Ocean Sensor Systems, Inc.
Sonic Wave Sensor XB, OSSI-010-035
A Wireless Ultrasonic Wave Sensor
With Synchronized Sampling

General Description

The OSSI010-035 Sonic Wave Sensor XB is a water level sensor that combines a rugged, IP67 resistant to water submersion package, Xbee RF Module, low power microprocessor and Anti-aliasing sensing circuit. It will provide months of operation with two industry standard C size alkaline batteries. Sonic Wave Sensor XB has a range of 2.5 meters. See Sheet 2 Wave Performance for limitations. Laptops and PCs can easily receive the Sonic Wave Sensor XB's data with any one of several optional Wireless Adaptors. Time stamped data can be used to synchronize up to 8 Sonic Wave Sensor XBs or Wave Staff XBs. A new, easy to use, PC Staff Product Interface Program is available to down load from our web site to configure, display, analyze and store the sensor data.

New: Lithium Battery option increased service life by 2.4 times. 0ption –L Tadiran Model TL5920

Features

- **Wireless connectivity: XBee/XBee-Pro Modules, ZigBee Personal Area Network (PAN)**
- **GateWay : USB to Com Port**
- **Up to 8 Sonic Wave Sensor XB's per PAN Network**
- **Measure Submillimeter Waves.**
- **Powered with 2 C size batteries, Alkaline or Rechargeable Nickel Metal Hydride**
- **Months of Battery Life**
- **Automatic Anti-aliasing filter**
- **Sample Rates: 1, 2, 4, 8, 16 & 32**
- **Continuous Sampling or Burst Mode**
- **Data output Continuous or Buffered**
- **Data format: ASCII, Binary Float or Binary Integer**
- **Configurable Start Time**
- **Time Tagged Data**
- **Real Time Clock Auto Synchronizing feature**
- **Battery Voltage Monitor**
- **0.25% FS Accuracy 0-100% range**
- **Optional 0.1% FS Accuracy 0-100% range**
- **Automatic Calibration**

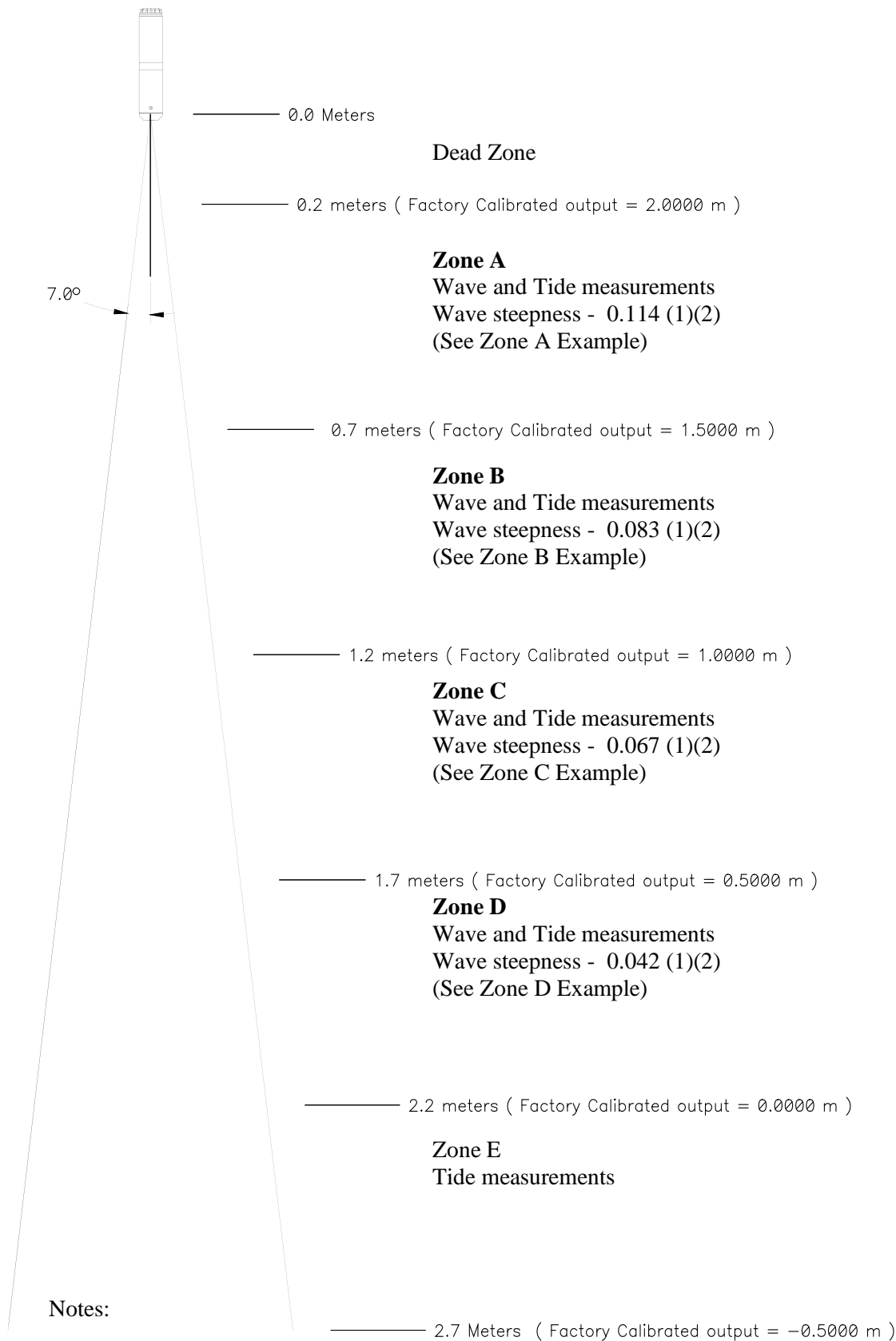Sonic Wave Sensor   PC's Staff Product Interface Program

- - - - - - - Wireless - - - - - - - >
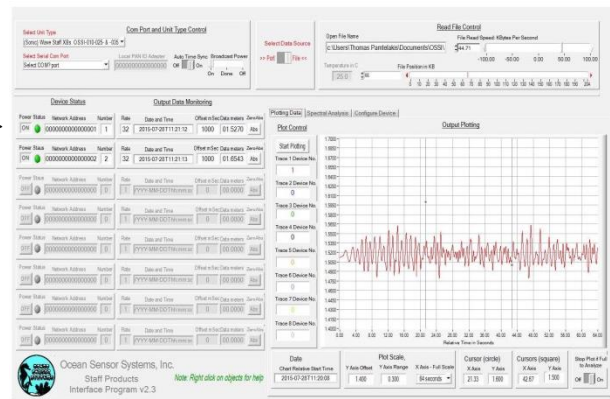
Wave Performance:

The Range chart below is divided into 5 arbitrary zones for convenience. The performance is a gradual change over the full range.

—————— 0.0 Meters

Dead Zone

—————— 0.2 meters (Factory Calibrated output = 2.0000 m)

7.0°

Zone A
Wave and Tide measurements
Wave steepness - 0.114 (1)(2)
(See Zone A Example)

—————— 0.7 meters (Factory Calibrated output = 1.5000 m)

Zone B
Wave and Tide measurements
Wave steepness - 0.083 (1)(2)
(See Zone B Example)

—————— 1.2 meters (Factory Calibrated output = 1.0000 m)

Zone C
Wave and Tide measurements
Wave steepness - 0.067 (1)(2)
(See Zone C Example)

—————— 1.7 meters (Factory Calibrated output = 0.5000 m)

Zone D
Wave and Tide measurements
Wave steepness - 0.042 (1)(2)
(See Zone D Example)

—————— 2.2 meters (Factory Calibrated output = 0.0000 m)

Zone E
Tide measurements

Notes:

—————— 2.7 Meters (Factory Calibrated output = −0.5000 m)

(1) Wave Steepness is the ratio of wave height divided by wave length (= H/L).

