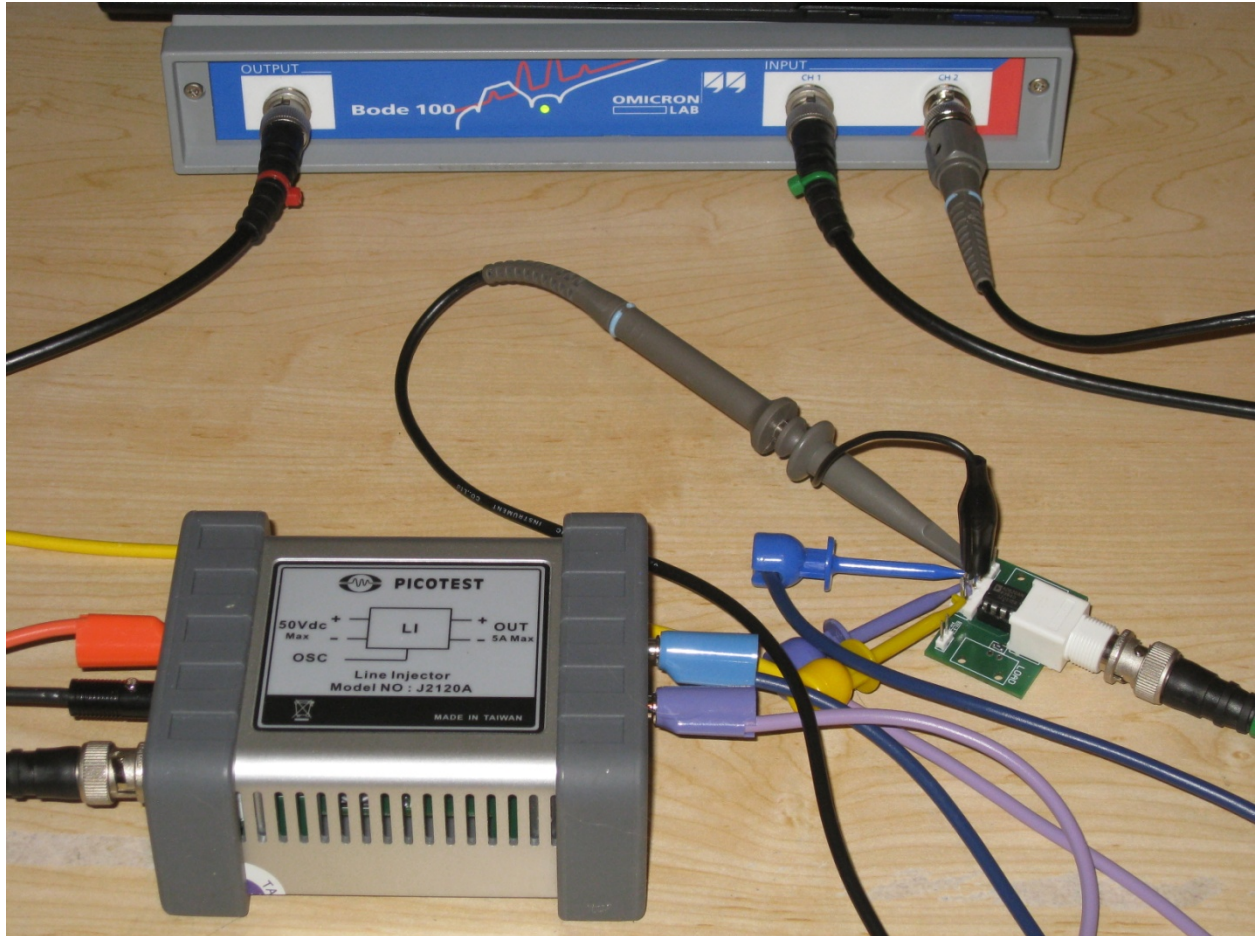


## Measuring Op Amp PSRR



In this article we detail the process of measuring a key performance characteristic of operational amplifiers (Op Amps), power supply rejection ratio or “PSRR”, using either the Picotest J2120A Line Injector or the J2111A Current Injector and the OMICRON Lab Bode 100 VNA.

