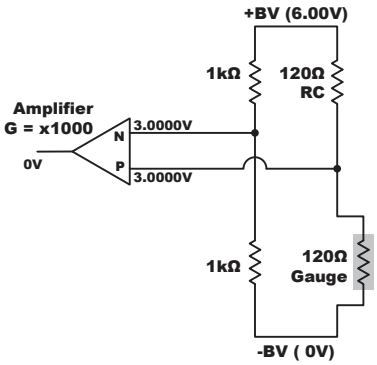
Correctly Wiring a 1/4 Bridge Strain Gauge

Of the numerous Strain Gauge connections available the 1/4 Bridge connection is the one that can cause the most problems. This is due to the fact that any wiring used to connect the remote 1/4 bridge strain gauge to the amplifier actually forms part of the bridge circuit. Incorrectly wiring the remote gauge can result in the bridge being so unbalanced that it is very hard for the Amplifiers balance circuitry to bring the output to zero. Even if the Amplifiers output can be brought to zero, the output will drift as the temperature of wiring to the remote gauge changes. The longer the wiring the worse the drift. The diagrams below explain the correct 3 wire connection method to a remote 1/4 Bridge Gauge, and explain the errors caused when what appears to be a much 'simpler' two wire connection is chosen.

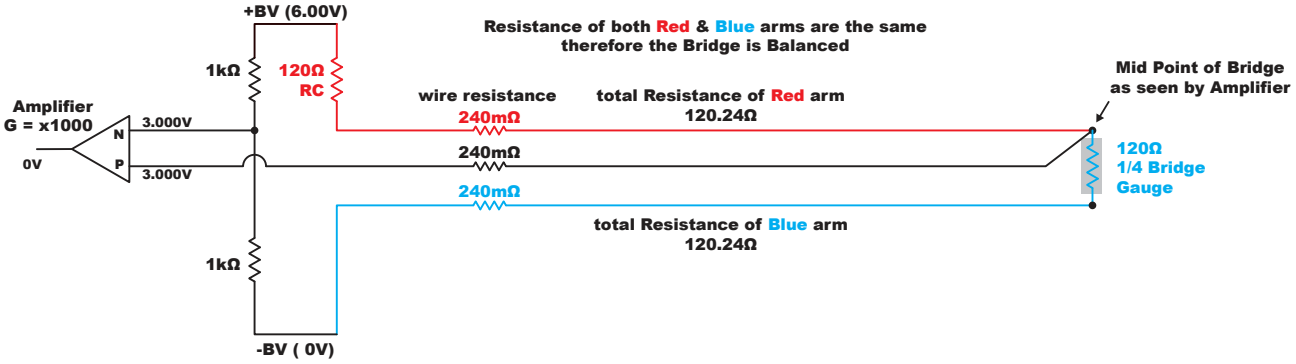


Ideal 1/4 Bridge Connection with no lead resistance between Amplifier & Gauge

The diagram shows a bridge made up of two precision 1K internal completion resistors, one precision 120R internal completion resistor (RC) and one external 120R single active strain gauge because the resistance of the arms of the Bridge are balanced (2 x 1K & 2 x 120R), the voltage seen by the Amplifier is identical (3.000V) on both the P & N inputs. Therefore the Bridge is balanced and the Amplifier output will be very close to 0.000V

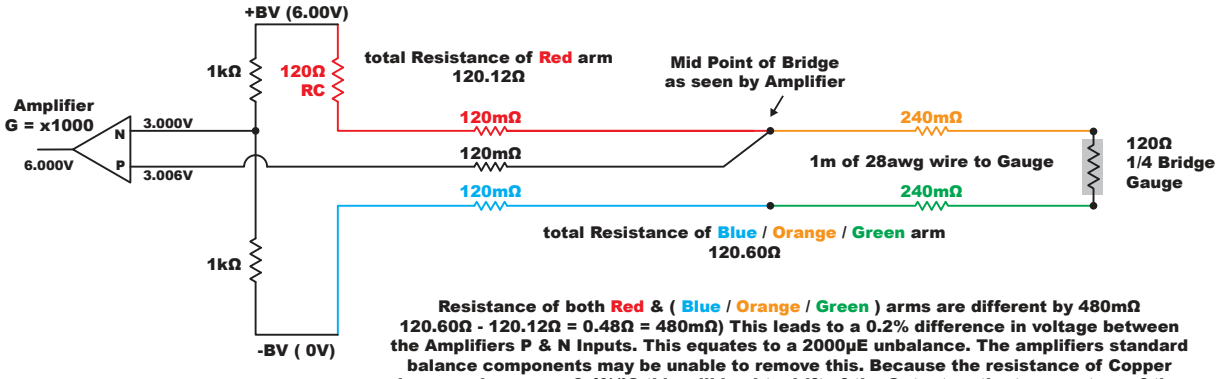
Typical 1/4 Bridge Connection with lead resistance between Amplifier & Gauge

Under most circumstances the 1/4 Bridge Gauge will be mounted remote of the amplifier and will require joining by a number of wires. Although the Strain Gauge is only a 2 terminal device it is important that 3 wires are used to make the connection to the Amplifier. In a 1/4 Bridge connection there is no way in avoiding the wiring from being in series with the remote 1/4 Bridge Gauge. To ensure a balanced connection it is vital that the 3 wire connection shown below is used. This places one length of wire in series with the Gauge and one length in series with the Completion Resistor. This ensures that the resistance of both Arms remains as identical as possible, and balancing the Bridge is possible. A third wire picks off the true mid point of the Bridge and returns it to the Amplifier input. Even though this wire is resistive (240mΩ) the Amplifier has a very high input impedance (1MΩ) so this causes virtually no error.



Incorrect wiring of a 1/4 Bridge Strain Gauge

Strain Gauges are available with two pre-attached insulated wires which maybe 1m (or more) in length. Quite often 28AWG copper wire is used. This would have a resistance of around 240mΩ per meter. These wires should NOT be used to extend a 3 wire connection to a Bridge Amplifier doing so will cause large unbalances that the Amplifiers balance circuitry may be unable to correct. This would result in the Amplifier output not being able to be zeroed.



Resistance of both Red & (Blue / Orange / Green) arms are different by 480mΩ 120.60Ω - 120.12Ω = 0.48Ω = 480mΩ) This leads to a 0.2% difference in voltage between the Amplifiers P & N Inputs. This equates to a 2000µE unbalance. The amplifiers standard balance components may be unable to remove this. Because the resistance of Copper increase by approx 0.4%/°C this will lead to drift of the Output as the temperature of the two extension wires fluctuates.

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