THE ELECTRICAL NOISE LEVEL OF THE HYDROPHONE AND ITS DRIFT WITH THE CHANGED OF THE ENVIRONMENT PARAMETERS

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Abstract— The aim of the paper is to show the drift of the electrical noise level of the hydrophone NAXYS, model Ethernet 02345 during a long time period, about 1 year, and find some relations between the hydropne's drift and the changed of the environment parameters.

Keywords— background level, hydrophone, correlation

I. INTRODUCCIÓN

This article is centred in the electrical noise of the hydrophone located in its work field, in this case the marine environment. The hydrophones are specialized equipment to measure the sound pressure in water. The hydrophone detect the pressure variation created by a source and generates an electrical signal. The source creates a sonic wave that travels to the water and irs detection consist in the pressure variation. The hydrophones are equipment composed by different elements but the hydrophone has always a transducer, the most use are the piezoelectric.

The hydrophone chosen is the Bjørge, model Naxys Ethernet 02345. Fig. 1.

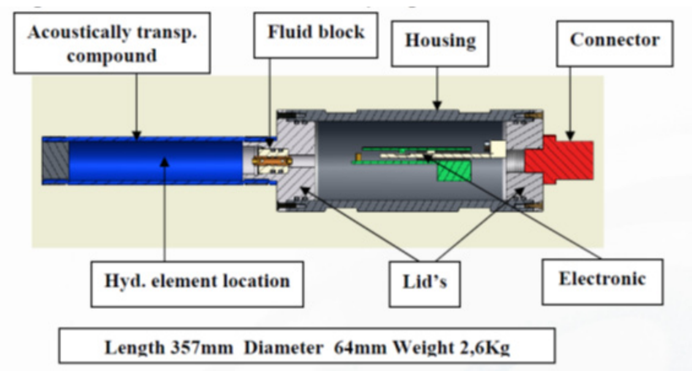

Fig 3. Pro-Oceanus CO2-Pro CO2 sensor

In this case the equipment detect the pressure variation and generates a voltage and then the same equipment converts the analogic voltage to digital signal using a converter of 16 bits and a maximum voltage of the ±2.5 v. The same equipment sends the digital signal to Ethernet. In the Fig. 2 shows the schematic process.

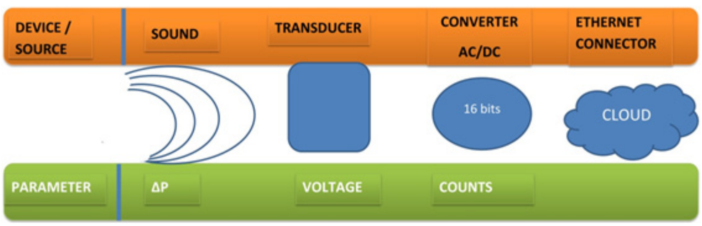

Figura 2. The acquisition and transformation scheme.

A main characteristic of the hydrophone is the high sensitivity, normally around -200 dB rel 1v/µPa.

The sensitivity is the relation between the input voltage and the output pressure. The mathematic equation is showed in (1):

$$S=20\log_{10}(V/P)$$

The marine environment has other conditions that the air, and in this environment the sonic wave is not like in the air. Some different aspects are the speed, absorption and the minimum audible signal. The speed of the sonic wave in the marine environment is around 1500m/s, and the speed in air is around 300 m/s. With this speed the sound must travels more than the air, and it is true partially. In the marine environment the low frequencies has a low absorption, but the high frequencies have a high absorption. The parameter of absorption is detailed in [1]. The minimum audible signal in the air is 20 µPa, but in the marine environment this signal is the 1 µPa, just this value is the reference pressure.

