

References & Regulators

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The articles listed below are involved with higher performance references and/or regulation stages for audio amplifiers and other solid state gear. They are listed in reverse order of appearance (most recent at top). Some of the very early articles are of mainly historical interest, but are included here due to the continuing interest in regulators.

2015: ['A Universal Shunt Regulator for Audio Applications'](#) is a new update to a long series of audio regulation articles, dating all the way back to 1969. As noted within, it follows logically from my *AudioXpress* interview, but features several worthy upgrades in both performance and functionality.

2012: *audioXpress* published an interview with yours truly, as conducted by Shannon Becker, appearing in their October issue on page 32. [This interview is available here as a PDF](#), through the courtesy of *audioXpress*. Figure 1 is a shunt regulator example.

2000: ['Improved Positive/Negative Regulators'](#) was a upgrade and sequel to the 1995 article series on regulators. It was published in *Audio Electronics*, issue 4 of 2000, with photographic and other assists from Mark Kovach.

1997: ['Low Noise Power for Analog Circuits'](#), was a 'Walt's Tools and Tips' column, within the *ED Analog Applications Issue* of June 23, 1997, pp. 65-68. This regulator version retains the scheme of driving the op amp supply from the regulated output, but is applied to lower voltages such as 5V.

1997: In ['Regulator Excels in Noise and Line Rejection'](#), in *EDN* January 12, 1997 pp. 92, 93, a scheme of driving the op amp supply from the regulated output appears. The circuit is the basic positive regulator from the 1995 series (above), enhanced with a buffer/level shifter to allow the rail bootstrapping. Line rejection is enhanced considerably.

1995: 'Regulators for High-Performance Audio' was a four part series published in *The Audio Amateur*, within issues 1-4. This series goes into the design, testing, layout and system performance of audio regulators. Parts 1 and 2 listed below, were authored by Walt. Part 3 was authored by Jan Didden, and is listed below, courtesy of Jan. Part 4 was authored by Gary Galo, and is listed below, courtesy of Gary.

[Part 1](#), [Part 2 A](#), [Part 2 B](#), [Part 2 C](#), [Part 3](#), [Part 4](#)

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1994: [‘Getting the Most from IC Voltage References’](#) was published in issue 28-1 of *Analog Dialogue*, pp. 13-21. This article explores the basic operation of both series and shunt mode zener and bandgap type voltage reference ICs, as well as their specifications and applications.

1974: [‘IC Regulated Power’](#) was published in *The Audio Amateur*, within issue 4 of 1974, pp. 14-20. This article focused on the basic performance of the op amp-based series type voltage regulator. It included a PCB layout suitable for a complete +/- output 1.5A lab supply, using the LM395 IC as the pass device. Mine is still working after 30+ years!

1969: [‘Don’t Shun the Shunt Regulator’](#) was published in the July 5, 1969 issue of ED, pp. 70-72. This very early regulator used a 2N3638 reference, a CA3018 IC array and a 2N3055 as a pass device. Old parts, but still a viable technique with the substitution of more modern stuff.