

USERS MANUAL
HM1 Hydrophone Preamplifier

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Introduction

The EOS HM1 preamplifier is a low-noise signal conditioning front-end for sonar hydrophones. The pre-amplifier provides:

- Fully differential input and output signals
- Stepped gain control
- Anti-aliasing filter
- Digitally controlled calibration circuit

Specifications

1.1 Electrical Specification

Input Voltage:	6-20 Volts
Input Current:	TBD
Bandwidth (High Frequency):	1 Hz – 100 kHz
Bandwidth (Low Frequency):	1 Hz – 25 kHz
Input Impedance:	TBD
Fixed Gain:	TBD
Gain Control:	0, 6, 12, 18 dB

Table 1: Electrical Specifications

1.2 Mechanical Specification

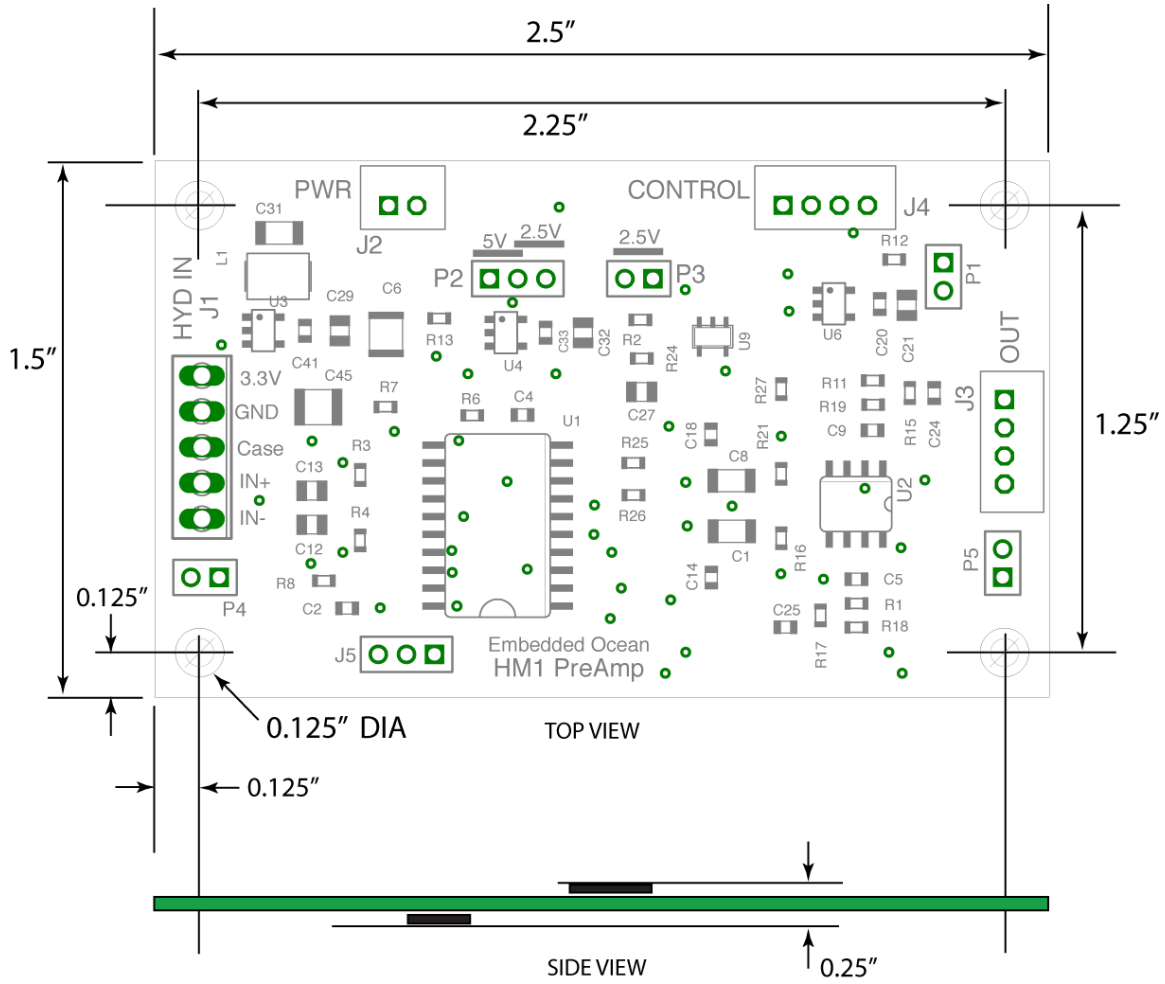


Figure 1: Top and side view with outline dimensions (inches).