II. DEVELOPMENT

In our case the hydrophone used is NAXYS Ethernet 02345 that it is connected at the submarine permanent observatory OBSEA [2] located 3 miles from the Vilanova i la Geltrú coast and on the seabed at 20 meters of depth. During almost one year the electrical noise of the hydrophones has been recorded every day with a spaced of 1 hour. The value obtained is the mean the measures during a 1 minute and 30 seconds, such the Fig. 2 details, the user receives the counts send for the hydrophone. These counts can to convert to voltage because the specification of the converter is known 16 bits (216) so the minim voltage generates by the hydrophone is of 3,05 •10-5 v. When the sensitivity is known the voltage can to convert in pressure, and in this case the sensitivity value is -192 dB rel 1V/1µPa, thereupon the minimum pressure that hydrophone can to detect is 119432 µPa (101,54 dB). That value is high and for this reason the hydrophone has a configurable gain. The values of the Gain are 0, 10 , 20 , 30 or 40 dB. So if the hydrophone can to detect around 81 dB using 40 dB of gain.

The environment parameters such water temperature at 20 meters of depth or the wind velocity in Surface are obtained from the other equipment connected at OBSEA such CTD and meteorological station located at buoy over OBSEA.

The hydrophone data has been collect from a program design in Python, because the high frequency of acquires of the hydrophone, around 96000 samples per second. Python is a programming language of open source and compatible with a lot operating systems. In Fig. 3 shows the communication process.

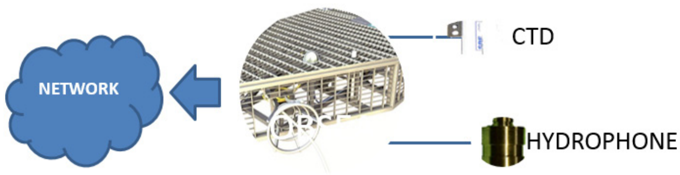

Fig.3 Communication process

III. RESULTS

All results of the electrical noise are expressed in counts such as the values were obtained.

The Fig. 4 shows the temperature variation versus the electrical noise.

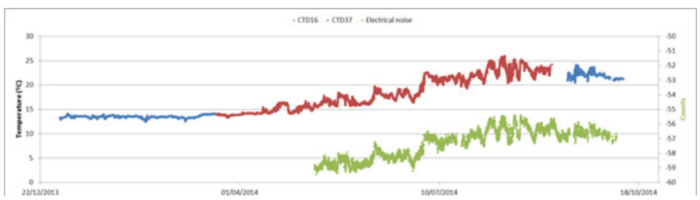

Fig.4 Temperature and electrical noise

In Fig.4 the temperature value were obtained for two CTD, that is normal, because a long term period the equipment needs maintenance and for this reason the equipment was replaced.

In Fig. 4 the relation the temperature and the electrical noise is evident, although the relation is not proportionally. For study with more accuracy the relation between theses variable the Fig. 5 shows the variation of 2 random days.

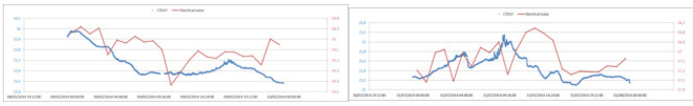

Figure 5. The temperature and electrical noise of 2 random days

In Fig.6 shows the variation of the wind at the sea Surface versus the electrical noise. The aim of the Fig. 6 is to verify if the environment conditions at the Surface could to affect at the electrical noise.

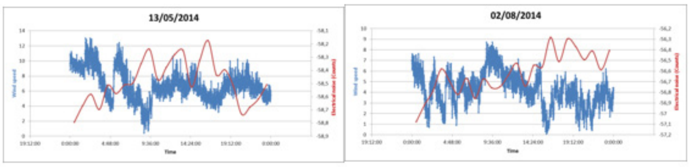

Figure 6. Variation of the wind speed versus the electrical noise

V. CONCLUSIONS

The electrical noise has a high variation, about 4 counts, in 6 months. This fact is important whenever the user wants to analyse the sound likes audio, because the user must add the electrical noise (offset) to the value obtained in this moment, for this the user must measure the offset value. But if the user only wants analyse the communication makes for an acoustic modem, the user should not be measure the offset value because the user only should to measure the difference between the maximum and minimum of signal.

Of this study conclusions can be drawn that the electrical noise has a high variation although the temperature variation was 10 Celsius degree. This suggests that the contribution of the temperature is important but not the only. The electrical noise is an important parameter to evaluate the state of the equipment, and to prevent the possible failures.

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