

## NATAKO AUDIO

# Charge Hydrophone Preamplifier RE2.0

## Technical Specification

### Product Overview

The Charge Hydrophone Preamplifier is a low-noise, battery-powered analog preamplifier for passive capacitive hydrophones. It converts the charge signal from the hydrophone into a voltage signal suitable for recorders, oscilloscopes, audio interfaces, and measurement systems with a suitable analog input.

The preamplifier is intended for underwater sound listening, field recording, laboratory comparison tests, and general hydrophone signal conditioning.

### Key Features

- Charge-amplifier input for passive capacitive hydrophones 10 nF to 30 nF typical.
- Five selectable gain positions: 5, 15, 25, 35, and 45 dB.
- Typical operating response up to 100 kHz, with an intentional narrow attenuation region around 50 Hz for mains-hum reduction.
- Integrated 50 Hz notch filter for reducing mains hum in difficult measurement environments.
- High output swing for direct connection to recorders or measurement inputs.
- Input-charge linearity characterized over the measured charge range.
- Portable battery-powered architecture.

### Typical Electrical Specifications

Unless otherwise noted, values below are typical measurements at room temperature with a 10 k $\Omega$  output load.

Parameter	Typical value / description
Recommended sensor type	Passive capacitive hydrophone
Recommended hydrophone capacitance	10 nF to 30 nF typical
Gain positions	5, 15, 25, 35, 45 dB
Charge sensitivity	Approx. 1.07 to 76.1 mV/pC, depending on gain
Operating bandwidth	Approx. 20 Hz to 100 kHz typical at 5–25 dB settings, excluding the intentional 50 Hz notch; gain-dependent LF roll-off at higher settings
50 Hz notch filter	Enabled in the standard delivered configuration to suppress mains-frequency pickup; response around 50 Hz is intentionally attenuated

Parameter	Typical value / description
Maximum clean output swing	Approx. 12.9 Vpp into 10 k $\Omega$
Output load used for validation	10 k $\Omega$
Noise reference condition	Measured with shielded 20 nF capacitive input load
Input-charge linearity	Measured from 5.8 to 229.4 pC pp for 5–35 dB gain settings; 45 dB limited by output swing above approx. 170 pC pp

## Gain and Charge Sensitivity

Charge sensitivity indicates the output voltage produced for a given injected input charge. Actual acoustic sensitivity depends on the connected hydrophone.

Gain setting	Charge sensitivity (mV/pC pp)	Charge sensitivity (mV/pC rms)
5 dB	1.07	0.78
15 dB	2.53	2.38
25 dB	7.72	7.66
35 dB	23.95	24.06
45 dB	76.10	75.87

## Input-Charge Linearity

The table below summarizes the measured electrical linearity versus injected input charge at 10 kHz. The results characterize the preamplifier charge-input behavior and do not replace acoustic calibration of the complete hydrophone system.

Gain	Linear charge range (pC pp)	Max output (Vpp)	Mean sensitivity (mV/pC pp)	Spread	Comment
5 dB	5.8 to 229.4	0.18	0.804	10.2%	Full measured range; low output level affects spread
15 dB	5.8 to 229.4	0.55	2.447	5.2%	Full measured range
25 dB	5.8 to 229.4	1.76	7.641	0.6%	Full measured range
35 dB	5.8 to 229.4	5.55	23.859	1.7%	Full measured range
45 dB	5.8 to 171.5	12.89	75.892	1.3%	Higher charge excluded due to output clipping

## Frequency Response

The preamplifier includes an internal 50 Hz notch filter for mains-interference reduction. The specified operating bandwidth is 20 Hz to 100 kHz, excluding the intentional narrow attenuation region around 50 Hz. The table below summarizes the typical measured passband behavior with the notch filter enabled.

