Precision Rectifiers
The power-supply rectifiers do not work with very small signals.

Precision rectifier has ideal \( V_i - V_o \) properties.

Superdiode precision half-wave rectifier
Precision rectifier has ideal Vi-Vo properties.

Improved version of the precision half-wave rectifier
An Application: Measuring AC voltage

Fig. 12.35  A simple ac voltmeter consisting of a precision half-wave rectifier followed by a first-order low-pass filter.
An Application: Measuring AC voltage

For a sine wave input with peak value $V_p$, the output of the half-wave rectifier is a half sine wave with peak $V_p R_2/R_1$. This half-wave has the following DC component:

$$V_1 = -\frac{1}{\pi} \int_0^{\pi} V_p \left( \frac{R_2}{R_1} \right) \sin t dt = -\frac{V_p}{\pi} \frac{R_2}{R_1}$$

The first order low pass filter can pick up the DC component with the gain $R_4/R_3$. Hence the output is:

$$V_0 = -\frac{V_p}{\pi} \frac{R_2}{R_1} \frac{R_4}{R_3}$$
Precision Full-Wave Rectifier

Fig. 12.36  Principle of full-wave rectification.
Fig. 12.37  (a) Precision full-wave rectifier based on the conceptual circuit of Fig. 12.36.  
(b) Transfer characteristic of the circuit in (a).
A Precision bridge Rectifier for Instrumentation Applications

Fig. 12.38 Use of the diode bridge in the design of an ac voltmeter.
When $v_i$ exceed $V_o$, $D$ will conduct and make $V_o$ follow $V_i$. $C$ will be charged. When $V_i$ goes over its peak and drops, $V_i < V_o$, so the op amp is negative saturated, and $D$ will cut off. This will keep $V_o$ at the peak value (if the discharge is slow). Therefore after some time the output will be the peak input.
Fig. 12.40  A buffered precision peak rectifier.