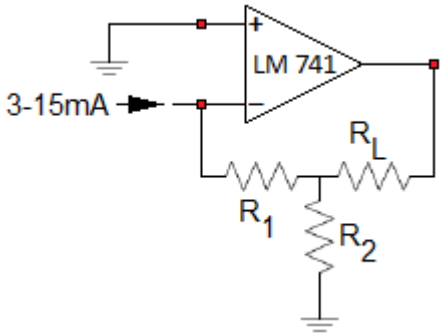
Electronics

Opamp as a current amplifier

Problem 1.- For a control application you have a new instrument with a 4-20 mA input, and an existing current loop with the non-standard 3-15mA. Design a circuit that couples the new instrument without loading the old loop.

Solution: We can use the current amplifier shown below, which has very small input impedance, so it will not load the existing loop.



To get 4-20mA in the load resistance the gain should be 4/3, so:

$$\frac{4}{3} = 1 + \frac{R_1}{R_2} \rightarrow R_2 = 3R_1$$

Any reasonable values of resistance would work, like 100ohm and 300ohm. We should not use too large resistances. For example if R_1=10kohm we would have 150V for 15mA, which the opamp cannot handle.

Problem 1a.- In a chemical plant, you have a control that requires a current in the range 3-15mA but the existing loop has the normal 4-20mA standard. Design a circuit that couples the instrument to the loop without loading it.

Solution: This problem is the reverse of the previous one, but notice that the solution there only works for gains greater than 1. In this case, we can solve the problem as follows: