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LIVE SOUND

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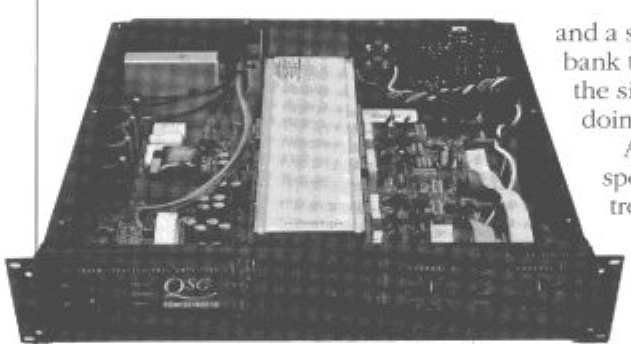
SOUNDCHECK



QSC PowerLight

QSC POWERLIGHT 1.8 AMP

QSC received a TEC Award nomination for its 18-pound PowerLight 1.8 amplifier ($1,998 list), rated at 900 watts per channel at 2 ohms. It comes in a two-space chassis, 18 inches deep. Voltage gain is "50 times," or 34 dB, and the input sensitivity is 1.1 VRMS. A new model, the PowerLight 4.0, will have the combined power of two 1.8s in a three-rackspace chassis, with a target weight under 30 pounds, producing 2,000 watts into 2 ohms. This low weight is achieved through use of QSC's new PowerWave™ fully resonant switching technology, eliminating the most expensive and heaviest single component in traditional power supplies. The design of the switching supply uses a much smaller, lighter transformer and a storage capacitor bank that is a fraction of the size of the capacitors doing the same job.

A quiet, variable-speed, temperature-controlled fan provides forced-air cooling out the front, avoiding heat on the inside of the rack. A heat-sink tunnel is an integral part of the chassis, running through the center. The front panel has an exhaust grille the entire height of the chassis, in the center. On the right side, two 11-position detented gain controls have 2dB steps for the first seven "clicks." These large knobs have a comfortable feel to their rubberized surface. Between these knobs are two vertical rows of four LEDs for audio level metering. A green signal-present LED lights at -30 dB, two yellow LEDs at -20 and -10 dB, and a red LED shows clipping. On the left is a large power switch and LEDs to indicate power (green), standby (yellow) and protect (red). On the rear, a contact closure places the amp in standby, allowing it to be turned on remotely when the power switch is in the "on" position.

Protection includes increased fan speed with higher heat-sink temperatures. Excessive temperature mutes the signal, with quick recovery (about 20 seconds), due to continued high-speed fan ventilation, which was verified by clipping the amp into a 2-ohm load while running pink noise. QSC's self-resetting Output Averaging™ protects the amp from delivering excessive current into short-circuits. Rather than using a relay, DC faults instantly "collapse" the power supply, eliminating a moving part common to most amps.

The new Neutrik Combo input connectors used on this amp accept either XLR (pin 2 hot, of course) or ¼-inch input jacks. The new binding posts on the outputs, now used on QSC's entire line, replace familiar hex-nut binding posts. These allow insertion of up to 7-gauge wire. Beveled edges prevent shearing of wire when tightened, and they are large enough to accept a banana plug directly through, sideways. The slotted head allows tightening with a coin, instead of having to use a hex driver.

Our Field Test included running a small system outdoors—two full-range boxes and two subwoofers on one PowerLight, and four bi-amped wedges on the other. Even though one channel of each amp was running a 2-ohm load up to clip, it was only possible to tell by looking at the blinking red LEDs. The PowerLight uses a Class H design and the same Toshiba 230-volt output devices found in many professional amplifiers. Other than the power supply, there are no major differences between it and traditional professional amplifiers in its power range. What the switching power supply does is change the dynamic behavior of the amp when it is running at or near clipping. It delivers excellent bass response, particularly on transients at or near clip.

