation})$. It is usually more convenient to sample the Wave Staff in free run mode and log the data for subsequent analysis. If a lower sample rate than 10Hz is required, simply discard the redundant information. When using an array of Wave Staffs to determine phase information about the surface being measured, SYNC mode is preferred. If the phase speed is of the order of several seconds, free run sampling at 30Hz will result in negligible delay error.

The internal temperature and optional external temperature are given in units $2 * \text{Celcius}$ so the actual temperature is found by dividing by 2.

Default Configuration: The Wave Staff is shipped with the following configuration. Alternative configurations may be requested by the customer.

- Free run
- Enabled internal temperature
- Disabled external temperature
- Disabled analog output
- 9600 baud
- ASCII output
- RS232 enabled
- 10Hz sample rate
- Alarms disabled
- Calibrated 0-4095 output

Software Interface: A beta release of the Wave Staff interface software is available from Ocean Sensor Systems. This software contains all of the features necessary to calibrate, configure and display data. It will run on most Windows based machines. If the



software does not start on your windows based computer, please call tech support at 1-954-796-6583 for assistance. An outline of the basic steps required to display and log data are given below.

With the Wave Staff connected to the computer through the RS232 port, start the Wave Staff Interface software. Choose the correct baud rate (usually 9600) and comm port (usually com 1 or 2). Turn on the Wave Staff and left click on the button labeled *DISPLAY*.



If communications failed one of four possibilities has occurred

1. The Wave Staff is not connected properly to the RS232 port. Review the discussion above and check the connection.
2. The Wave Staff is not powered within 5 seconds after clicking on the 'display' button. Try powering up the unit after clicking the display button.
3. The Wave Staff is connected to a different RS232 port than the one selected. Check to see which port it is connected to and select the correct port.
4. The baud rate is incorrect. There are only two possibilities, 9600 or 19200.

Cycle Power on the Wave Staff Please



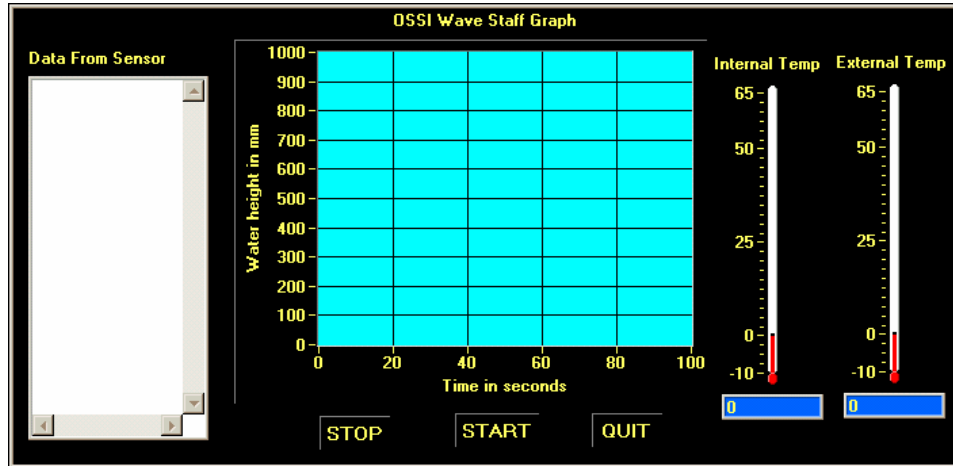
If no communications error is detected, you will be asked to cycle the power. This will reprogram the Wave Staff. Cycle power by turning off the power to the Wave Staff, waiting 3 seconds, and then turning the power back on. A window will appear allowing you to select appropriate parameters for displaying the data. Do not select the external temperature if an external temperature sensor is not connected.

If you wish to log the data, select the Log Data to File button BEFORE

displaying the data. You will be prompted to name a file for the data. Be sure to select the correct staff length in millimeters and the desired data rate. For most situations, 10Hz is more than adequate. When all of the parameters are set as desired, press the 'GO' button. You will be prompted to cycle the power to the wave staff. Do this by turning off the power, waiting 3 seconds and then turning the power back on. If you get a communications error message you must begin over again by selecting the baud rate and port number. If the Wave Staff is successfully reprogrammed, the graphic display will appear. Press the start button to begin displaying and logging data. The data may be paused by pressing the stop button or you may return to the previous window by selecting the quit button. Once you press the quit button, you will need to select another file in

order to resume logging data. There will be a 5 second pause before the parameter selection window will respond while the Wave Staff is reprogrammed.

In the data display window, the data is presented both graphically and as text as it is received from the Wave Staff. If the 'Log Data To File' was selected in the previous window, the data will also be logged to the previously selected file.



Configuration of the Wave Staff: The interface software may also be used to configure and calibrate the Wave Staff. Begin the process as described in the previous section, select either the Calibration or the Configure button and follow the prompts.

Instrument Accuracy: The Wave Staff is accurate to 1% of full scale. If greater accuracy is desired, the unit may be calibrated in-situ and the data may be post-processed with a 3rd order curve fit. Both techniques are for the advanced user and will result in better than 0.1% accuracy over the full range of the unit.