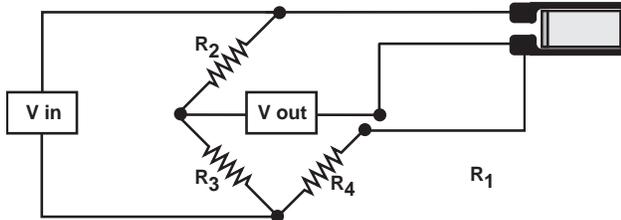


## External Bridge Completion For Strain Gage Circuits

The Wheatstone bridge used in most strain gage measurement circuits usually consists of (a) the gages for actively measuring the strains and (b) precision resistors incorporated in the measuring instrument for completing the circuit, as shown below.



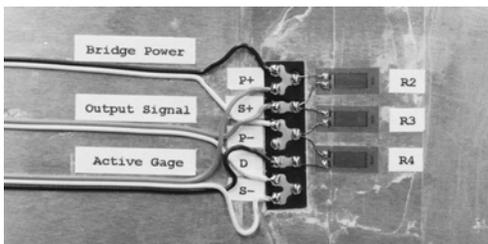
Typical three-wire quarter-bridge strain-gage circuit requires three bridge completion resistors.

Sometimes, however, the circuit must be completed external to the instrument. The most common reason, of course, is when bridge completion resistors are not built into the instrument; but accuracy considerations can also be a factor. In certain test conditions, external bridge completion can reduce the effects of noise pick-up in the leadwire system, or eliminate the effects of contact resistance. Suitable elements for completion of the bridge outside the instrument in these cases include:

- Bonded strain gages
- Precision resistors
- Bridge completion modules (BCM's)

Functional differences, along with differences in product configuration and installation techniques, provide both advantages and disadvantages for each type of external bridge completion.

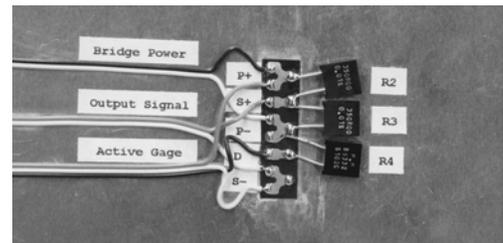
### BONDED STRAIN GAGES



Bonding strain gages to the test part (individually or with multiple grids on the same backing) is a good choice when large changes in test temperature are expected, since this is the only completion method that will provide temperature compensation. Installation is relatively easy and inexpensive. Both active and completion gages must be of

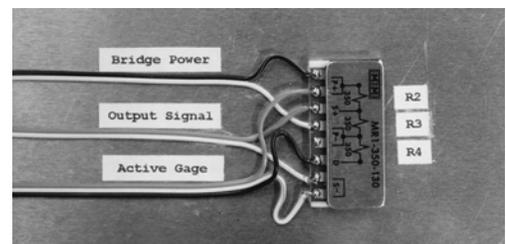
the same alloy, with the same S-T-C number. For highest accuracy, all should be from the same production batch of foil. Of course, the temperature of gages in adjacent arms of the bridge must always be identical for effective temperature compensation. Further, care must be taken to install the completion gages in a region that (a) is free from applied strains, and (b) can undergo thermal expansion without any mechanical restraint.

### PRECISION RESISTORS



Temperature-stable precision resistors are an alternative to strain gages for bridge completion. They are particularly useful when nonstandard bridge resistances are required, and they are also beneficial when higher power levels must be dissipated within the bridge circuit. Precision resistors are designed to be very insensitive to temperature and, therefore, cannot be used to provide compensation for any thermal output from the active gages in the circuit. Unlike strain gages, precision resistors are usually not attached directly to the test part. Rather, a terminal strip is typically bonded to the part for anchoring the resistor leads. As with strain gages, care must be taken to protect both the leads and solder joints from the test environment, making installation somewhat demanding.

### BRIDGE COMPLETION MODULES



Micro-Measurements MR-Series Bridge Completion Modules (BCM's) were introduced in 1989. Since then, they have become the preferred method of bridge completion at the gage site when temperature compensation within the bridge is not required. Even more insensitive to temperature than precision resistors, they are certainly the easiest to install. These networks of matched resistive grids come ready for use with quarter and/or half bridges of active gages. Their integral solder tabs minimize the number of solder connections required to complete the circuit, while a foam

## External Bridge Completion For Strain Gage Circuits

tape attaches each BCM to the test part. This foam decouples the BCM from any strains present in the underlying surface.

While the subject of external bridge completion is too broad to adequately cover here, much more detailed information is available in the technical literature. The Tech Notes on thermal output in strain gages (TN-504, Strain Gage Thermal Output and Gage Factor Variation with Temperature) and noise in strain gage circuits (TN-501, Noise Control in Strain Gage Measurements) are particularly useful in this regard. And, as always, our Applications Engineering Department will be pleased to help you select the right compensating strain gage, precision resistor, or bridge completion module for your particular strain measurement application.