At extreme levels of power demand, the voltage rails driving the PowerLight's output devices are stiffer than can be provided by a traditional power supply. At clipping, a traditional power supply allows the low frequency of the AC supply voltage to actually modulate the signal while it is being clipped. This was later verified on the bench. By running an amp with a traditional supply on a 4-ohm resistive "bench load" up to clipping, using a sine wave of a few hundred hertz, it's possible to see the 60 Hz of the AC waveform modulated onto the clipped signal. Placing a reasonably high-power speaker and an L-pad in parallel with this load, it is possible to hear this effect. By varying the sine wave's frequency, it can be heard to "beat" as it passes multiples of 60 Hz. Sweeping from 230 Hz to 250 Hz is particularly illuminating. The same test using the PowerLight reveals no modulation of the signal while clipping. Using dynamic signals, its performance is stable at clipping, when other amps start to distort the low end on transients. An extension of this test is to substitute a musical signal for the sine wave (try Pink Floyd's "Money"). Using two studio monitors along with L-pads and a bench load "power soak," it is possible to compare the performance of two different amplifiers running at clipping at relatively comfortable listening levels.

Observing the RMS ammeter on the Furman PM-Pro power conditioner in the amp rack, I noticed that two PowerLights used 2 amps idling, and about 10 amps at full-tilt boogie. Back on the bench, it was possible to confirm that a traditional amp of similar power consumed almost twice as much current. Also, the PowerLight's fan was considerably quieter, and less heat was generated. Standing directly in front of stacks or wedges, it was difficult to tell whether the amp was on by listening to its self-noise. The measured signal-to-noise ratio was at least 5 dB better than QSC's preliminary spec of 100 dB below full rated output. QSC tells me that the S/N spec is being revised to reflect that.

The constantly changing musical demands placed on a power amp require it to supply varying amounts of current. For average musical requirements, only a fraction of an amp's maximum output is needed, with full power required only for musical peaks. A traditional power supply uses a large, heavy transformer, working at a relatively slow 60 cycles per second, to first step the AC down to a lower voltage. A full-wave rectifier then converts this lower-voltage AC into a pulsing, positive electrical voltage, charging the large capacitors that act as electrical reservoirs 120 times each second. These storage caps provide the positive and negative DC rails that are drawn on by the output devices. The storage caps charge for about 2 milliseconds during each peak from the rectifier, and then must wait 6 milliseconds for their next charge. Large musical peaks can cause the supply voltage to sag, and there can be a small delay before they are recharged, depleting the stored energy faster than the caps can be recharged.

A switching supply's design is turned around. PowerLight's switching supply *first* rectifies the AC line voltage and charges a capacitor bank to the peak voltage of the AC line. This voltage is then connected to the center tap on the primary of a high-frequency transformer. Electrical storage occurs before the transformer, rather than after it, and the transformer operates at a much higher frequency. The ability of this pulsing, high-voltage DC supply to deliver current is not limited by the impedance of a large power transformer between it and the wall. Each end of the high-frequency transformer's primary is alternatively switched on and off by a square-wave oscillator running at 114 kHz, creating a very high-voltage, high-frequency AC supply. This transformer can be small. Secondary windings on this high-speed transformer step the voltage down to sets of rectifiers and filter capacitors, creating the DC supply rails that the amp's output devices run on.

The PowerLight's switching power supply operates at a frequency almost 2,000 times higher than the 60 Hz coming out of the wall. Rather than charging multiple reservoirs at a line transformer's speed of 60 Hz, there is a *single* capacitor bank *before* the high-speed transformer, and the current is distributed *as needed* to the different DC rails. In the switching supply, current is delivered all the time, compared to traditional designs, where storage capacitors can deliver current only part of the time. Previous lightweight amplifier designs have had performance compromises, turning many users off to the concept. With this new amplifier, performance can exceed that of traditional amplifiers, with the weight and energy savings as an added bonus.

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