

PASS-2447B

Passive Acoustic Surveillance System

Overview

Omnitech Electronics' Passive Acoustic Surveillance System (PASS) is a bottom-laid low-noise acoustic array with 48-element hydrophones. The arrays can be easily deployed from a small craft and tethered to shore via a 1500 m long light-weight electro-optical cable. The PASS Data Collection Unit (DCU) located onshore powers the array and distributes array data to one or more client computers for analysis and display. Typical applications for PASS are harbour and port security, acoustic signature measurements to aid in reducing self-noise of subsurface and surface vessels, diver detection, and acoustic front-end for the development of advanced underwater tracking and detection algorithms. Ancillary sensors on the array measure depth, orientation (magnetic heading) and water temperature.

Standard Connectivity

The array connects to an underwater Array Receiver (AR) that manages power to the array, controls gain, synchronizes sampling, and streams the digitized data to the DCU onshore over Ethernet. The DCU contains a PC, Array Interface (AI), two Network Attached Storage (NAS) drives, GPS, and all data routing and power management electronics. Each NAS has 32 TB of redundant storage. Data logging can switch between the NAS units in real-time to allow for easy removal of data. In addition to storing data, the DCU can stream real-time data over TCP to any additional processing clients. The DCU can send data in the raw array format and/or reformat the data for simplified post-processing by client applications.

The DCU has one universal AC power input and an optional DC power inverter for battery-powered operation.

Tracking Ready

All hydrophones across multiple PASS arrays have synchronized samples to better than $1\mu\text{s}$ of UTC, referenced via GPS. Hydrophones are spaced in groups of five linear apertures from 100 to 1600 Hz. Additional hydrophones and alternate spacing options are available. PASS arrays can be expanded to include hundreds of mixed sensors.



Data Collection and Control Unit (top),
Software Screenshot (left), Acoustic Node (right)

Calibrated Gain Matching

Each PASS hydrophone can adjust the in-sensor analog gain values to account for small variations in sensor to sensor sensitivity. Customer calibration values for any single frequency can be programmed and stored in each array element and applied automatically in hardware.

- 48 Digital Hydrophones, 24 bits, 15 kSps
- 5 nested linear apertures
- Self-noise below Wenz minimum up to 2 kHz
- Shore tethered through small electro-optical cable.
- Rugged, seamless, solid construction
- Custom configurations available including:
 - additional hydrophones and sensors types
 - modified or additional apertures
 - higher sampling rates
 - longer shore cable or battery deployments

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Performance and Specifications

Parameter	Specifications	Comments
Number of Hydrophones	48	Digitization co-located with acoustic sensor
Design Frequencies / Apertures	5	100, 200, 400, 800, and 1600 Hz 16-acoustic elements per aperture
Acoustic Length	112.5 m	Overall array length is 120 m
Ancillary Sensors	3	Each with depth, temperature, array orientation
Operating Depth (Max)	150 m	300 m survival
Hydrophone Elements		
Bandwidth	10 Hz – 7 kHz	-3 dB points
Self-Noise:		
@10Hz	39 dB	Measured at 60 dB gain, based on worst case hydrophone sensitivity and minimum hydrophone capacitance (re 1 μ Pa/VHz \pm 1.5 dB).
@100Hz	28 dB	
@1kHz	24 dB	
Maximum Unclipped Tonal Signal	>194 dB	re 1 μ Pa(peak) @ 1 kHz, gain = 0 dB
Electrical Crosstalk Between Channels	Better than 128 dB	Measured at 7 kHz with full-scale input into adjacent channel and measured channel shorted with HP equivalent capacitance.
Selectable Gain	0 dB – 60 dB	in 10 dB steps, gain (electrical) calibrated @ 1 kHz to within \pm 0.15 dB,
Sample Rate	15 kSps	@ 24 bits
Simultaneous Sampling	< 1 μ s	Worst case difference in sampling window across all sensors and multiple arrays synced by GPS.
Other		
Array Construction	Acoustic sensor and digitization circuitry are thermally molded to array cable at each hydrophone location to eliminate connectors and minimize water ingress paths. Damaged hydrophones are factory repairable.	
Firmware Download	Hydrophone and ancillary sensor firmware is field upgradeable.	