(2) Wave steepness greater than the listed value per zone will cause some lost samples during the steepest portion of the wave.   During this time the Sonic Wave Sensor will report the last valid value until the next valid sample is read.
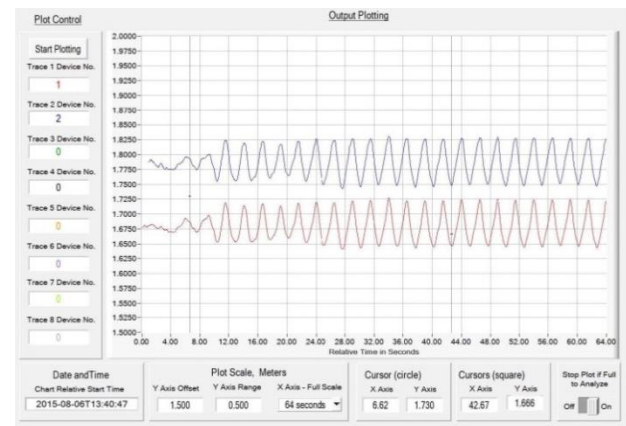
Zone A - Example: (zoom in to view details)

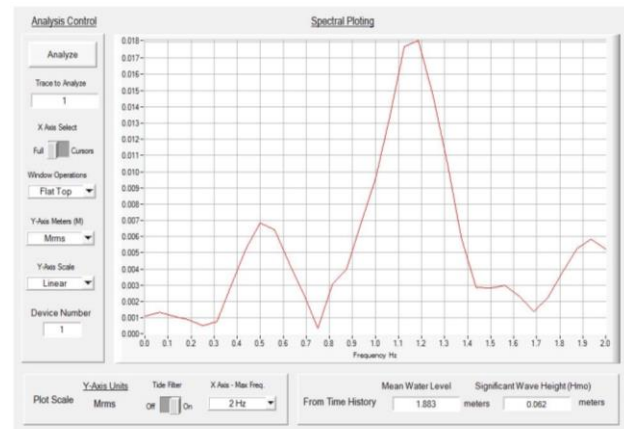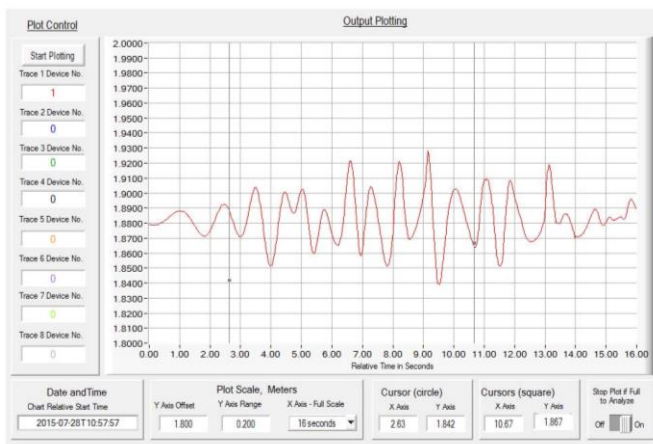Zone A: Fast Submillimeter wave measurements. Sonic
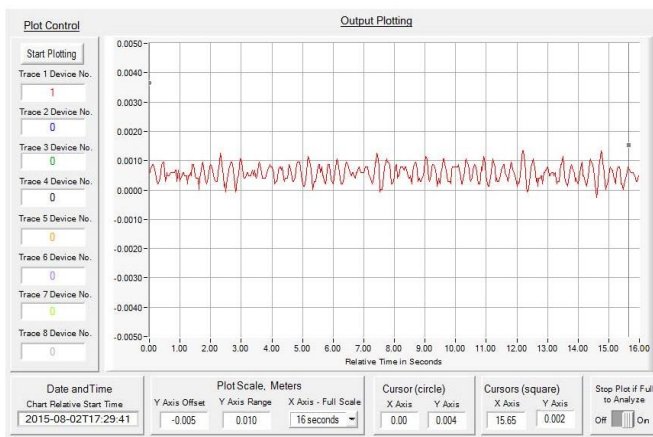
Zone A: Fresh Water Wave Tank, Red is the

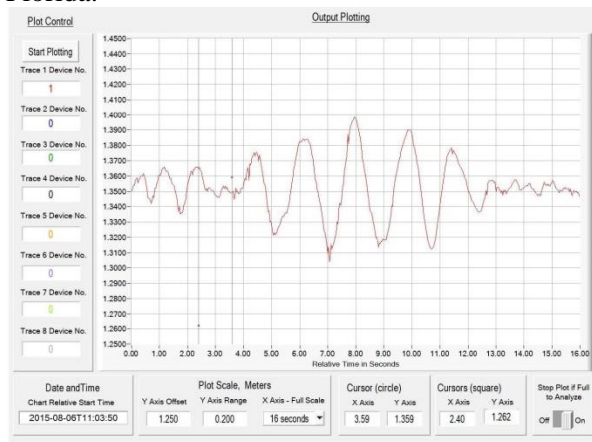Wave Sensor XB and Blue is a Wave Staff XB with a 2 meter cable Staff.

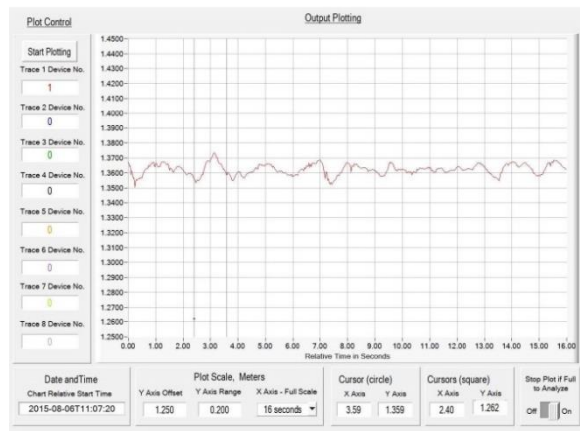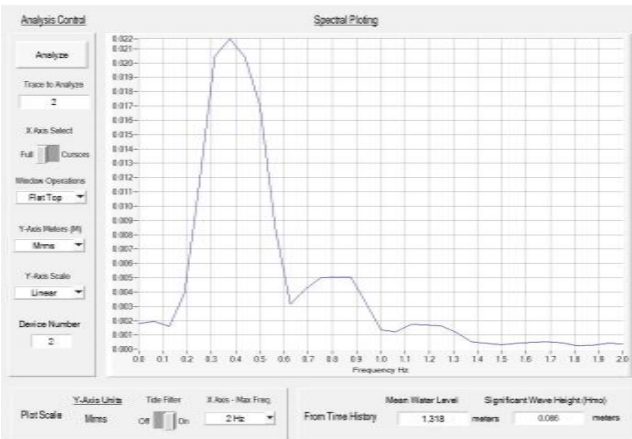Zone A: Pool waves with high wave steepness

Zone B - Example:

Zone B: Boat Wake on Intracoastal at Dania Beach Beach Florida.

Zone B: Small waves on Intracoastal at Dania Florida.

Zone B: Fresh Water Wave Tank, Red is the Sonic Wave Sensor XB and Blue is a Wave Staff XB with a 2 meter cable Staff.

Zone B: Pool Waves with high wave steepness
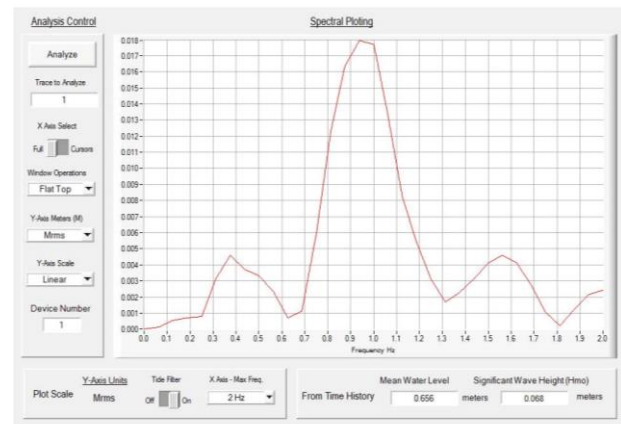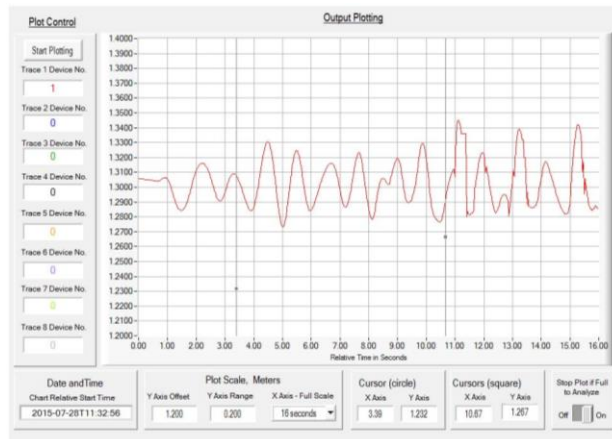
Zone C - Example:

Zone C: Fresh Water Wave Tank, Red is the Sonic
Wave Sensor XB and Blue is a Wave Staff XB with a
2 meter cable Staff.