Connectors are not shown on side view.

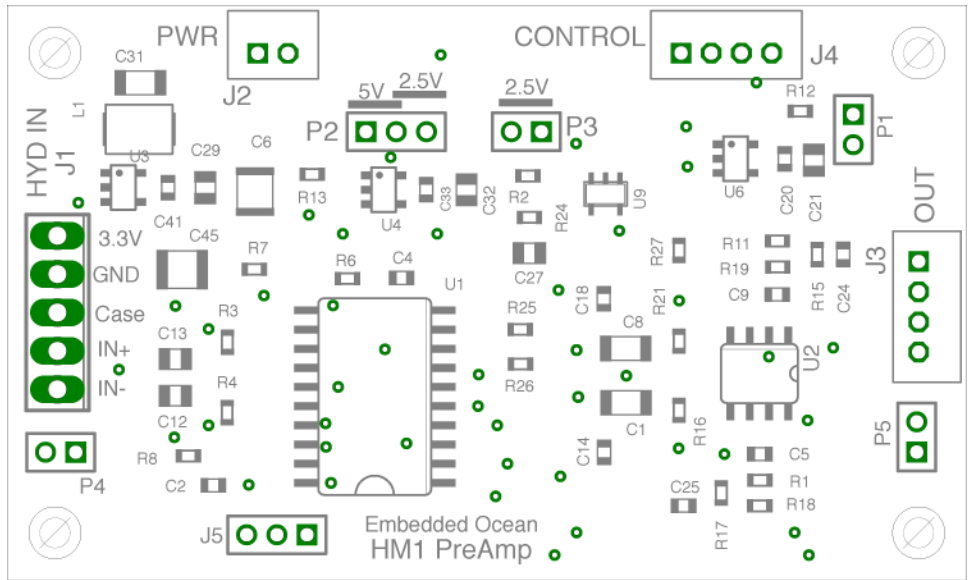


Figure 2: Top assembly drawing

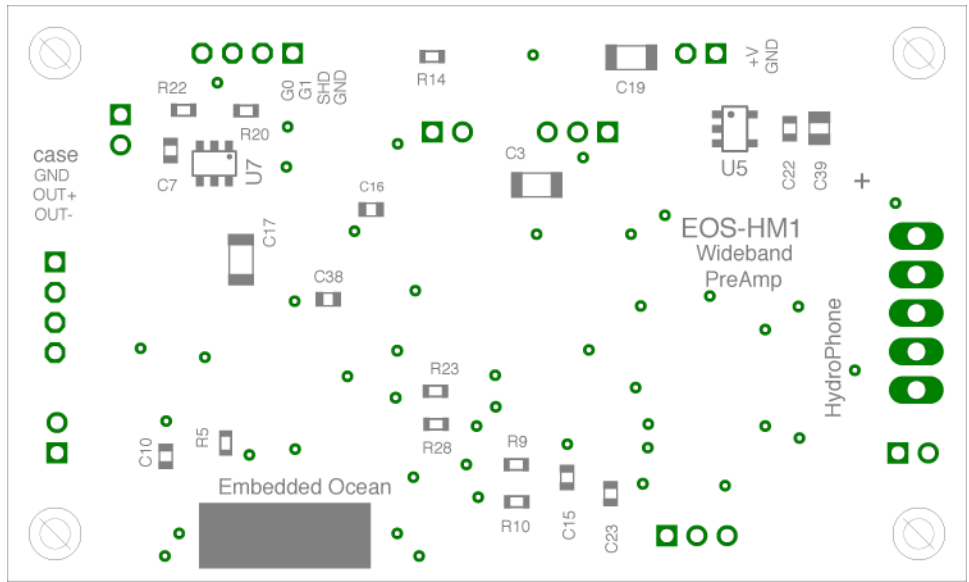


Figure 3: Bottom assembly drawing

Connector pin 1 is indicated with a square solder pad on all connectors

1.3 Connector Specification

Connectors are located on the top of the board and labeled J1 through J5, as illustrated in Figure 2. All connectors except J1 are 2mm pitch, PH series, crimp style connectors: <http://www.jst-mfg.com/product/pdf/eng/ePH.pdf>.

Each connector is marked with a number and a name, for example J2 and PWR. Pin 1 is indicated with a *square solder pad* on all connectors.

1.3.1 Hydrophone Signal INPUT Connector

Connector J1 is the hydrophone *differential* signal analog input. The J1 connector is a 5 position screw terminal block.

