Many applications require current sources rather than voltage sources. When you need a high-current source, using a linear regulator is inadvisable, because of the high power dissipation in the series resistor. To solve the wasted-power problem, you can use a switch-mode regulator. The circuit of Figure 1 uses IC1, an LM2576 adjustable regulator. It needs only a few external elements and has an adjustable sensing input, which you use for controlling the output current. Resistor Rsc is a current sensor. IC2A, one-half of a TL082 op amp, operates as a difference amplifier. When R1/R2=R3/R4, the output voltage is proportional to the current flowing in Rsc. Good common-mode rejection and a wide common-mode voltage range are important, because the amplifier works with large, changing common-mode signals.

The second half of the TL082 op amp, IC2B, operates as a noninverting amplifier. The required gain depends on the output current you need: G=Vref/Vsc, where G is gain, Vref is the voltage on the sensing input of the LM2576, and Vsc is the voltage across Rsc. Note that Vsc=Iout*Rsc, where Iout is the output current. For example, if Iout=2A and Rsc=0.12Ω, then Vsc=0.24V. Typically, for the LM2576, Vref=1.237V. So, you can obtain the gain of the noninverting amplifier from the gain equation: G=5.15/V. The overall gain of the noninverting amplifier is G=1+R6/R7. If R7=100kΩ and G=5.15, you can solve for R6 (24.1 kΩ). When you need a precise output current, you can replace the fixed resistor, R6, with a series connection of a fixed resistor and a potentiometer. Tests showed that the output current is practically constant with varying loads. For example, the 2A output current changed less than 1% for an output-voltage range of 0.3 to 15V.