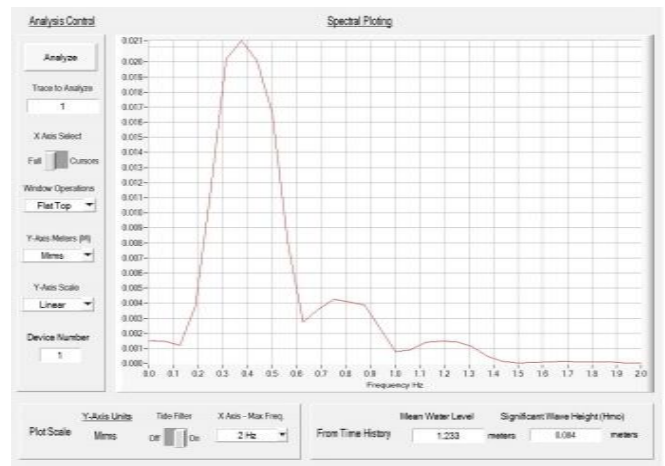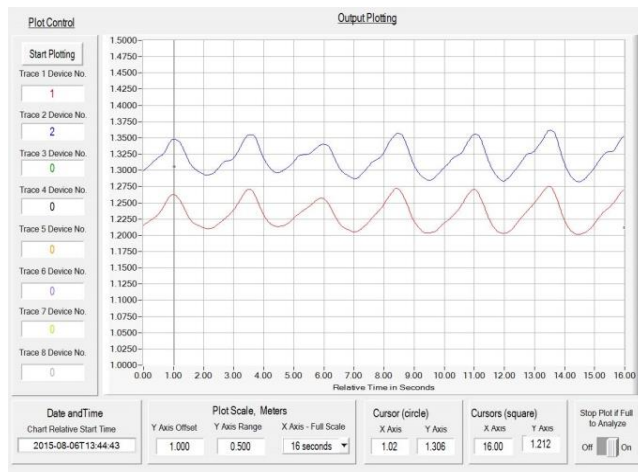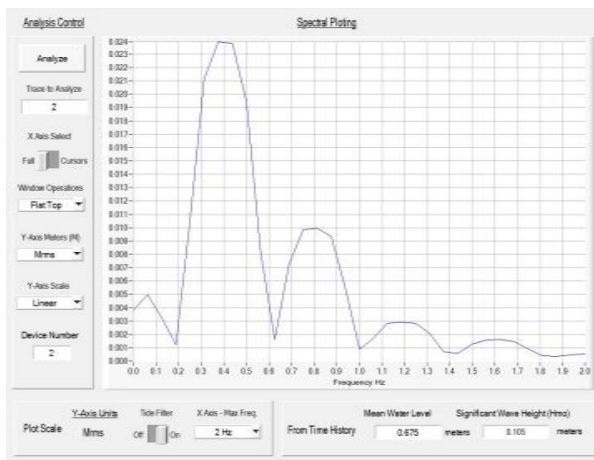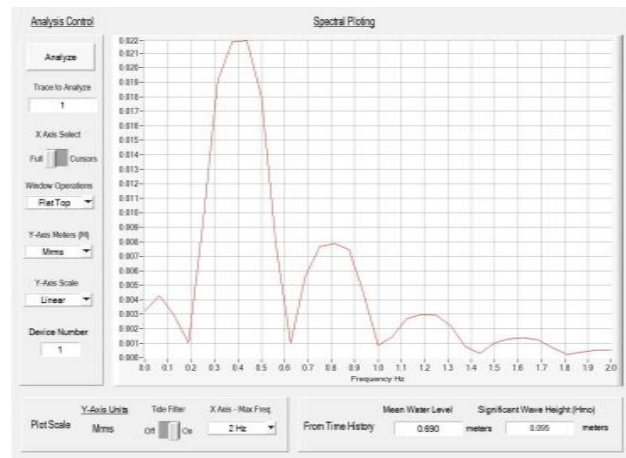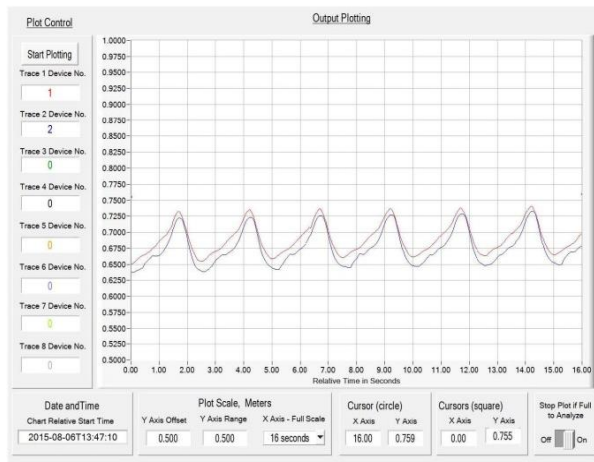Zone C: Pool Waves with high wave steepness
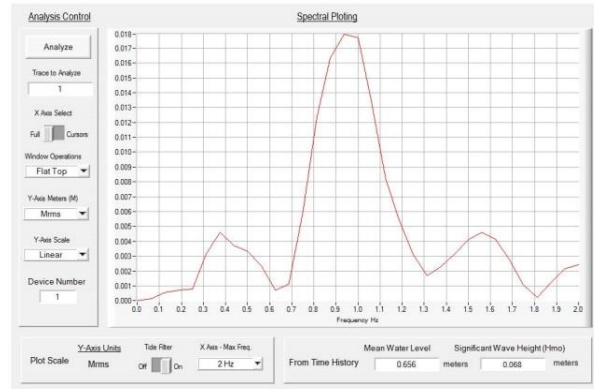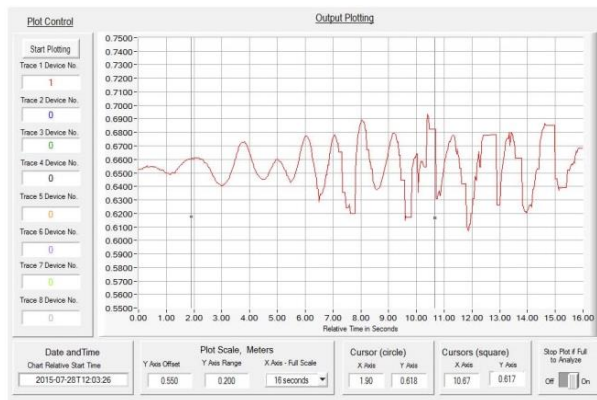
Zone D - Example:
Zone D: Pool Waves with high wave steepness
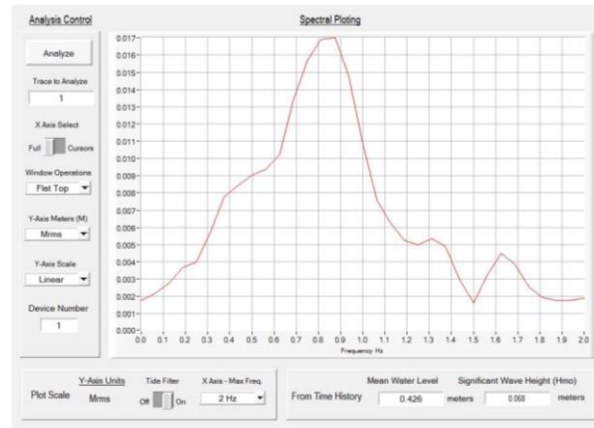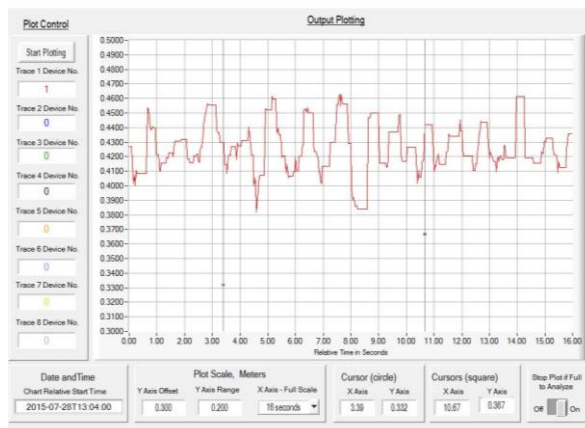
Sonic Wave Sensor XB OSSI-010-035 Adapters

