



**Chelonia Limited**  
Cetacean Monitoring Systems

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The C-POD is now 'end of life' – we can only build a limited number of new ones because the main micro-processor can no longer be obtained anywhere in the world and production has been cancelled abruptly. So it is only available to existing users with ongoing monitoring projects

## **C-POD : Specification**

C-PODs log tonal ultrasounds including those from all odontocetes (cetaceans with teeth: toothed whales, dolphins and porpoises) except the sperm whale. All these species produce clicks in trains at rates that can vary from 1 per second to over 1500 per second. Post-processing of the data identifies trains and distinguishes cetaceans from other sources of clicks or trains.

The system has been designed to achieve - within a small, low-cost unit - long running times, high sensitivity, very low false positive rates and rapid automated data analysis.



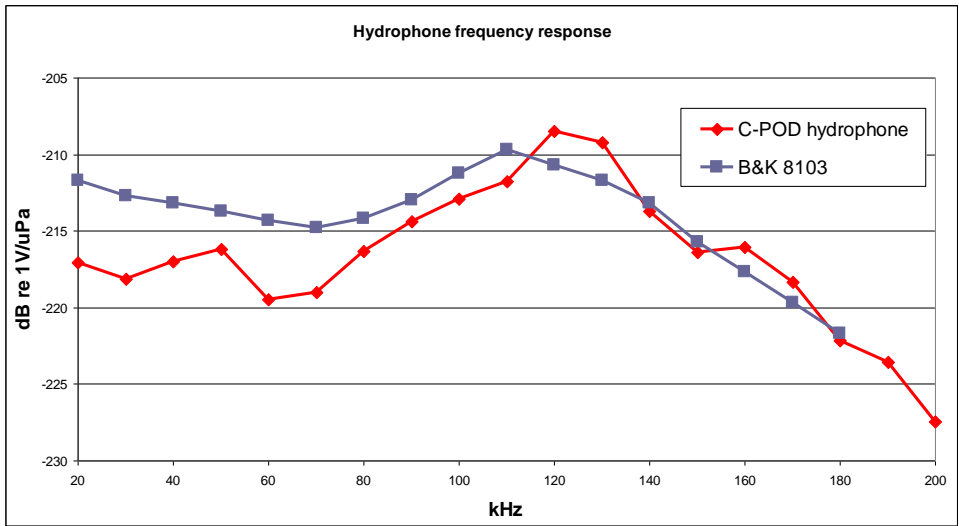
## **Acoustic performance and standardisation**

Transducer: Piezo ceramic transducer sensitive to all frequencies below 160kHz.  
Incoming sound is high-pass filtered, with options of 20kHz, 40kHz, 80kHz.

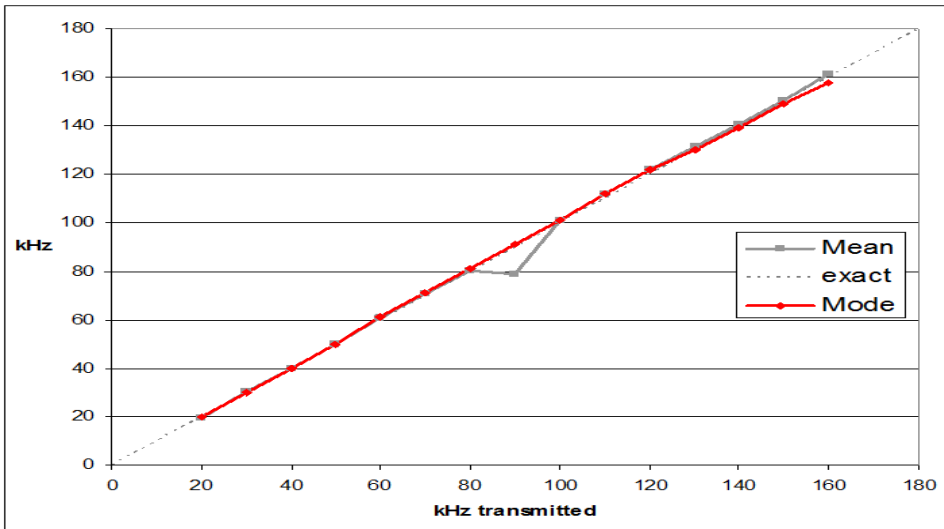
The transducer housing is a highly abrasion resistant plastic, and the transducer mounting is shock-resistant. No cases of broken or damaged C-POD transducers have been found so far.

Standardisation: The complete instrument is rotated in a sound field and adjusted to give a radially averaged, temperature corrected, pressure reading within 5% of the standard at 130kHz. ( $\pm 0.5$ dB).

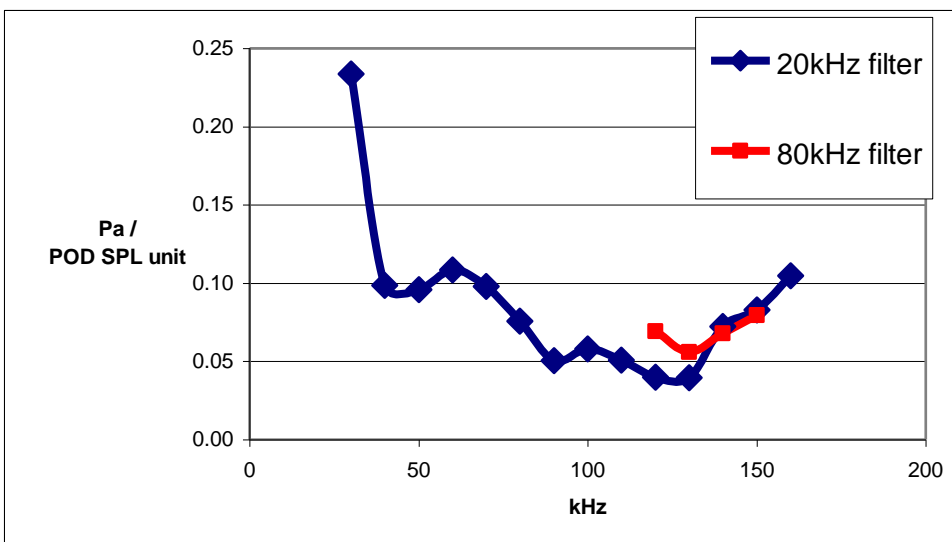
Radial variation  $< \pm 2$ dB at 130kHz.



