

## User Manual for LEGION AMP128, retail version 128-channel custom preamplifier board with Cannon DL(M)- 260 IO

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### Read first: Safety instructions and requirements

1. **AMP128 must operate in receive (photoacoustic) mode only. TR (ultrasound mode) will destroy the device.**
2. The board has a protective cover and standoffs.
3. Preamplifier has ESD (electrostatic discharge) protection for analog input and outputs, but parts inside the housing are sensitive to ESD.
4. Electric: Preamplifier is powered using 5V (rated),  $\geq 2.5A$  isolated power supply. Verify power voltage level. The central pin is +. Use of higher voltage supply will damage the board or/and blow the fuse. Fuse integrity can be tested using Ohm-meter (multimeter) applied between power connector pins.
5. Thermal: Preamplifier power dissipation is 6W with no signal or small signal. Operate board at room temperature in a ventilated area. For operation, the board must be mounted vertically (the top of the board has the 'PhotoSound' logo).
6. Connection to the machine:
  - a. Unplug power before connecting the AMP128-18 to the US machine (recommended for US machine safety only). The probe can be hot-plugged.
  - b. Adjust the two standoffs by hand or using 1/8 hex wrench to support the AMP128 housing against a surface.
  - c. Power the preamplifier after attaching the US machine to the Output Connector Latch (clockwise to secure latch) and the Probe to the Input Connector. The AMP128 currently has no power switch, use a power strip with a switch or unplug the device when not in operation.

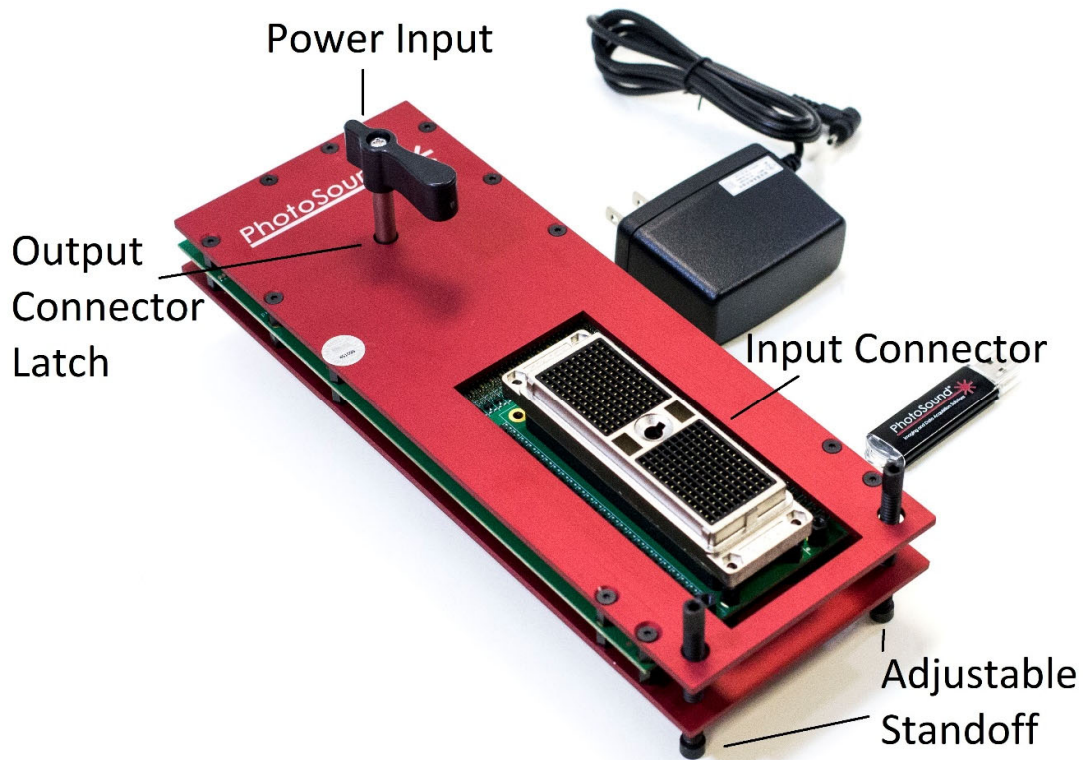


Figure 1: LEGION AMP128. Key features on the AMP128 are labeled. Accompanying power supply and PhotoSound USB drive are included.

### Key specs, measured

- AC-DC power supply with 5V, 4A output to 2.1mm barrel connector (the inner pin is +5V, the barrel is ground). Power 6W measured at AC, under no signal condition. Input has reverse voltage protection. Preamplifier input has reverse polarity protection on positive input (diode in series).
- Analog inputs and outputs have ESD protection, which cannot protect amplifiers in case if high voltage level is applied from US machine in transmit mode.
- Gain 40 dB to 50Ω load, 46 dB to highZ (high impedance), measured using signal generator and oscilloscope. Gain measured with probe depends on the probe capacitance and is generally slightly lower.
- Amplifier is inverting.
- Recommended operating conditions: input signal  $\leq 2\text{mVpp}$  to highZ load, which corresponds to 200mVpp output to 50Ω load or 400mVpp to highZ load. 10mVpp to highZ input is acceptable, but not recommended. 10mVpp to 50Ω (= 20mVpp to highZ) input will cause preamplifier output saturation and high distortions. Under

- any conditions the input signal should not exceed 2Vpp (such input signal will cause preamplifier output saturation).
- Preamplifier has rail-to-rail design at 3.3V, which means that maximal output signal is  $\leq 3.3V_{pp}$  to highZ load, and  $\leq 1.65V_{pp}$  to  $50\Omega$  under any conditions.
  - BW -6 dB 25kHz – 35MHz, BW -3dB 40kHz – 30MHz measured using signal generator.
    - Note: actual BW depends on the probe capacitance.
  - Shielding, ground stitching – PCB internal:
    - Signal layers are internal; all signal layers are internal and coupled to ground.
    - Layers are ground filled; signal traces are ground stitched.
  - Crosstalk < -50 dB, except Cannon DLM connector effects.
  - Temperature at U2 and U3, open air, indoor, 44°C, max expected 50°C, under no signal conditions.
  - **Signal mapping of the input and output connectors are different, use the attached Excel file, 'AMP128-18 channel map.xlsx', to track the signals. If an additional signal mapping is required, construct a custom signal map using the attached excel file as the AMP128 output.**
  - Input impedance  $\geq 1 M\Omega$ , the best in terms of noise according to tests (New version, Fall 2020 and later, the older versions had 39 k $\Omega$  input impedance).

## User Notes and Known Issues

The following notes were documented out by a customer using PhotoSound's AMP128 with a Verasonics Vantage 128 system:

- The Vantage 128 system treats the AMP128 as a custom probe under the 'KnownTransducers' list. A custom probe label must be made for the AMP128 in the 'KnownTransducers' list with identical settings as the attached probe.
- The AMP128-18's channel mapping will not match the exact channel mapping of every probe. For generic probes and after the custom 'KnownTransducers' AMP128 label is made, the Trans.Connector array must be modified to interface correctly with the Vantage 128. The attached excel map file, which is a column of integers from 1-128 ordered as a channel map, must be set as the Trans.Connector array (i.e. Trans.Connector = [\* .map];).