STRAIN GAUGE INSTALLATIONS
GENERAL INFORMATION

A wide variety of strain gauges for various industrial, scientific or transducer applications have been made available for our customers. OMEGA® strives to keep the entire line in stock so the strain gauges are available for immediate delivery.

The OMEGA line of strain gauges offer a broad selection of precision strain gauges that are grouped into three basic sections shown below. Plus, for OEM users, OMEGA customises any gauge to match your requirements. Special tab placements, resistance, grid shape, grid or backing dimensions plus most gauges are available with A to Z creep values for high precision applications.

General Purpose Precision Strain Gauges

General purpose precision strain gauges are encapsulated constantan foil strain gauges offered in a wide variety of patterns for scientific, industrial and experimental stress analysis. These precision strain gauges can be used for experimental stress analysis monitoring industrial equipment or various scientific applications. In the General purpose strain gauge section you will find the strain gauge patterns next to the part numbers so that you will be able to see the geometry of the strain gauge. The gauge dimensions are also provided in and SI (Metric, mm) and US Customary (English, inches) units. General purpose precision strain gauges are offered in linear patterns, dual parallel-grid patterns, Tee rosettes (0/90°), rectangular or delta (45° or 60°), stacked or planar rosettes, and shear patterns.

Transducer Quality Strain Gauges

Transducer-quality strain gauges are for customers who are manufacturing transducers or similar sensing devices. Transducer-quality strain gauges feature a tighter tolerance on the carrier trim dimensions which allows the carrier edge to be used for strain gauge alignment if required. They also feature tighter tolerances on nominal resistance values. These gauges can be creep adjusted to meet a transducer manufacturer's specifications and they can be customised to the unique requirements of a transducer. They are also excellent gauges off-the-shelf for experimental stress analysis and/or strain verification projects.

Karma, Strain Gauges

OMEGA offers a full line of Karma Strain Gauges. Karma Strain gages can be used for various static and dynamic applications. Karma strain gauges are used for transducer applications where long term stability or higher temperature use is required. When used at room temperature, for static strain measurements, the transducer will have very good stability for months or even for years. Karma strain gauges are also suggested for static strain measurement over a wide temperature range from -75 to 200°C (-100 to 392°F) due to its good linearity over this wide temperature range. Karma strain gauges are often used for fatigue-rated transducer designs. The fatigue life of Karma alloy tends to be much better than constantan, and so transducers using Karma strain gauges provide good fatigue life. Karma is a nickel-chromium alloy, and was selected as a strain gauge material for it's modulus-compensating capabilities which tends to significantly reduce span shift in transducer design. With Karma alloys, the gauge factor tends to decrease with increasing temperature. This effect of decreasing elastic modulus will tend to reduce the span shift. Karma alloys do have drawbacks, for example they are difficult to solder without special fluxes. OMEGA has the solution. We have eliminated this problem by offering our Karma Strain Gauges with copper plated solder pads. No special flux or procedures are needed.

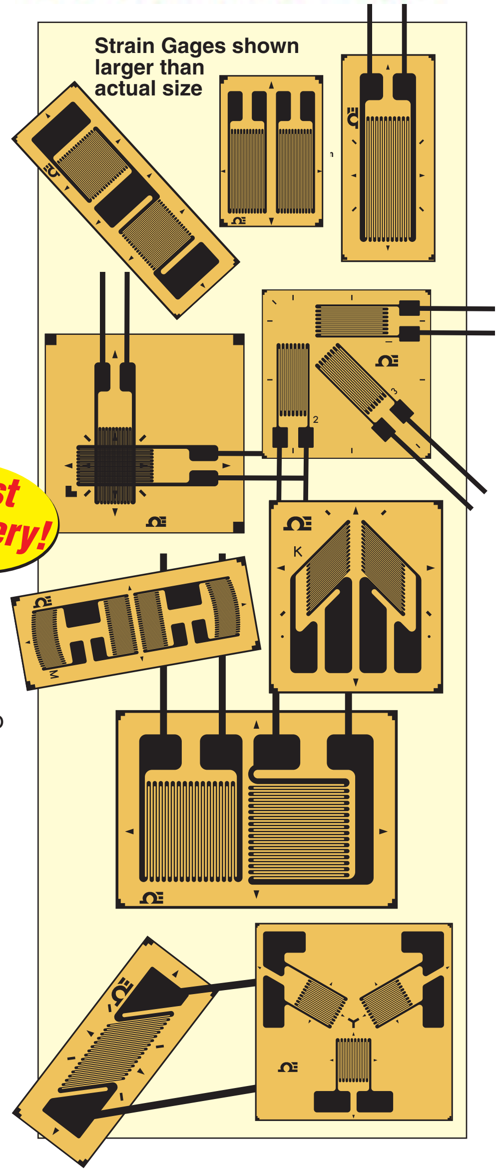
Fast Delivery!