Two Standard
C Size Batteries

1.706" Diameter

Clamp Location
1.66" Diameter

0.520

8.080

3.650
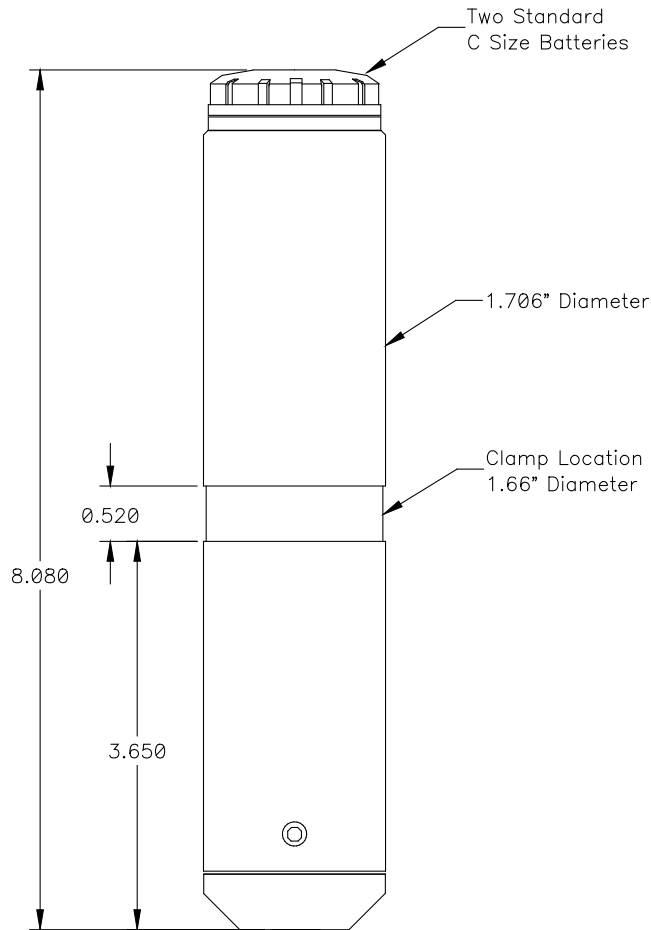
Mounting Bracket #015-018-B

Wireless Computer

XStick USB Adapter XU-Z11
OSSI-581-016

XBee to USB Adapter, Waterproof, IP67 with 5-meter-long cable.
OSSI-015-020 Pro for North America
OSSI-015-021 for International

XBee RS232 Adapter XA-Z14-CS2PH
OSSI-581-020-A Pro for North America
OSSI-581-020-W Pro for International

Sonic Wave Sensor XB Part Numbers

Product	Product
Sonic Wave Sensor XB	OSSI-010-035
Sonic Wave Sensor XB-Pro	OSSI-010-035P

Add suffix E to the part number for 0.10% FS Factory Calibration Accuracy. Example: OSSI-010-035P-E
Add suffix L for Lithium Battery option. Example: OSSI-010-035P-L

Adapter Part Numbers

GateWay Products:	Certified Region	DiGi International	OSSI Part Number
XStick USB	US,CA,EU	XU-Z11	OSSI-581-016
XStick USB for Japan	JP	XU-Z11J	OSSI-581-016-J
XBee to USB adapter, Waterproof, 5 meter cable	International	OSSI	OSSI-015-021
XBee to USB adapter, Waterproof, 5-meter cable	North America	OSSI	OSSI-015-020
XBee ZB RS323 adapter, internal wire antenna	International	XA-Z14-CS2PH-W	OSSI-581-020-W
XBee ZB-PRO RS232 adapter, internal wire antenna	North America	XA-Z14-CE1P-A	OSSI-581-020-A

Wireless Connectivity Table:

Sonic Wave Sensor XB & Wave Staff XB Products:	Certified Region	Frequency	RF Line of Sight Range	Indoor/Urban Range
Sonic Wave Sensor XB	US, CA, EU, AU, BR, JP	2.4GHz	4000 ft. (1.2 Km)	200 ft. (60 m)
Sonic Wave Sensor XB-Pro	US, CA, AU, BR	2.4GHz	2 miles (3.2 Km)	300 ft. (90 m)
GateWay Products:	**Certified Region**	**Frequency**	**RF Line of Sight Range**	**Indoor/Urban Range**
XStick USB	US, CA, EU, JP	2.4GHz	164 ft. (50 m)	66 ft. (20 m)
XBee to USB adapter, OSSI-015-021	US, CA, EU, AU, BR, JP	2.4GHz	4000 ft. (1.2 Km)	200 ft. (60 m)
XBee ZB-PRO USB adapter, OSSI-015-020	US, CA, AU, BR	2.4GHz	2 miles (3.2 Km)	300 ft. (90 m)
XBee-PRO ZB RS232 adapter, internal wire antenna	US, CA, AU, BR	2.4GHz	2 miles (3.2 Km)	300 ft. (90 m)

Note: The Sonic Wave Sensor range is based on a Gateway Adapter having the same or greater rated range. For example, a Digi XSick would limit the range to its lower rated range.

Characteristics:

Parameter	Conditions	Min.	Typ.	Max.	Units
Alkaline Battery Voltage, Total for Two C size cells	2V = Battery Low Warning 1.8V = Battery Bad	1.8	3.0	3.3	Volts
Lithium Battery option - L Two C size Tadiran Model TL5920	4.7V = Battery Low Warning 4.2V = Battery Bad	4.2	7.2	10	volts
Battery Life	See Days of battery Life Tables				days
Data Accuracy	0-100% of Full Scale (1) (6)		0.15	0.25	±% (2)
Data Accuracy, suffix E	0-100% of Full Scale (1) (6)		0.05	0.10	±% (2)
Data Resolution	ASCII 32 Samples (4)		1		mm
	Float 32 Samples (5)		0.1		mm
	Integer 64 Samples (5)		1		mm
	ACCII 1 sample (4)		1		mm
Adjustable Data Range	ASCII 32 Samples (4)	0		99.999	meters
	Float 32 Samples (5)	-99.9999		+99.9999	meters
	Integer 64 Samples (5)	-30		+30	meters
	ACCII 1 sample (4)	0		99.999	meters
Data Linearity			0.15	0.25	± % (2)
Data Linearity, suffix E			0.05	0.10	± % (2)
Data Hysteresis		0.0	0.0	0.0	mm
Sample Frequency		1		32	Hz
Wireless Connection	XBee ZB or XBee-PRO ZB		2.4		GHz
Wireless Range	See Wireless Connectivity Table				
Sample Burst Time	Programmable	0		59	minutes
Sample Burst Interval	Programmable	1		60	minutes
Real Time Clock Accuracy	Typical at 25°C		10		PPM (3)
Auto Time Synchronize	Synchronize Time to PC's Clock		0.01		Seconds

Note 1: The unit may need to be calibrated in-situ to meet the Data Accuracy.
Note 2: Percent of Full Scale
Note 3: parts per million
Note 4: Buffered or Continuous output mode.
Note 5: Buffered output mode only
Note 6: Accuracy at 25°C Air temperature. Internal temperature sensor compensates for air temperature changes.
Note 7: Factory set at Float 32 Samples form 2.00 meters to -0.5 meters. Data range may be changed with in-situ calibration per the Min – Max limits.