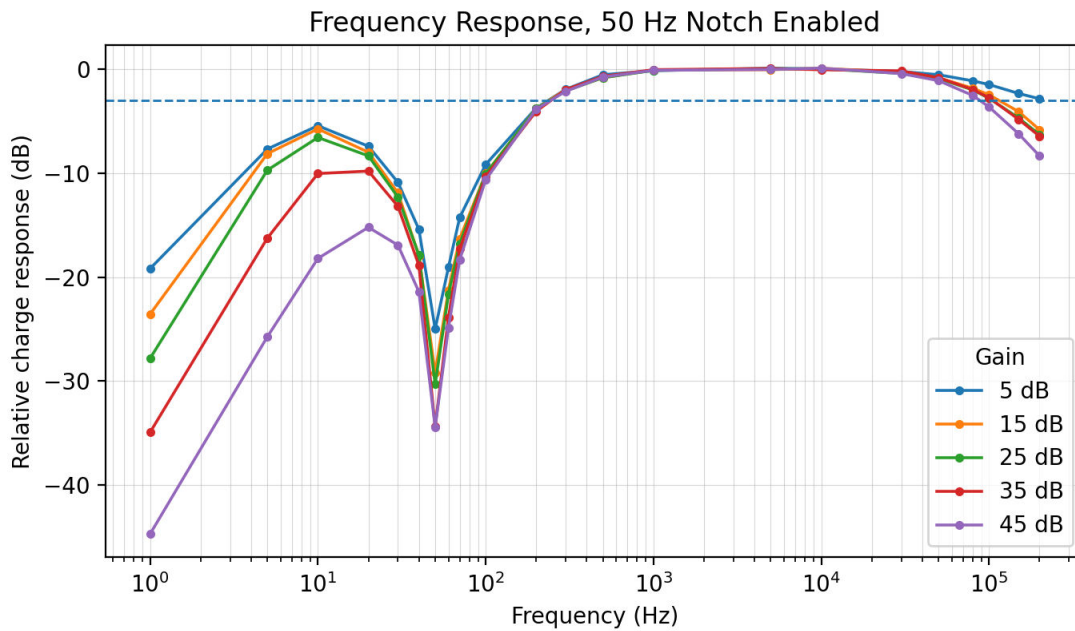


Figure 1. Typical measured charge response with the standard 50 Hz notch filter enabled.

Gain setting	Low-frequency response (excluding 50 Hz notch)	High-frequency response	Intentional 50 Hz rejection
5 dB	19 Hz	191 kHz	-25 dB
15 dB	19 Hz	113 kHz	-29 dB
25 dB	22 Hz	111 kHz	-30 dB
35 dB	35 Hz	103 kHz	-34 dB
45 dB	63 Hz	86 kHz	-34 dB

The 50 Hz attenuation is an intentional feature of the delivered configuration and should not be interpreted as a defect in the broadband response.

## Noise Performance

Noise was measured as output rms voltage and calculated as input-referred charge noise. The table uses the shielded 20 nF capacitive input-load measurement. Each entry is shown as output noise in mVrms / input-referred charge noise in pCrms.

Gain	1 Hz – 100 kHz	100 Hz – 100 kHz	20 Hz – 20 kHz	100 Hz – 20 kHz
5 dB	0.192 / 0.245	0.191 / 0.244	0.092 / 0.118	0.090 / 0.115

Gain	1 Hz – 100 kHz	100 Hz – 100 kHz	20 Hz – 20 kHz	100 Hz – 20 kHz
15 dB	0.256 / 0.107	0.233 / 0.098	0.173 / 0.073	0.136 / 0.057
25 dB	0.428 / 0.056	0.419 / 0.055	0.351 / 0.046	0.340 / 0.044
35 dB	1.620 / 0.067	1.111 / 0.046	1.543 / 0.064	0.996 / 0.041
45 dB	3.759 / 0.050	2.735 / 0.036	3.501 / 0.046	2.367 / 0.031

## Output Range and Recommended Use

Item	Recommendation
Recommended output load	10 k $\Omega$ or higher
Maximum clean output swing	Approx. 12.9 V <sub>pp</sub> into 10 k $\Omega$
45 dB gain input limit	Keep injected charge below approx. 170–180 pC pp to avoid output clipping
Polarity	Inverting charge signal path
Use with 50 Hz notch	Recommended standard configuration for reducing mains hum; amplitude measurements around 50 Hz are intentionally attenuated and should not be used for flat-response calibration

## Notes and Limitations

- Specifications are typical.
- Linearity and noise values are measured electrical results under stated bench-test conditions and should be treated as typical values.
- The preamplifier itself does not define the acoustic sensitivity of the connected hydrophone.
- The 50 Hz notch filter is useful for hum reduction, but it intentionally changes the measured amplitude around 50 Hz and nearby low-frequency bands.
- For precision pressure measurements, the complete hydrophone and preamplifier chain should be calibrated together.