Custom Strain Gauges for OEM Applications

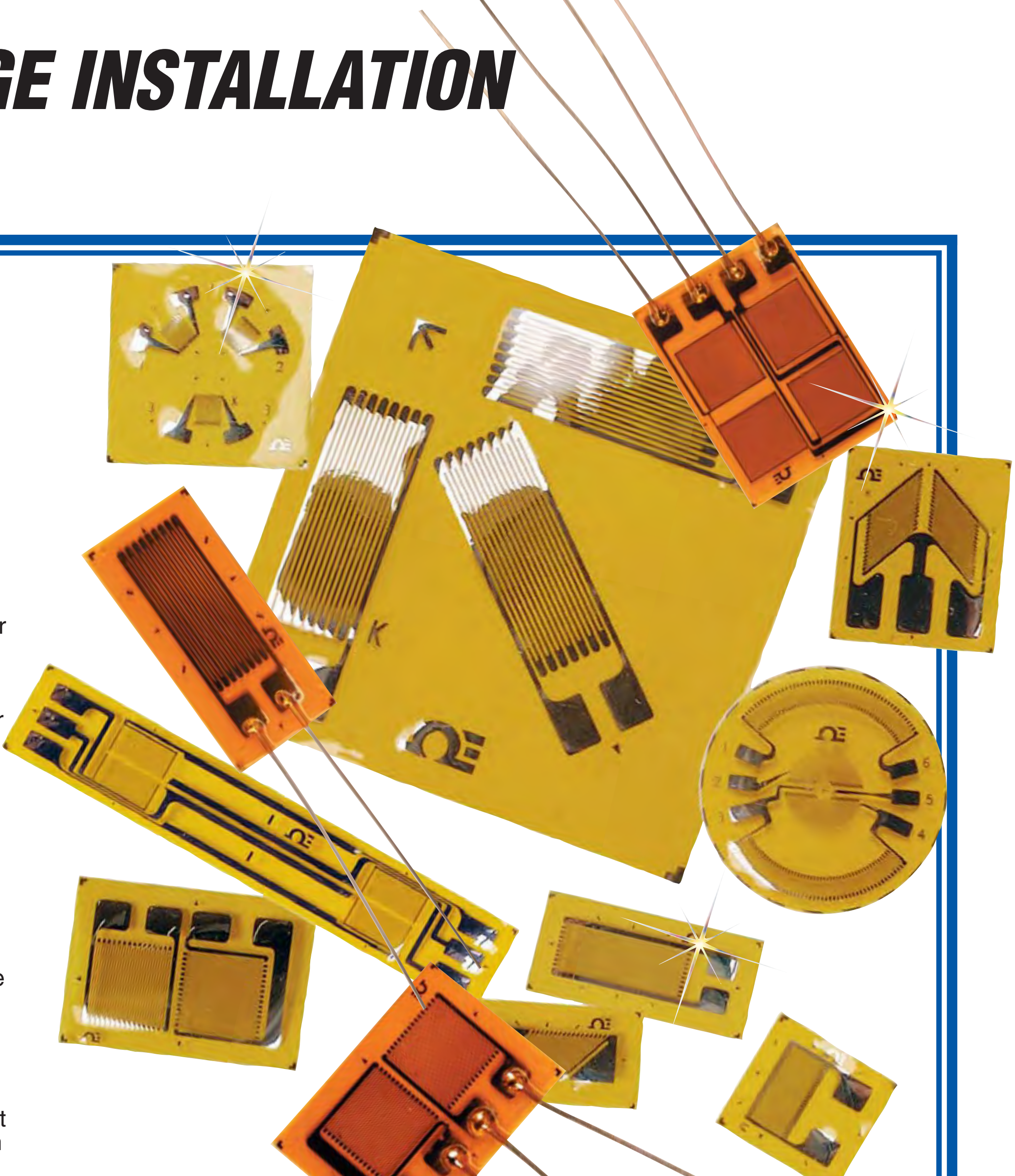
OMEGA can also make custom strain gauges for OEM applications. We understand that our customers may require strain gauges that are manufactured to their specifications. Custom strain gages can be designed to simplify strain gauge installation or for a specific application or for an environment where space is limited. If you need a modification of a standard strain gauge pattern, or a non-standard lead length or material, or you need relocation of a solder pad, or a custom trim dimension, please let us know. If you need the creep modified on a strain gauge to match the characteristics of the spring element being used to maximize the transducer performance, call us. OMEGA can provide strain gauges with modified creep compensation, higher or lower as required by your transducer test results. OMEGA can also provide ½ or full Wheatstone bridge designs or custom rosettes. Send OMEGA your custom strain gauge drawing along with your specifications and the quantity of strain gauges required. A quotation for the custom strain gauges can be provided. A custom part number can be created for your future needs to make reordering custom strain gauges fast and easy. Call us here at OMEGA! We are here to assist you.