Maximum Number of operating units on the same Personal Area Network (PAN) versus Sample Rate and Data Format:

Data Format Output Transmit Mode	Sample Rate Hz					
	1 Hz	2 Hz	4 Hz	8 Hz	16 Hz	32 Hz
ASCII 32 Samples (Buffered)	8	8	8	8	6	3
Float 32 Samples (Buffered)	8	8	8	8	8	4
Integer 64 Samples (Buffered)	8	8	8	8	8	8
ASCII 1 Sample	8	4	2	1	0	0

Days of Battery Life:
Sonic Wave Sensor XB-Pro with Filter Off

Output Transmit Mode	Sample Rate Hz	Battery Life in Days per Burst duty cycle, Length/Interval (1)				
		Continuous 100%	40% Burst	20% Burst	10% Burst	5% Burst
Continuous, ASCII 1	1	28.1	59.4	94.5	134.1	169.5
Continuous, ASCII 1	2	21.2	46.6	77.5	116.0	154.3
Continuous, ASCII 1	4	15.4	34.9	60.6	96.0	135.6
Continuous, ASCII 1	8	12.1	28.0	50.0	82.1	121.1
Buffered, ASCII 32	1	42.4	83.1	122.1	159.6	188.6
Buffered, ASCII 32	2	38.0	76.2	114.6	153.0	184.0
Buffered, ASCII 32	4	36.5	73.8	111.8	150.5	182.1
Buffered, ASCII 32	8	31.2	64.9	101.3	140.7	174.8
Buffered, ASCII 32	16	22.5	49.0	80.9	119.7	157.6
Buffered, ASCII 32	32	15.2	34.7	60.2	95.5	135.1
Buffered Binary, Float 32	1	42.9	83.9	123.0	160.4	189.2
Buffered Binary, Float 32	2	41.0	80.9	119.8	157.6	187.2
Buffered Binary, Float 32	4	37.6	75.6	113.8	152.4	183.5
Buffered Binary, Float 32	8	32.4	66.9	103.7	143.1	176.5
Buffered Binary, Float 32	16	23.8	51.5	84.2	123.3	160.7
Buffered Binary, Float 32	32	17.0	38.3	65.6	102.2	141.6
Buffered Binary, Integer 64	1	42.9	83.9	123.0	160.4	189.2
Buffered Binary, Integer 64	2	41.4	81.6	120.5	158.3	187.7
Buffered Binary, Integer 64	4	39.2	78.1	116.7	155.0	185.3
Buffered Binary, Integer 64	8	35.1	71.5	109.1	148.1	180.3
Buffered Binary, Integer 64	16	27.7	58.7	93.6	133.1	168.8
Buffered Binary, Integer 64	32	19.4	43.1	72.6	110.4	149.3

Note 1: Battery Life for two Standard C cell Batteries 22400 mWHr - (2 ea. Energizer EN93 8000 mAh)
Note 2: Battery life when Powered off or Burst sleep period is 230.5 Days
Note 3: The Lithium Battery Option –L increases the battery life by 2.4 times. (2 each Tadiran Model TL5920 8500 mAh at 3.6V)

Note 4: Lithium Battery option: The Staff & Sonic products Interface Programs displayed battery voltage correction. The Lithium Batteries voltage is 2.33 times the indicated value. Dark Green/Light Green is 100% to 5% Service life remaining and Yellow/Orange/Red is 5% to 0% Service life remaining. Service life remaining should be based on usage.

Days of Battery Life:
Sonic Wave Sensor XB with Filter Off

Output Transmit Mode	Sample Rate Hz	Battery Life in Days per Burst duty cycle, Length/Interval (1)				
		Continuous 100%	40% Burst	20% Burst	10% Burst	5% Burst
Continuous, ASCII 1	1	30.5	64.3	102.1	144.5	182.4
Continuous, ASCII 1	2	23.2	50.8	84.3	125.7	166.6
Continuous, ASCII 1	4	17.1	38.8	67.0	105.4	147.8
Continuous, ASCII 1	8	14.2	32.8	57.8	93.8	136.0
Buffered, ASCII 32	1	45.0	88.3	130.1	170.5	201.8
Buffered, ASCII 32	2	40.5	81.3	122.4	163.7	197.0
Buffered, ASCII 32	4	39.5	79.7	120.6	162.1	195.8
Buffered, ASCII 32	8	34.7	71.6	111.1	153.3	189.2
Buffered, ASCII 32	16	25.1	54.4	89.2	131.1	171.3
Buffered, ASCII 32	32	17.1	38.7	66.9	105.3	147.7
Buffered Binary, Float 32	1	46.4	90.5	132.5	172.5	203.2
Buffered Binary, Float 32	2	44.1	86.9	128.6	169.2	200.9
Buffered Binary, Float 32	4	40.6	81.5	122.5	163.9	197.1
Buffered Binary, Float 32	8	34.9	72.0	111.5	153.7	189.5
Buffered Binary, Float 32	16	26.0	56.1	91.5	133.6	173.4
Buffered Binary, Float 32	32	18.7	42.1	71.9	111.4	153.6
Buffered Binary, Integer 64	1	46.6	90.8	132.8	172.8	203.4
Buffered Binary, Integer 64	2	44.6	87.7	129.5	170.0	201.4
Buffered Binary, Integer 64	4	42.0	83.7	125.1	166.1	198.7
Buffered Binary, Integer 64	8	37.7	76.6	117.0	158.9	193.4
Buffered Binary, Integer 64	16	29.4	62.3	99.6	142.0	180.4
Buffered Binary, Integer 64	32	20.7	45.9	77.4	117.9	159.7

Note 1: Battery Life for two Standard C cell Batteries 22400 mWHr - (2 ea. Energizer EN93 8000 mAh)
Note 2: Battery life when Powered off or Burst sleep period is 230.5 Days
Note 3: The Lithium Battery Option –L increases the battery life by 2.4 times. (2 each Tadiran Model TL5920 8500 mAh at 3.6V)
Note 4: Lithium Battery option: The Staff & Sonic products Interface Programs displayed battery voltage correction. The Lithium Batteries voltage is 2.33 times the indicated value. Dark Green/Light Green is 100% to 5% Service life remaining and Yellow/Orange/Red is 5% to 0% Service life remaining. Service life remaining should be based on usage.

Days of Battery Life:

Sonic Wave Sensor XB-Pro with Filter On

Output Transmit Mode	Sample Rate Hz	Battery Life in Days per Burst duty cycle, Length/Interval (1)				
		Continuous 100%	40% Burst	20% Burst	10% Burst	5% Burst
Continuous, ASCII 1	1	12.9	29.8	52.8	85.9	125.2
Continuous, ASCII 1	2	11.6	26.9	48.1	79.6	118.4
Continuous, ASCII 1	4	9.5	22.4	40.8	69.3	106.6
Continuous, ASCII 1	8	8.4	19.9	36.6	63.1	99.1
Buffered, ASCII 32	1	15.8	35.7	61.9	97.6	137.1
Buffered, ASCII 32	2	15.4	35.0	60.8	96.3	135.8
Buffered, ASCII 32	4	15.0	34.2	59.6	94.7	134.3
Buffered, ASCII 32	8	14.5	33.0	57.8	92.4	131.9
Buffered, ASCII 32	16	13.4	30.7	54.2	87.8	127.2
Buffered, ASCII 32	32	11.5	26.8	48.0	79.5	118.2
Buffered Binary, Float 32	1	15.6	35.5	61.5	97.0	136.6
Buffered Binary, Float 32	2	15.3	34.8	60.5	95.9	135.4
Buffered Binary, Float 32	4	15.1	34.4	59.9	95.0	134.6
Buffered Binary, Float 32	8	14.5	33.0	57.8	92.4	132.0
Buffered Binary, Float 32	16	13.8	31.6	55.5	89.5	128.9
Buffered Binary, Float 32	32	12.6	29.1	51.6	84.4	123.5
Buffered Binary, Integer 64	1	15.5	35.2	61.1	96.5	136.1
Buffered Binary, Integer 64	2	15.8	35.7	61.9	97.5	137.1
Buffered Binary, Integer 64	4	15.6	35.4	61.4	96.9	136.5
Buffered Binary, Integer 64	8	15.2	34.5	60.1	95.3	134.8
Buffered Binary, Integer 64	16	14.8	33.8	58.9	93.9	133.4
Buffered Binary, Integer 64	32	13.7	31.4	55.2	89.1	128.5

Note 1: Battery Life for two Standard C cell Batteries 22400 mWHr - (2 ea. Energizer EN93 8000 mAh)
Note 2: Battery life when Powered off or Burst sleep period is 230.5 Days
Note 3: The Lithium Battery Option -L increases the battery life by 2.4 times. (2 each Tadiran Model TL5920 8500 mAh at 3.6V)
Note 4: Lithium Battery option: The Staff & Sonic products Interface Programs displayed battery voltage correction. The Lithium Batteries voltage is 2.33 times the indicated value. Dark Green/Light Green is 100% to 5% Service life remaining and Yellow/Orange/Red is 5% to 0% Service life remaining. Service life remaining should be based on usage.