One characteristic of Op Amps that limits the performance of low noise and precision circuits is PSRR. The output of the Op Amp is not only a function of the inputs, but also of the power supply. The PSRR of Op Amps is a frequency dependent function, so that the higher the signal frequency, the lower the PSRR is.

In general, the manufacturers provide high fidelity data for PSRR, which might lead to the question of why we should measure it. There are several reasons that we should measure it ourselves.

The first reason is that the manufacturer generally provides balanced signals to both the +Vcc and -Vee pins simultaneously. The reason for this is to eliminate any common mode effects from entering into the PSRR measurement. While this makes sense, it has little to do with the way we will implement the Op Amp in our circuit. A second reason is that the PSRR is a function of the signal amplitude and in most cases the signals we will have on our power supply lines will be much smaller than in the testing performed by the manufacturer. The PSRR is also a function of circuit gain and finally the printed circuit board can influence the PSRR.

The simplest injector for the PSRR test is the line injector, which can only be used for positive voltages, or +Vcc. The use of the J2120A minimizes ground currents, allowing the measurement to be made without the addition of common mode transformers to isolate ground currents. A setup diagram for the measurement is shown in Figure 1

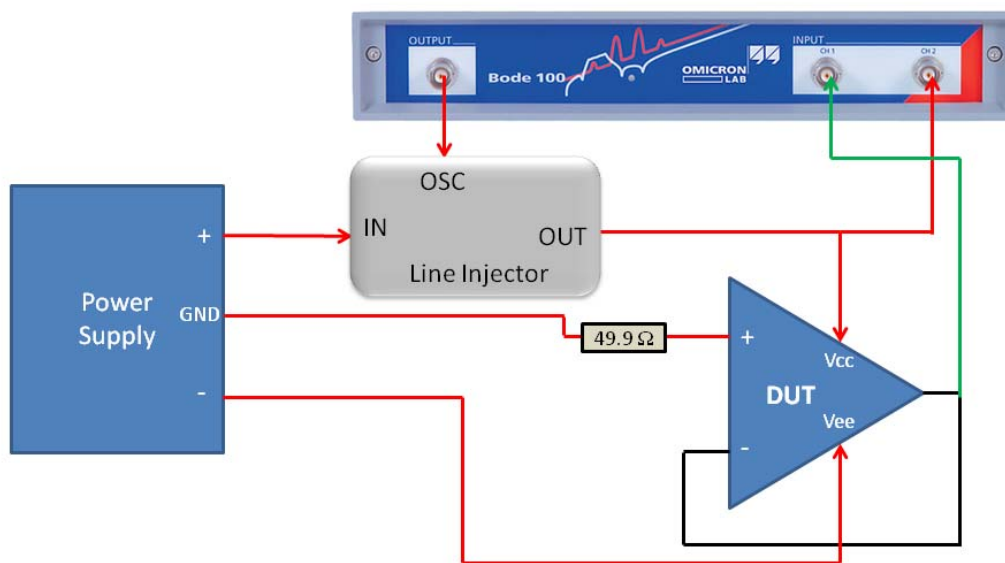


Figure 1 Setup Diagram of Op Amp PSRR with J2120A

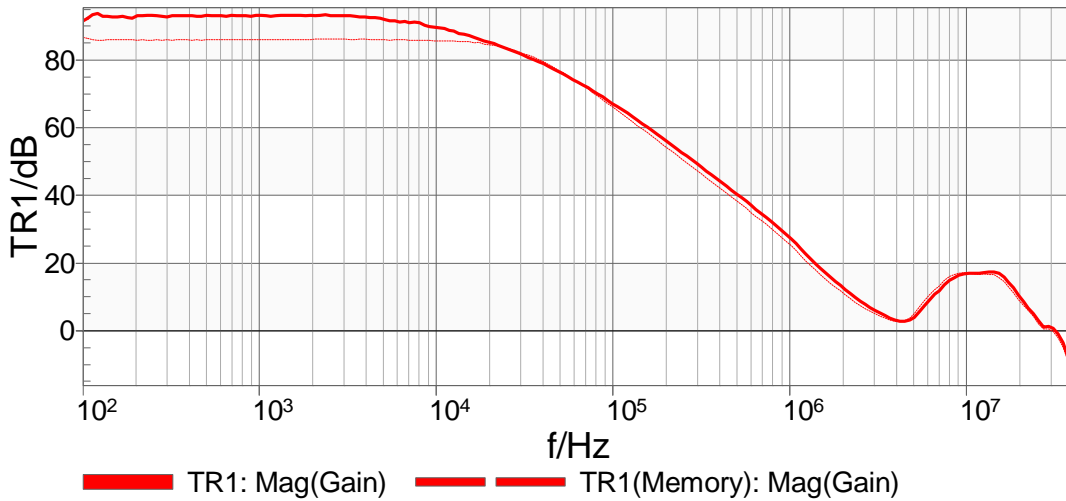


Figure 2 AD820 Op Amp PSRR with J2120A Line Injector  $V_{cc}=5V$  (dashed) and  $15V$  (solid)

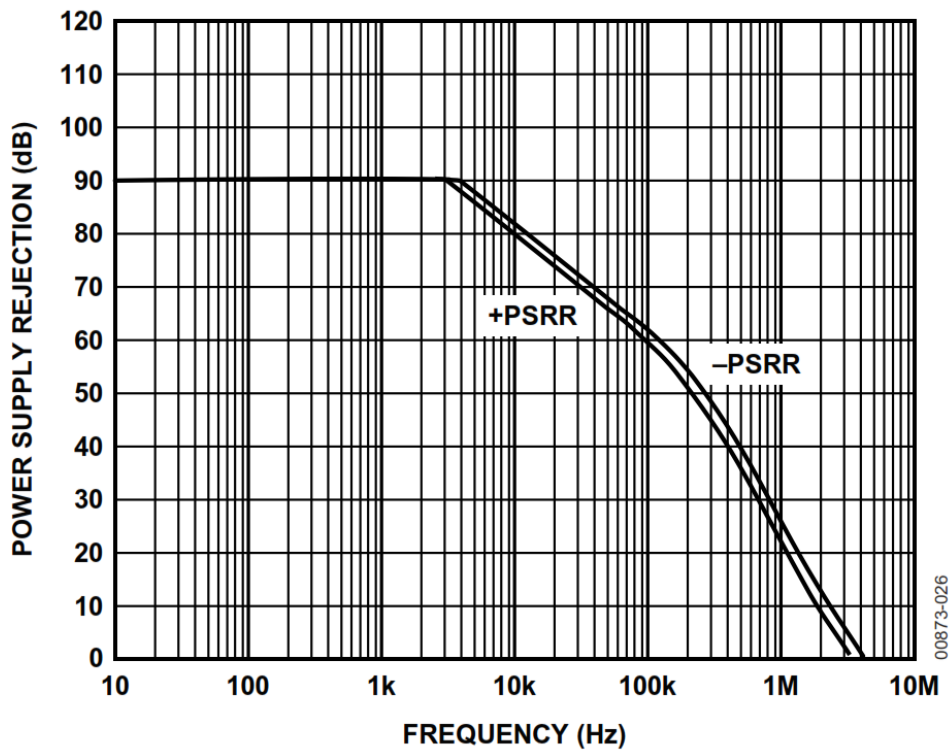


Figure 3 AD820 Op Amp PSRR from datasheet

The measurement can also be made with the J2111A current injector. The J2111A offers the advantages that the measurement can be made on either the  $+V_{cc}$  or  $-V_{ee}$  power supply pins. The J2111A does have ground currents, which can interfere with the measurement, and so a 100 Ohm resistor is added in

series with the power supply to isolate these ground currents. The connection diagram for the PSRR measurement using the J2111A is shown in figure 4.