Contact OMEGA at:

FREE PHONE (UK ONLY)
0800-488-488


Strain Gages shown larger than actual size

STRAIN GAUGE INSTALLATION
TECHNICAL DATA



STRAIN GAUGE MEASUREMENT

The most universal measuring device for the electrical measurement of mechanical quantities is the strain gauge. Several types of strain gauges depend for their operation on the proportional variance of electrical resistance to strain: the piezoresistive or semi-conductor gauge, the carbon resistive gauge, the bonded metallic wire, and foil resistance gauges. The bonded resistance strain gauge is by far the most widely used in experimental stress analysis. This gauge consists of a grid of very fine wire or foil bonded to a backing or carrier matrix. The electrical resistance of the grid varies linearly with strain. In use, the carrier matrix is bonded to the surface, force is applied, and the strain is found by measuring the change in resistance. The bonded resistance strain gauge is low in cost, can be made with a short gauge length, is only moderately affected by temperature changes, has small physical size and low mass, and has fairly high sensitivity to strain. In a strain gauge application, the carrier matrix and the adhesive must work together to transmit the strain from the specimen to the grid. In addition, they combine to function as an electrical insulator and heat dissipator. The three primary factors influencing gauge selection are: operating temperature, state of strain (gradient, magnitude, and time dependence), and the stability required.

Because of its outstanding sensitivity, the Wheatstone bridge circuit is the most frequently used circuit for static strain measurement. Ideally, the strain gauge is the only resistor in the circuit that varies, and then only due to a change in strain on the surface. There are two main methods used to indicate the change in resistance caused by strain on a gauge in a Wheatstone bridge. Often, an indicator will rebalance the bridge, displaying the change in resistance required in micro-strain. The second method calls for installation of an indicator, calibrated in micro-strain, that responds to the voltage output of the bridge. This method assumes a linear relationship between voltage out and strain, an initially balanced bridge, and a known VIN. In reality, the VOUT-strain relationship is nonlinear, but for strains up to a few thousand micro-strain, the error is not significant.

POTENTIAL ERROR SOURCES

In a stress analysis application, the entire gauge installation cannot be calibrated as can some pressure transducers. Therefore, it is important to examine potential error sources prior to taking data. Some gauges may be damaged during installation. It is important therefore to check the resistance of the strain gauge prior to applying stress. Electrical noise and interference may alter your readings. Shielded leads and adequately insulating coatings may prevent these problems. A value of less than 500 MΩ (using an ohmmeter) usually indicates surface contamination. Thermally induced voltages are caused by thermocouple effects at the junction of dissimilar metals within the measurement circuit. Magnetically induced voltages can occur when wiring is located in a time-varying magnetic field.

Magnetic induction can be controlled by using twisted lead wires and forming minimum but equal loop areas in each side of the bridge.

Temperature effects on gauge resistance and gage factor should be compensated for as well. This may require measurement of temperature at the gauge itself, using thermocouples, thermistors, or RTDs. Most metallic gauge alloys, however, exhibit a nearly linear gauge factor variation with temperature over a broad range, which is less than ±1% within ±100°C/180°F.