Days of Battery Life:
Sonic Wave Sensor XB-Pro with Filter On

Output Transmit Mode	Sample Rate Hz	Battery Life in Days per Burst duty cycle, Length/Interval (1)				
		Continuous 100%	40% Burst	20% Burst	10% Burst	5% Burst
Continuous, ASCII 1	1	13.4	31.0	55.1	90.1	132.1
Continuous, ASCII 1	2	12.1	28.2	50.7	84.1	125.5
Continuous, ASCII 1	4	10.1	23.9	43.6	74.1	114.0
Continuous, ASCII 1	8	9.4	22.1	40.6	69.8	108.8
Buffered, ASCII 32	1	16.1	36.7	63.9	101.5	143.9
Buffered, ASCII 32	2	15.8	36.1	63.0	100.4	142.8
Buffered, ASCII 32	4	15.5	35.5	62.0	99.2	141.5
Buffered, ASCII 32	8	15.2	34.7	60.9	97.7	140.0
Buffered, ASCII 32	16	14.2	32.8	57.8	93.8	136.0
Buffered, ASCII 32	32	12.5	29.2	52.2	86.1	127.8
Buffered Binary, Float 32	1	16.1	36.6	63.7	101.4	143.8
Buffered Binary, Float 32	2	15.7	35.9	62.7	100.1	142.5
Buffered Binary, Float 32	4	15.6	35.6	62.2	99.4	141.8
Buffered Binary, Float 32	8	14.9	34.2	60.1	96.8	139.1
Buffered Binary, Float 32	16	14.5	33.3	58.6	94.8	137.0
Buffered Binary, Float 32	32	13.5	31.2	55.4	90.6	132.6
Buffered Binary, Integer 64	1	15.9	36.3	63.4	100.9	143.3
Buffered Binary, Integer 64	2	16.2	36.8	64.1	101.9	144.3
Buffered Binary, Integer 64	4	16.0	36.5	63.6	101.2	143.6
Buffered Binary, Integer 64	8	15.6	35.7	62.4	99.6	142.0
Buffered Binary, Integer 64	16	15.3	34.9	61.2	98.2	140.5
Buffered Binary, Integer 64	32	14.3	32.8	57.9	93.9	136.1

Note 1: Battery Life for two Standard C cell Batteries 22400 mWHr - (2 ea. Energizer EN93 8000 mAh)

Note 2: Battery life when Powered off or Burst sleep period is 230.5 Days

Note 3: The Lithium Battery Option –L increases the battery life by 2.4 times. (2 each Tadiran Model TL5920 8500 mAh at 3.6V)

Note 4: Lithium Battery option: The Staff & Sonic products Interface Programs displayed battery voltage correction. The Lithium Batteries voltage is 2.33 times the indicated value. Dark Green/Light Green is 100% to 5% Service life remaining and Yellow/Orange/Red is 5% to 0% Service life remaining. Service life remaining should be based on usage.

Estimating Remaining Battery Service Life by measuring Battery voltage:

3V (2 alkaline cells) Pack Battery with 20 mW load and 25°C:
>2.85V = 80% to 100% Service Life remaining
2.73V to 2.85V = 60% to 80% Service Life remaining
2.67V to2.73 = 40% to 60% Service Life remaining
 2.62V to 2.67V = 20% to 40% Service Life remaining
<2.62V = 0% to 20% Service Life remaining

1.5V (1 alkaline cell) Pack Battery with 20 mW load and 25°C:
>1.42V = 80% to 100% Service Life remaining
1.37V to 1.42V = 60% to 80% Service Life remaining
1.33V to1.37 = 40% to 60% Service Life remaining
 1.308V to 1.33V = 20% to 40% Service Life remaining
<1.308V = 0% to 20% Service Life remaining

Sensor Calibration Using the Interface Software:
The Sonic Wave Sensor XB's are calibrated at the factory and in most cases they do not need to be re-calibrated.   If a different data range, than the factory values, is desired an in-situ re-calibration may be performed.

Multiple Point Sensor Calibration: Up to 12 calibrations positions can be set for 0.05% FS accuracy.

1. Plan to place the Sonic Wave Sensor two or more positions from a flat surface.   Maximum 12 positions!
Example 1 locations: 20% and 80%
Example 2 locations: 0%, 5%, 25%, 50%, 75%, 95% and 100%.

2. With the Sonic Wave Sensor set at each position set the "Calibrate Meters" value to each position and press the Set button.   Each Calibration point will be displayed on the Calibration Points table as they are added.

Sensor Automatic Anti-Aliasing Filter:

When the filter is switched on readings will be taken at a 64 Hz and the reported value will be the average value for the last two configured sample periods. Example: With a configured sample rate of 8Hz the unit will average the last 16 reading at 64Hz and output the value every 125mS. If the filter is disabled one reading will be made per the configured sample rate.   The filter response changes automatically with the setting of the Sample Rate. The recommended Sample Rate is 8 or more times the maximum Wave Frequency that will be measured. <u>Note: The battery life is greatly reduced with the filter on. See battery life table</u>!

Filter Response plot: The Amplitude is normalized to the Wave Height and the Frequency normalized to $1/8^{th}$ of the Sample Rate. Example if the Sample Rate is set to 8 Hz then the Normalized Wave Frequency was 1 Hz. If the Sample Rate is set to 16 Hz then the Normalized Wave Frequency was 2 Hz.
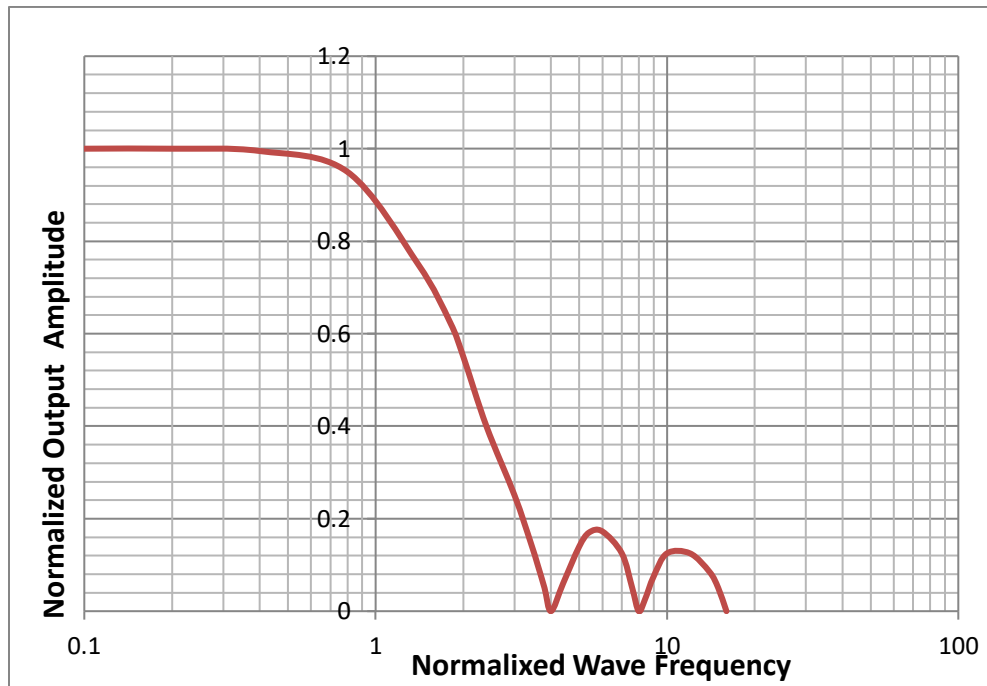
RTC Calibration: (Factory Calibrated)

Method:
1. Determine the Real Time Clock (RTC) error in seconds per minute. (Example .0025 seconds per minute)
2. Calculate the RTC correction value.   (32768 * error)/4 = correction value. The value should be negative if the time is fast and positive if the time is slow.
3. Read the current correction value with the Interface Software and add it to the correction value.
4. Enter the new value with the Interface Software.

