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Why has special formulated NBR replaced Chloroprene rubber as encapsulation material in Reson hydrophones?

A:

A small amount of lead added to the chloroprene vulcanized rubber used in RESON hydrophones ensured the acoustic properties, long lifetime, sturdiness in hostile environments and other properties of the compound and RESON hydrophones.

RESON anticipated regulations in the use of lead and initiated comprehensive testing of a broad range of alternatives 10 years ago. The tests included such properties as water permeability, quelling, acoustic properties, electrical properties, abrasion resistance, tensile strength and long-term stability in various environments.

The NBR rubber demonstrated equal performance, and therefore replaces chloroprene for the RESON 1000 and 4000 series transducers and hydrophones without any change in performance specifications and physical outlines.

Additionally the NBR rubber encapsulation has very good chemical resistance to hydrocarbons and other pollutants likely to be found in harbors. It is also well suited for applications directly submerged in fluids such as kerosene and castor oil.

However NBR show some sensitivity to UV and Ozone, and care should therefore be taken not to expose the hydrophones to direct sunlight and weathering for very long periods.

Why does plots for hydrophones only show measurements from 5kHz and upwards?

A:

As a standard RESON does not calibrate hydrophones in water below 5kHz, due to the limitations in size of our test tank. Measurements at lower frequencies will require, that measurements needs to be performed in open sea, which is very expensive.

Instead, receive sensitivity measurements are performed in air at 250Hz using calibrated pistonphone and pistonphone coupler, and this value is compared to measurement at 5kHz.

Many years of experience have shown that hydrophone sensitivity has a very flat response up to 5kHz, so measurements at these frequencies are not worth taking.

Why are RESON hydrophones made out of sea bronze instead of stainless steel?

A:

Sea Bronze, or Aluminium Bronze Alloy (ALCu10Ni5Fe4), has been proven to be more resistant to corrosion over time than Stainless Steel. Sea Bronze has over the years demonstrated very-very good corrosion resistance. To have absolutely best corrosion results, then never clamp directly on the sea bronze housing using other metals. Instead use electrical isolating mounting brackets to avoid any electro galvanic corrosion. Keep minimum of a few millimeters clearance from metal parts to sea bronze housing.

What sensitivity loss can be accounted for by pressure?

About 0.03dB/Bar (1bar=10m)

What is the maximum voltage I can use to drive the TC 4013, TC 4033, TC 4034 as projectors?

A:

100Vrms max @ 1% Duty Cycle

10Vrms max @ 10% Duty Cycle

1Vrms max @ 100% Duty Cycle

Each decade increase of input voltage = 20dB addition signal output

Formula: 20logV = SPL

V = voltage input

SPL = pressure level in dB added to transmit sensitivity at a given frequency

For example, TC 4013 transmitting at 40kHz; refer to the included ‘Transmit Sensitivity’ plot at 40kHz

1Vrms = 110dB re 1uPa/V at 1m

10Vrms = 130dB

100Vrms = 150dB

What is the maximum Sound pressure level I can measure with TC4035 or TC4038?

A:

+227dB re 1µPa/V (0.2MPa) can be measured with the TC4035 before the preamplifier saturates

+235dB re 1µPa/V (0.6MPa) can be safely measured with the TC4038

What is the difference between input and output gain for CCA1000?

A:

The input gain is capacitive gain (or attenuation) by adjusting the input capacitance in relation to the hydrophone and cable. The Output gain is a voltage gain from a standard voltage preamplifier (resistors). The 2 values combined give the total gain of the signal going through the CCA1000.

What does dB sensitivity means?

A:

Decibel (dB) is a comparative reference unit, 1Volt output per µPa at 1m distance (dB re 1V/µPa)r>The less negative the number, the more sensitive the hydrophone;

TC 4032 is –170 dB re 1V/mPa is more sensitive than TC 4013 -211dB re 1V/mPa

This means +211dB sound pressure level (SPL) will result in 1Vrms output from the hydrophone.

An increase or decrease in SPL will result in a corresponding increase or decrease in Voltage output. Every 6dB change is SPL = doubling or halving the voltage output:

Ex) TC 4013 (Sensitivity or Open Circuit Voltage (OCV) is -211dB re 1V/mPa)

+193dB results in 0.125Vrms output

+199dB results in 0.25Vrms output

+205dB results in 0.5Vrms output

+211dB results in 1Vrms output

+217dB results in 2Vrms output

+226dB results in 4Vrms output

+232dB results in 8Vrms output

Use equation SPL = 20log(Vrms) – OCV

What are the example of using 2 x TC 4013, one as a projector, one as a hydrophone?

A:

TC 4013 can be used as a transmitter. Any signal/function generator can be used for low power. A Power amplifier may be required for more power.

One-Way Transmission Loss formula: RL = SL – 20logR – aR

RL = receive level at hydrophone

SL = source level at transmitter

R = range (m)

a = attenuation coefficient (based on temperature, frequency, salinity)

For example, using 2 x TC 4013, one to transmit, one to receive:

Transmit: 30kHz, 100Vrms = 150dB signal, Range = 100m, a = 0.005

RL = SL – 20logR – aR

RL = 150-20log100 – .005 (100)

RL = 109.5dB

RL is the SPL at receiver

Receive: -211dB re 1V/uPa

20log(Vrms) – OCV = SPL

20log(Vrms) – (-211dB) = 109.5

Vrms = 8.4 E-6 V = 8.4uV output

If using VP 1000 with 10dB gain (add +10dB to –211dB):

20log(Vrms) – OCV = SPL

20log(Vrms) – (-201dB) = 109.5

Vrms = 2.66 E-5 V = 26.6uV output

dB to Pascal Formula:

20log(uPa) = dB

How many Pa is 202dB?

A:

Formula 4) 20log(uPa) = dB

uPa = 10E(dB/20) = 10E(202/20) = 10E(10.1)

= 1.2589 E10 uPa

= 12589 Pa

How do I determine signal pressure level (SPL), or energy level from a source, at the tip of a hydrophone? (In dB, and then convert to Pascal?) All this based on the output reading on my oscilloscope.

A:

Formula 1) SPL = 20log(Vrms) – OCV

RL = 20log(Vrms) – OCV

(RL and SPL are the same, the sound pressure level at the hydrophone tip is the receive level)

RL = receive level at phone (this is the unknown here)

OCV = hydrophone sensitivity (-211dB re uPa/V for TC 4013)

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Formula 2) Vrms = Vpp/2sqrt2 or Vp/sqrt2

Oscilloscopes readings usually give you Vpp

Signal Analyzers may give you dBVrms

Formula 3) dBV = 20log(Vrms)

If you get 1V output from your TC 4013 hydrophone using an oscilloscope (Hyd sensitivity is -211dB):

Vrms=Vpp/2sqrt2 = 1Vpp/2sqrt2 = 0.353Vrms

dBV – OCV = SPL

20log(Vrms) – OCV = SPL

20log(0.353) – (-211) = 202dB

So energy level at the hydrophone is 202dB re 1V/µPa

Can hydrophones operate in a full vacuum?

A: Yes. Many RESON models have been used in water tunnels under vacuum conditions.