

**Table 3–1** Operational-Amplifier Circuits That May Be Used as Compensators

	Control Action	$G(s) = \frac{E_o(s)}{E_i(s)}$	Operational-Amplifier Circuits
1	P	$\frac{R_4}{R_3} \frac{R_2}{R_1}$	
2	I	$\frac{R_4}{R_3} \frac{1}{R_1 C_2 s}$	
3	PD	$\frac{R_4}{R_3} \frac{R_2}{R_1} (R_1 C_1 s + 1)$	
4	PI	$\frac{R_4}{R_3} \frac{R_2}{R_1} \frac{R_2 C_2 s + 1}{R_2 C_2 s}$	
5	PID	$\frac{R_4}{R_3} \frac{R_2}{R_1} \frac{(R_1 C_1 s + 1) (R_2 C_2 s + 1)}{R_2 C_2 s}$	
6	Lead or lag	$\frac{R_4}{R_3} \frac{R_2}{R_1} \frac{R_1 C_1 s + 1}{R_2 C_2 s + 1}$	
7	Lag-lead	$\frac{R_6}{R_5} \frac{R_4}{R_3} \frac{[(R_1 + R_3) C_1 s + 1] (R_2 C_2 s + 1)}{(R_1 C_1 s + 1) [(R_2 + R_4) C_2 s + 1]}$	