J1	HYDRO IN	TYPE	LEVEL	SYMBOL
1	3.3V Hydrophone Supply	PWR		+3.3V
2	GROUND	GND		GND
3	SHIELD IN	GND		SHEILD_IN
4	+SIGNAL IN	INPUT		IN+
5	- SIGNAL IN	INPUT		IN-

Table 2: Hydrophone Input Connector

If a HM1 preamplifier input is unused, as in the case of a single-ended sensor with one side of the sensor grounded, the unused input should be connected to sensor ground via a capacitor of value equal to that of the sensor.

1.3.2 Main Power Connector

Connector J2 provides the input supply voltage.

J2	PWR	Type	Level	Symbol
1	Ground	GND		GND
2	Input Supply Voltage	PWR	5.5 to 20 VDC	VIN

Table 3: Main power connector

1.3.3 Hydrophone Signal OUTPUT Connector.

Connector J3 is the preamplifier *differential* analog signal output.

J3	SIGNAL OUT	TYPE	LEVEL	SYMBOL
1	SHIELD OUT	GND		SHIELD_OUT
2	GROUND	GND		GND
3	+SIGNAL OUT	OUTPUT	0 to 5 V	OUT+
4	-SIGNAL OUT	OUTPUT	0 to 5 V	OUT-

Table 4: Signal Output Connector

1.3.4 Control Connector

Connector J4 provides TTL level control signals to shutdown the preamp. The shutdown signal is active low. A logic level 0 will turn the preamp OFF. A logic level of 1 will turn the preamp ON. Pre-amp gain is controlled by the GAIN 0 and GAIN 1, providing 4 gain settings with two logic lines G0 and G1. Gain control logis are defined in Table 6.

J4	CONTROL	TYPE	LEVEL	SYMBOL
1	Ground	GND		GND
2	SHUTDOWN	INPUT	0 to 5 V	SHUTDOWN
3	GAIN 1	INPUT	0 to 5 V	G1
4	GAIN 0	INPUT	0 to 5 V	G0

Table 5: Control Connector

The digital inputs G0 and G1 use +5 volt logic with a nominal threshold voltage of +1.3V, and include on-chip pull-up resistors. If these inputs are left unconnected, the internal pull-up resistors will result in a step gain of 18 dB. Logic gates or wire straps can be used to connect the G0 and G1 inputs to ground and thus reduce the amount of step gain. The following table illustrates the gain control logic:

G0	G1	GAIN
0	0	0 dB
1	0	6 dB
0	1	12 dB
1	1	18 dB

Table 6: Gain Control

1.3.5 Calibration Connector

Connector J5 provides calibration signal input and control.

The digital inputs CAL_SIG and CAL_ON use +5 volt logic with a nominal threshold voltage of +1.3V, and include on-chip pull-up resistors. The CAL_SIG signal goes to a 1-bit digital-to-analog converter. This converter generates a differential, two-level analog signal which is summed with the hydrophone signal in the preamplifier stage feedback network.

J4	CONTROL	TYPE	LEVEL	SYMBOL
1	Ground	GND		GND
2	CAL SIGNAL	INPUT	0 to 5 V	CAL_SIG
3	CAL ON	INPUT	0 to 5 V	CAL_ON

Table 7: Calibration Connector

1.3.6 Jumpers

Jumper P1 overrides the shutdown pin on connector J4.

P1 OPEN - SHUTDOWN pin on J4 controls power ON/OFF.

P1 CLOSED - the pre-amp power is always ON.

Jumpers P2 and P3 set the output voltage mean and range.

P2 OPEN - sets the mean output voltage to 1.25 Volts.

P2 CLOSED - sets the mean output voltage to 2.5 Volts.

P3-5V CLOSED sets the output voltage range to 5.0 Volts.

P3-2.5V CLOSED sets the output voltage range to 2.5 Volts.

Jumper P4 and P5 connect the input and output shield to ground, respectively.

P4 OPEN - INPUT Shield is floating.

P4 CLOSED - INPUT Shield is connected to GND.

P5 OPEN - OUTPUT Shield is floating.