Example: The clock is 24 second slow every week and the correction value is 7.
-24 / (60min * 24hour * 7days) = -0 .00239 seconds per minute
(32768 * -0.00239) / 4 = -19.5 + 7 = -12.5
Enter the new correction value.

User Interface Software:

A new, easy to use, Staff Product Interface Program is available to down load from our web site. We recommend using the program to configure the Sonic Wave Sensor XB for your particular requirements. It can also be used to display and analyze wave data. Sampled data can be saved to a file for future analysis with the Interface Software or other analysis software. Up to 8 Sonic Wave Sensors XBs or Wave Staff XBs may be connected to the Interface Program at one time. Right click on any object while running the Interface Program for help.

Output Plotting Tab:

The Output Plotting Tab can be used to plot data from the Sonic Wave Sensor XBs or from a saved file. All data is time tagged and plotted in real time. Vertical Line Cursors can be used to select a portion of the plot for analysis.

Spectral Analysis Tab:

Plotted Data can be Spectral Analyzed with this tab, with various window operations, data format and scaling. The Mean Water Level and Significant Wave Height are also displayed.
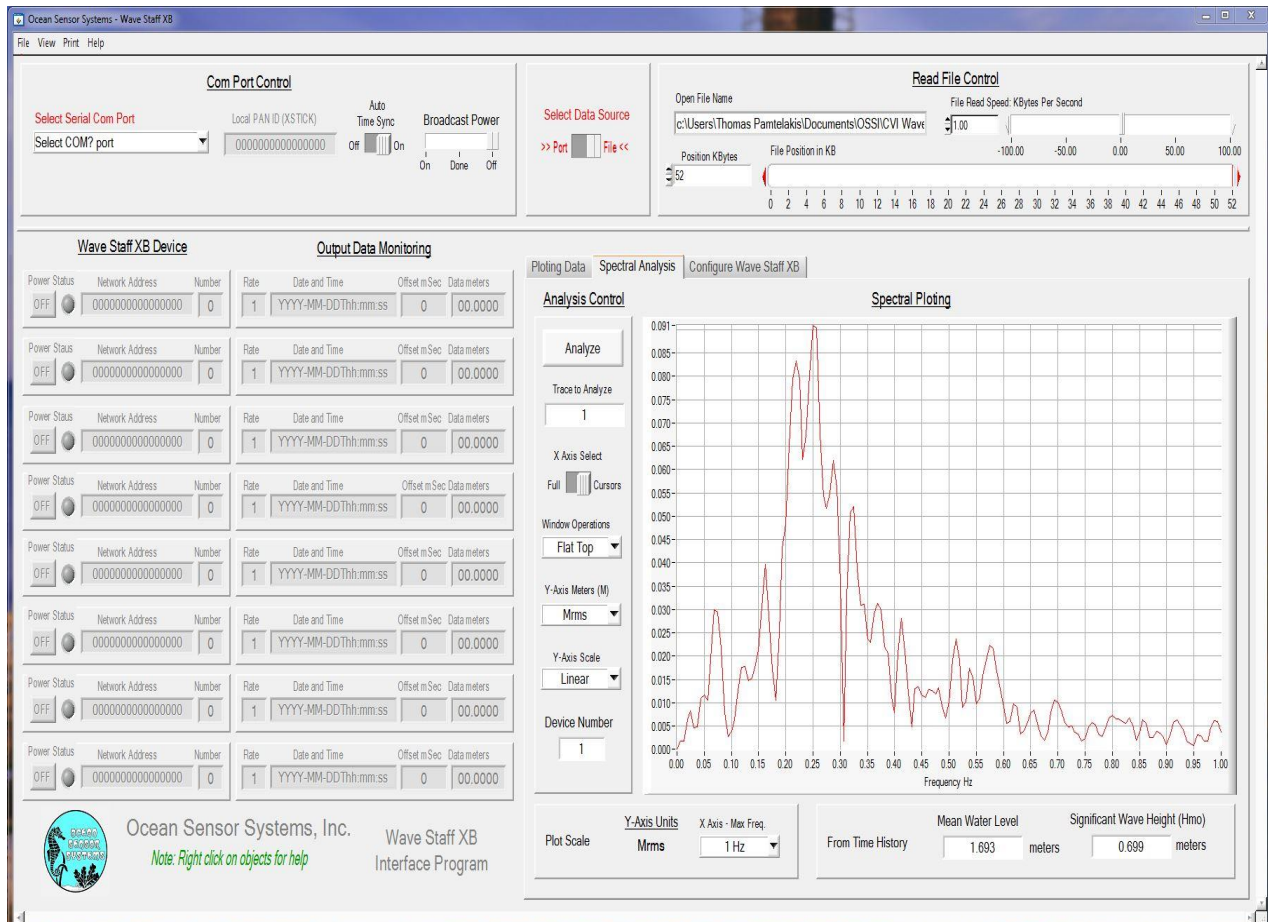
Configure Device Tab:

Use this tab to select and configure the Sonic Wave Sensor XB for your particular requirements.

Save Output Data to File:

The format of the data file saved by the Sonic Wave Sensor XB Interface Software is as follows:

The first character of each string defines the data format. The Strings are terminated with a Carriage Return Line Feed.

The first letter defines:
C – ASCII 1 Sample
A - ASCII 32 Samples
F – Float 32 Samples
I - Integer 64 Samples

The ASCII 32 Samples and Float 32 Samples have the same format. The Integer 64 Samples has the same format except for its 64 Samples rather than 32. The value after the first letter is the Device Number followed with a comma. The value after the S is the Sample Rate followed with a comma. (Fixed 2 digit length) The value after the B is the Battery status followed with a comma. (0 = Good Battery, 1 = Low Battery and 2 = Bad battery). The next value is the Date and Time (YYYY-MM-DDThh:mm:ss) that the first sample data in the string was taken. Last is the sampled data. The format is a comma separated ASCII fixed 2.4 length value.

Example - ASCII 32 Samples:
A001,S32,B0,2014-03-29T20:46:15,12.9990,…(32)……,15,12.9990\r\n

Example - Float 32 Samples:
F001,S32,B0,2014-03-29T20:46:15,12.9999,…(32)……,15,12.9999\r\n

Example - Integer 64 Samples:
I001,S32,B0,2014-03-29T20:46:15,12.9990,…(64)……,15,12.9990\r\n

The ASCII 1 Samples format has separate strings for Battery status and Date Time. The value after the D defines the string type followed with a comma. The Date and Time lines are added every 32 samples.

D1 – Sampled Data Example: C001,D1,S08,04.0290\r\n
D8 – Date YYY-MM-DD Example: C001,D8,2014-03-29\r\n
D9 – Time hh:mm:ss   Example: C001,D9,22:26:21\r\n
D7 – Battery Status Example C001,D7,GoodBattery\r\n

Wireless Adapter for Laptops and PCs:

Two types of adapters are available to connect to the Sonic Wave Sensor XBs.   Either a Digi International Inc. XStick or the longer range XBee-PRO ZB adapter.

Digi's XStick:

 Digi's XStick is an easy-to-use USB to XBee Wireless Personal Area Network (WPAN) adapter, providing local connectivity to wireless networks. Simply plug the XStick into the USB port of a laptop or PC for instant access to an XBee network and its connected devices. This compact, USB-powered wireless adapter enables local network configuration, diagnostics or device monitoring.