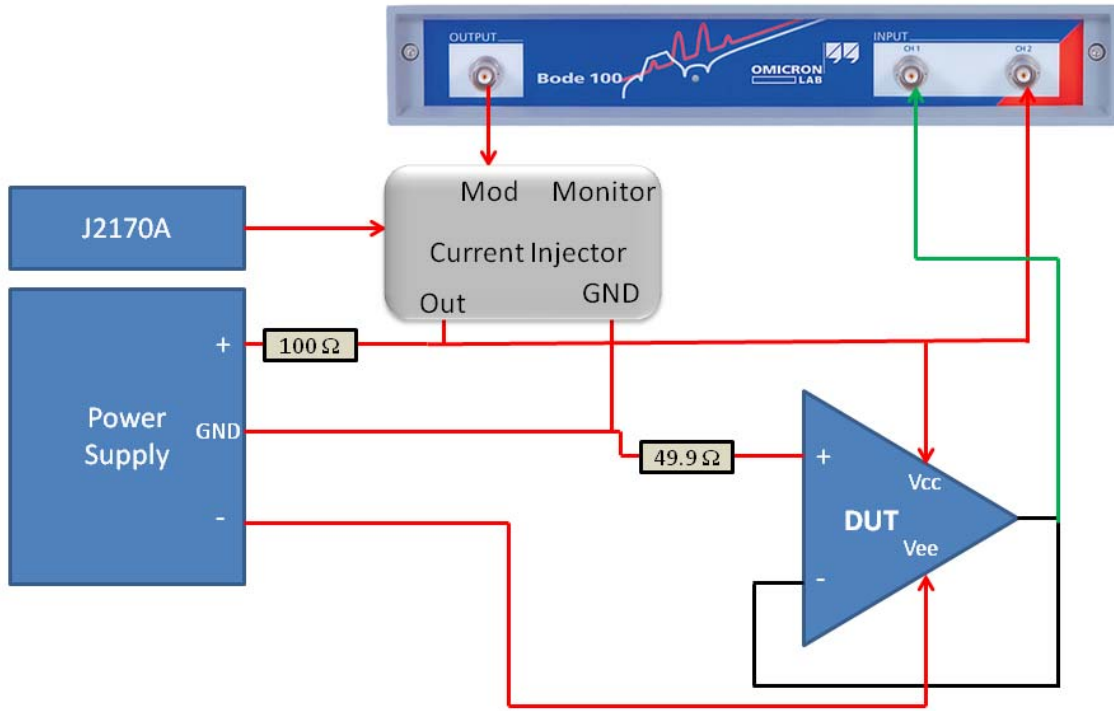


Figure 4 AD820 Op Amp PSRR with J2111A Current Injector and J2120A Line Injector

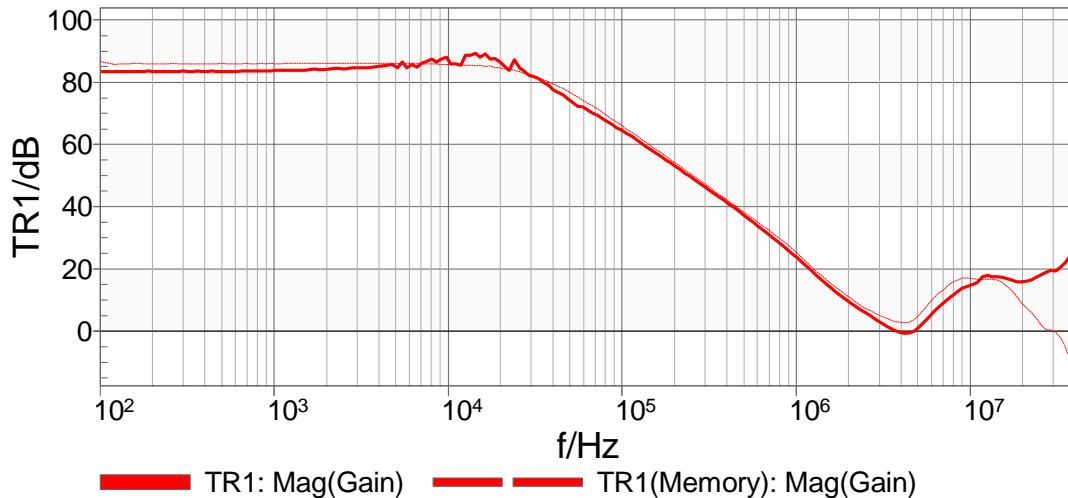


Figure 5 AD820 Op Amp PSRR with J2111A Current Injector (solid) and J2120A Line Injector (dashed)

We have shown how simple it is to measure the PSRR of an Op Amp using the Picotest signal injectors with the OMICRON Lab Bode 100 VNA. The AD820 was selected, since it offers approximately 90 dB PSRR, showing off the dynamic range and noise floor of the measurement. The measured results are in good agreement with the graphs shown in the manufacturers datasheet.