The frequency response (from tests by the National Physical Laboratory in the UK) of the C-POD hydrophone is shown above in comparison with the widely used B&K 8103.



The frequency readout for pure tones of 10 cycles duration is shown above from tests by the National Physical Laboratory in the UK. At 90kHz some low values arise from an internal resonance.



The frequency response scale of a C-POD is shown above. The C-POD software allows sound pressure levels to be viewed as the raw value or, corrected for frequency, as Pascals.

Porpoise clicks are detected down to a minimum of approximately 0.5Pa peak to peak, with maximum detection range of approximately 300m. Dolphins are detected at much longer distances.

## Data

The following measures of each click or tonal event are stored:

- Time: 5µs resolution
- Duration: 5µs resolution
- Frequency: mean frequency of the first 10 cycles derived from zero-crossing intervals.
- Amplitude as maximum peak-to-peak pressure: 8 bit scale up to 25Pa at 130kHz, higher at other frequencies. Sounds far in excess of this are logged.
- Bandwidth: arbitrary scale 0 – 31
- Envelope – two measures

The temperature and angle of the unit to vertical are logged each minute.

## Memory

SDHC cards, specially formatted. Cards up to 8GB can be used. 4GB is the standard size.

## Batteries

10 alkaline D-cells. A special version taking 12 Lithium primary D-cells is under development.

The cells are in two stacks and the lower powered stack is selected and exhausted first. This allows the second stack to be re-used unless maximum running times are required.

## Running time

Running time: 5 – 6 months. 4GB is adequate in most locations for this, but on sandy substrates with movement 4GB may be inadequate.

## Switch

A G-sensor is polled each minute and the POD can be set to record when within a range of angles. This allows the unit to be set up some time in advance of deployment and not accumulate detections of tones within radio-frequency interference while out of the water.

## Housing

The housing is buoyant when fully loaded. This allows recovery of instruments that have been lost at sea. Polypropylene tube 90mm outside diameter, 660mm long, with mooring line 1.5m long.

A stainless steel mooring ring at the mid point of the housing holds a polypropylene mooring line with abrasion shield and spliced attachment loop. The mid-point attachment minimises leaning downstream in a current.

Weight: 2.1kg without batteries. Batteries 1.6kg. Buoyancy loaded = 0.5kg in freshwater.

Depth: 100m. A single POD has been tested to destruction and failed at 220m.

Two external rubber buffer rings to reduce impacts.

## Lid

Screws within the tube and has a double 'O-ring seal.

Tommy bar hole for closing and opening.

Security line hole.

Engraved text 'www.phonehome.org.uk' So far (10/09) eight lost PODs have been re-united with their owners via this website.

## Software

CPOD.exe is essential to read the SD card, and to view, process and export the data.

System requirements: PC with Windows, 2GB RAM.

## Train detection

The processing within CPOD.exe is currently the most advanced train detection algorithm available but is present only in a provisional form with the first full version due in Dec 2010.

## Train classification

The train filter classifies trains on two scales: train quality (the of the train having arisen from a non-train source) and species. 'Species' classifies trains as arising from boat sonars or from some group of odontocetes: porpoise-type, dolphins, beaked whale type. The species classifiers are due in June 2010, but a simple classifier is present in the current software.

## Noise

Ambient noise and its impact on detections thresholds can be assessed from the logged data. Metrics are under development. Usually ambient noise levels are below system noise levels so no impact on detection is seen, but in some locations there are noisy events that do impact on detection and these will be identified.

## Viewing data

An analysis utility shows graphs of the click and train class parameters for whole files or filtered subsets. All click parameters and train classes can be displayed and filtered.

Data can be viewed as individual clicks on high resolution scales or aggregated values on low resolution scales.

Xscale: 20 ranges from 20µs to 1 week.

Users can capture the values for clicks on screen and paste them into a spreadsheet.

## Data export

Number of clicks, as filtered, or detection positive minutes can be exported for 1 minute, 10minute, hour, ¼ tide cycle or day in a format that can be used by spreadsheets or databases.

Train details can also be exported.

Raw click data can be placed directly on the clipboard.

Temperatures and angles can be exported.

## Compatibility

The data format is heavily compressed and cannot be analysed using .wav file utilities.

The software will develop, especially in the area of species discrimination, but will maintain backwards compatibility so that all raw data sets can be reanalysed with all subsequent versions of CPOD.exe.

A future version of the C-POD that captures waveforms is under development. It will retain the basic processing of the current version. A future stereo version of this may be produced.

## Deep C-POD

A deepwater version is available that differs only having a heavy anodised aluminium housing that is capable to immersion to over 3000m. The dimensions are:

Length: 686mm

Maximum diameter: 112mm (includes rubber buffer rings)

Weight in air, no batteries: 6.7kg Batteries 1.6kg

Safety: a pressure bleed screw is present for use if water ingress is detected. No instances of this have yet occurred.

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Some of these specifications may change.