P5 CLOSED - OUTPUT Shield is connected to GND

Application Notes

1. The combination of the capacitive sensor and the high impedance preamplifier inputs forms an antenna which is sensitive to electrostatic and magnetic interference. The wiring between the HM1 and the hydrophone should be twisted, shielded pair (TSP) and as short as practical. The hydrophone, HM1, and associated passive components should ideally be enclosed in electrostatic shields. These shields should be grounded at the HM1 signal ground only.
2. It is important that the preamplifier input wiring be kept as short as practical and also be kept away from the HM1 output wiring and circuit board components. Also, keep the preamplifier differential input wires close together in order to minimize loop area and resultant induced voltages from stray magnetic fields. Hydrophone input wires should be separated from digital wiring. It is recommended that any connectors between the hydrophone and the HM1 also be shielded.
3. The preamplifier inputs (IN- and IN+) are at a DC bias of approximately +1.3 volts.
4. If a HM1 preamplifier input is unused, as in the case of a single-ended sensor with one side of the sensor grounded, the unused input should be connected to sensor ground via a capacitor of value equal to that of the sensor.

Input (mV)	Freq [Hz]	Output (mV)	Linear Scale Gain	PreAmp Gain dB
100	1	56.3	0.6	-5.0
100	2	146.0	1.5	3.3
40	5	156.0	3.9	11.8
40	10	259.0	6.5	16.2
20	20	169.0	8.5	18.5
20	50	190.5	9.5	19.6
20	100	196.5	9.8	19.8
10	200	106.0	10.6	20.5
10	500	131.0	13.1	22.3
10	1000	203.0	20.3	26.1
10	2000	362.0	36.2	31.2
10	5000	875.0	87.5	38.8
10	10000	1609.0	160.9	44.1
10	20000	2516.0	251.6	48.0
10	30000	2906.0	290.6	49.3
10	40000	3094.0	309.4	49.8
10	50000	3125.0	312.5	49.9
10	60000	3109.0	310.9	49.9
10	70000	3047.0	304.7	49.7
10	80000	2969.0	296.9	49.5
10	90000	2859.0	285.9	49.1
10	100000	2750.0	275.0	48.8

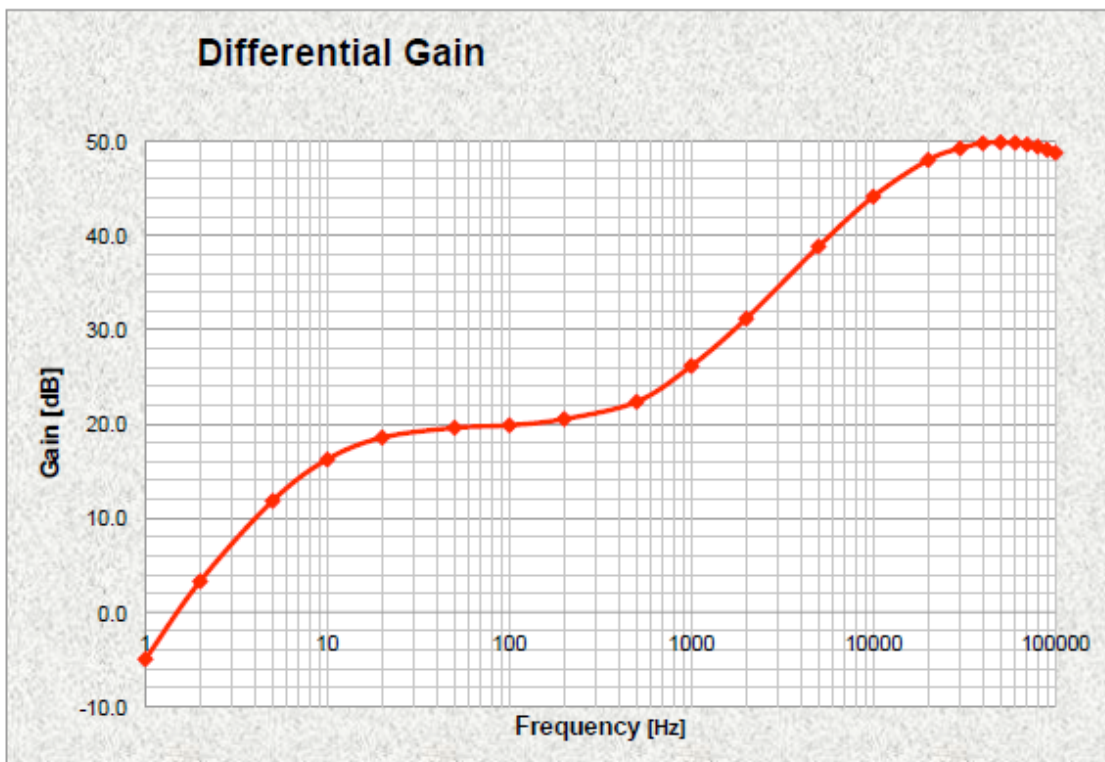


Figure 4: Pre-amp gain as a function of frequency