

TECHNICAL TERMS

GAUGE LENGTH

This dimension represents the actual grid length in the sensitive direction.

GAUGE RESISTANCE

Gauge resistance in ohms (Ω) expresses electrical resistance under free conditions at room temperature, unbonded as supplied.

GAUGE FACTOR

The amount shown in the following equation is called the gauge factor. In this equation, ϵ indicates the strain generated due to uniaxial stress in the direction of the strain gauge axis. $\Delta R/R$ shows the ratio of resistance change due to strain ϵ . This is generally indicated by specifying the Poisson's ratio of the test specimen used.

$$K = \frac{\Delta R/R}{\epsilon}$$

, where K : Gauge Factor
 ϵ : Mechanical strain
 R : Gauge Resistance
 ΔR : Resistance variation

TRANSVERSE SENSITIVITY (Kt)

The gauge also exhibits sensitivity in the direction perpendicular to the axial direction. The amount shown in the following equation due to the uniaxial strain (ϵ_t) in the direction perpendicular to the gauge axis, and the resistance variation generated thereby, is called transverse sensitivity (Kt).

$$K_t = \frac{\Delta R/R}{\epsilon_t} \times 100$$

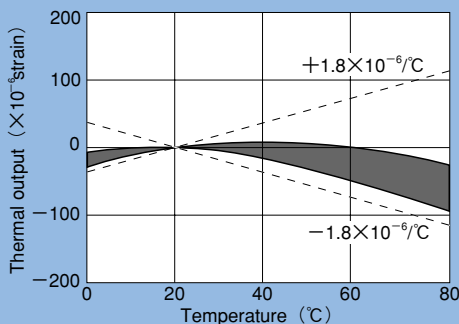
, where K_t : Transverse sensitivity
 ϵ_t : uniaxial strain

TEMPERATURE COMPENSATION RANGE

This refers to a temperature range in which the thermal output of a self-temperature compensated gauge conforms to the requirement. Compensation is accurate within approximately $\pm 1.8 \times 10^{-6}$ strain/ $^{\circ}\text{C}$. For greater accuracy, corrections can be made using the curves for apparent strain vs. temperature which are supplied with each package of gauge.

SELF-TEMPERATURE COMPENSATED GAUGES

The ambient temperature change may cause a variation of strain gauge resistance. The amount of variation is subject to the thermal expansion of both the strain gauge material and the specimen, together with the thermal coefficient of resistance of the gauge material. Self-temperature compensated gauges are commonly used to minimize the gauge thermal output when bonded to test specimens having a specific linear thermal expansion coefficient in the specified temperature range. The following graph shows an example of thermal output.



OPERATIONAL TEMPERATURE RANGE

The temperature range listed in the Normal column of the selection is for stable static measurement. The Short-Term or Special column indicates the range for dynamic measurement, short term measurement or measurement without temperature change.

STRAIN LIMIT

The strain limit or allowable elongation percent depends on the properties of the wire, foil material, backing, and adhesive used. In general, the strain limit for a gauge with a short gauge length is slightly lower than that for one with a longer gauge length in the same series.

FATIGUE LIFE

When strain is repeatedly applied to the gauge, it causes increased resistance under zero strain, peeling-off of the gauge, or disconnection, resulting in failure. The number of repeated cycles that the gauge can endure is called its fatigue life. It is generally indicated by the repetition number under the specified conditions of strain amount and repetition speed as apparent strain drifts to 100×10^{-6} strain from the beginning. The fatigue life of TML gauges depends mainly on the properties of the backing material and adhesive used. This varies somewhat with the size and configuration of the grid. In general, larger gauges exhibit better fatigue performance. It is advisable to use foil gauges where maximum resistance to fatigue is required.

STRAIN GAUGE SHAPE

TML also supplies strain gauges in different patterns for a range of applications. Select the appropriate gauge patterns for your application.

Qty. of elements	1	2	2
Gauge pattern			
Nomenclature	Single element	2-element Cross	2-element Cross
Grid layout	—	Stacked type	Plane type
Qty. of elements	3	3	5
Gauge pattern			
Nomenclature	3-element Rosette	3-element Rosette	5-element Single-axis
Grid layout	Stacked type	Plane type	—

GAUGE LENGTH SELECTION

Different gauge length should be selected depending on the specimen. Gauges with short gauge lengths are used to measure localized strain, while gauges with long lengths can be used to measure averaged stress over a larger area. For a heterogeneous material, a gauge length is required that can average out the irregular stresses in the material. For example, because concrete is composed of cement and an aggregate (gravel or sand, etc.), the length of the gauge used is three times the diameter of the gravel pieces so as to give an averaged evaluation of the concrete.

Gauge length	Gauge applications
0.2~1 mm	For stress concentration measurement
2~6 mm	For metal and general use
10~20 mm	For mortar, wood, FRP, etc.
30~120 mm	For concrete

FREQUENCY RESPONSE

The frequency response of a strain gauge is determined by the gauge length and the longitudinal elastic wave speed of the test specimen.

Gauge length (mm)	0.2	1	3	5	10	30	60
Steel [kHz]	660	530	360	270	170	—	—
Concrete [kHz]	—	—	—	—	120	50	20

GAUGE WIDTH

Strain gauges with the same gauge length are also available in a narrower width (FLK-type). Select narrow strain gauges for thin specimens such as cylindrical pipes, etc.