PRIME STRAIN GAUGE SELECTION CONSIDERATIONS

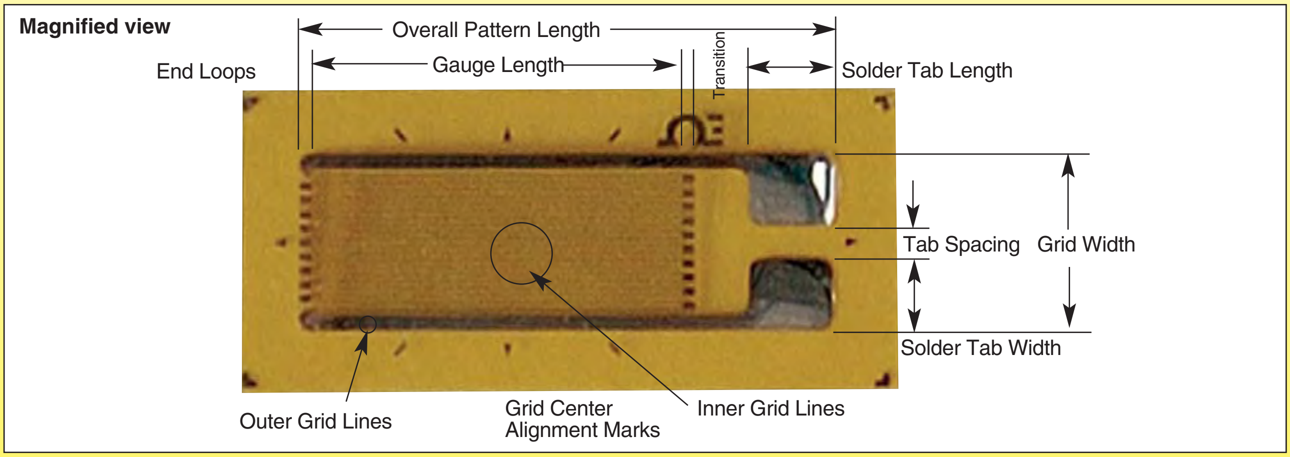
- Gauge Length
- Number of Gauges in Gauge Pattern
- Arrangement of Gauges in Gauge Pattern
- Grid Resistance
- Strain-Sensitive Alloy
- Carrier Material
- Gauge Width
- Solder Tab Type
- Configuration of Solder Tab
- Availability

STRAIN GAUGE INSTALLATION

THE STRAIN GAUGE IS ONE OF THE MOST IMPORTANT TOOLS

The strain gauge is one of the most important tools used to apply electrical measurement techniques to the measurement of mechanical quantities. As their name indicates, they are used for the measurement of strain. As a technical term, “strain” is comprised of tensile and compressive strain, distinguished by a positive or negative sign. Thus, strain gauges can be used to detect expansion as well as contraction.

The strain of a body is always caused by an external influence or an internal effect. Strain can be caused by forces, pressures, moments, heat, structural changes of the material and the like. If certain conditions are fulfilled, the amount or the value of the influencing quantity can be derived from the measured strain value. In experimental stress analysis, this feature is widely exploited. Experimental stress analysis uses the strain values measured on the surface of a specimen or structural part to determine the stress in the material and also to predict its safety and endurance. Special transducers can be designed for the measurement of forces or other derived quantities, *e.g.*, moments, pressures, accelerations, displacements, vibrations and others. The transducer generally contains a pressure-sensitive diaphragm with strain gauges bonded to it.



STRAIN GAUGE DIMENSIONS

The active grid length, in the case of foil gauges, is the net grid length without the tabs, and includes the return loops of the wire gauges.

Carrier dimensions are designed by OMEGA® for optimum function of the strain gauge.

STRAIN GAUGE RESISTANCE

The resistance of a strain gauge is defined as the electrical resistance measured between the two metal ribbons or contact areas intended for the connection of measurement cables. The range covers strain gauges with nominal resistances of 120, 350, 600 and 700 Ω.

GAUGE FACTOR (STRAIN SENSITIVITY)

The strain sensitivity k of a strain gauge is the proportionality factor between the relative change of the resistance.

Strain sensitivity is a figure without dimension and is generally called gauge factor.

The gauge factor of each production lot is determined by sample measurement and is given on each package as the nominal value with its tolerance.

REFERENCE TEMPERATURE

The reference temperature is the ambient temperature for which the technical data concerning a strain gauge are valid, unless temperature ranges are given.The technical data quoted for strain gauges are based on a reference temperature of 23°C (73°F).

TEMPERATURE CHARACTERISTICS

Temperature-dependent changes in specific strain gauge grid resistance occur in the applied gauge owing to the linear thermal expansion coefficients of the grid and specimen materials. These resistance changes appear to be mechanical strain in the specimen. The representation of apparent strain as a function of temperature is called the temperature characteristic of the strain gauge application.

In order to keep apparent strain through temperature changes as small as possible, each strain gauge is matched during production to a certain linear thermal expansion coefficient. OMEGA offers strain gauges with temperature characteristics matched to ferritic steel and aluminium.

SERVICE TEMPERATURE RANGE

The service temperature range is the range of ambient temperature wherein the use of a strain gauge is possible without permanent change in the measurement properties. Service temperature ranges are different, whether static or dynamic values are to be sensed.

MAXIMUM PERMITTED RMS BRIDGE ENERGIZING VOLTAGE

The maximum values quoted are permitted only for appropriate application on materials with good conduction (*e.g.*, steel of sufficient thickness) if room temperature is not exceeded. In other cases, temperature rise in the measuring grid area may lead to measurement error. Measurement on plastics and other materials with bad heat conduction requires reduction of the energising voltage or of the duty cycle (pulsed operation).

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