Digi's XBee-PRO ZB adapters:

Digi's XBee-PRO ZB adapters deliver wireless connectivity to electronic devices through advanced mesh networks. These adapters utilize the ZigBee PRO Feature Set, for robust self-healing, self-configuring networks. They are ideal for wirelessly enabling sensors, controllers and other devices in legacy wired applications, or where a common hardware interface is preferable.

The Adapter Configuration:

The following Configuration changes were made from the default values using the Digi X-CTU software:
Function Set – ZIGBEE COORDINATOR API
Update to the latest code.
ID – PAN ID set to same as the Sonic Wave Sensor
BD - Baud Rate = 7 (115,200)
AP – API Enable = 2   API with escaping   (note: Digi X-CTU software bug reading with escaping)
SP – Cyclic Sleep Period = AFO
SN – Number of Cyclic Sleep Periods = 150
NH – Maximum Hops = 2
SC - Scan Channels = FFFF for XBee and or 7FFF for XBee pro modules

The following information is for reference and is not needed when the Staff Product Interface Software is used with **Wireless Adapters from Ocean Sensor Systems.**

The Sonic Wave Sensor XB's ZigBee RF Modules:

The Sonic Wave Sensor XB's ZigBee RF Module was configured to following using the OSSI-100-029 adapter board with the Link Select switch set to XBee:
Update to the latest code.
ID - PAN ID set to the specific customer PAN ID
CE - Not a Coordinator for end points
AP - API Enable = 2   API with escaping
BD - Baud Rate = 7 (115,200)
AO - API output mode Native = 0
SC - Scan Channels = FFFF for XBee and or 7FFF for XBee pro
D6 - RTS Flow Control = 1
D7 - CTS Flow Control = 1
SM - Pin Hibernate for End = 1
DH - Set Destination Address to Coordinator = 00000000
DL - Set Destination Address to Coordinator = 00000000
ZS - ZigBee Stack Profile = 0
NH - Maximum Hops = 2

Wireless Adapter Communication format:

API Frame Specifications:

API Operation - with Escape Characters (AP parameter = 2) The UART data frame structure is defined as follows: (For more information refer to the Digi manual XBee®/XBee-PRO® ZB SMT RF Modules 90002002_G.pdf)

UART Data Frame Structure - with escape control characters:
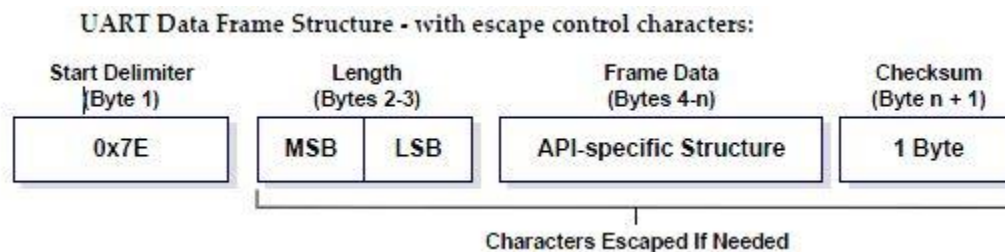
The Frame data of the serial port data frame forms an API-specific structure as follows:

Serial Port Data Frame & API-specific Structure:
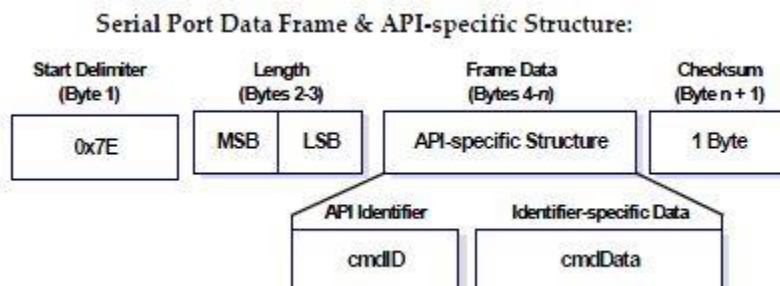
The Following is the Sonic Wave Sensor XB format of the cmdData:

cmdData is the Sonic Wave Sensor XB's data in one of 4 formats (ASCII 1 Sample, ASCII 32 Samples, Float 32 Samples and Integer 64 Samples. The format is the same as the Save Output Data file by the Staff Product Interface Software except for the sample data. The Sample data is as follows: ASCII 32 Samples: Data Format ASCII characters 0 thru 9 (0 to 9999 millimeter) with a resolution of 1.0 millimeter. Float 32 Samples: Data Format Binary Float (4 bytes) with a resolution of 0.1 millimeter. Integer 64 Samples: Data Format 16 bit unsigned integer (0 to 19999 millimeter) with a resolution of 1.0 millimeter.

Direct Command and controls:

The followings commands can be made using the OSSI-100-029 adapter board with the Link Select switch set to PIC24. These are the same commands used in the cmdData section of the API frame.

Enter help to see the command list (adapter board only)

To read configuration values:
Enter RH to read the Part number
Enter RK to read the Software version
Enter RD to read the Serial number
Enter RX to read the Device Number (1 to 255)
Enter RS to read the Sample Rate
Enter RL to read the Burst Length
Enter RI to read the Burst Interval
Enter RF to read Filter Enable Status (1=yes 2=no)
Enter RR to read Start Time Enable Status (1=yes 2=no)
Enter RT to read the Time and Date (YY-MM-DDThh:mm:ssZ)
Enter RQ to read the Start Time and Date minus 1 minute (YY-MM-DDThh:mmZ)
Enter RV to read the Battery Voltage
Enter RM to read Output Local Enable Status (1=yes 2=no)
Enter RN to read Output XBee Enable Status (1=yes 2=no)
Enter RZ to read Time & Date Sync to Second (YY-MM-DDThh:mm:ssZ)
Enter RB to Read latest Sensor data
Enter RO to read Output Data Format (1=ASCII, 2=Binary float, 3=Binary Int & 4=Continuous ASCII)
Enter RJ to read Output Offset Count (0 to 1023) 7.8125mS per count
Enter RP to read Power State (1=on & 2=off)
Enter RC to read the RTC Cal clock per Min. (-127 to 128)

To write new configuration values:
Enter WZ,? to Enable/Disable Text Interface(1=on & 2=off)\
Enter WS,?? to write the Sample Rate (1,2,4,8,16 or 32 Hz)
Enter WL,?? to write the Burst Length (1 to 59 Minutes, 0 for Continuous)
Enter WI,?? to write the Burst Interval (1 to 60 Minutes)
Enter WF,??? to write Filter enabled (1=yes & 2=no)\r\n"
Enter WX,?? to write new Device Address Number(1 to 255)
Enter WR,? to write Start Time enabled (1=yes & 2=no)
Enter WT,YY-MM-DDThh:mm:ss to write New Time and Date
Enter WQ,YY-MM-DDThh:mm to write New Start Time and Date
Enter WO,? to write Output Data Format (1=ASCII, 2=Binary float, 3=Binary Int & 4=Continuous ASCII)
Enter WP,? to write Power On and Off (1=on & 2=off)
Enter WJ,?? to write Output Offset Count (0 to 1023) 7.8125mS per count
Enter WC,??? to write the RTC Cal clock per Min.(-127 to 128)

To read Calibrate values:

Enter GT to Get Sensor Type (1 = Rod, 2= cable, 3 = sonic)
Enter GS to Get the Sensor range in meters
Enter GA to Get all calibration points

To Set the Calibrate values:
Enter FT,??.??? to Set sensor Type <Ref only> (1 = Rod, 2= cable, 3 = sonic)
Enter FS,??.??? to Set Sensor Range in meters <Ref only> (0.500 to 2.5)
Enter FF,1 to restore the factory calibration value
Enter FP,? to Set a Low current calibration point <Ref only>
Enter FN,? to Clear a Low current calibration point <Ref only>
Enter FC,1 to Clear all Low current calibration points <Ref only>
Enter FF,1 to restore the factory calibration value

 Other Commands:
Enter OL,? Local Output Device Data (1=yes & 2=no)
Enter LB,ee to link Local to XBee Device cycle power to quit