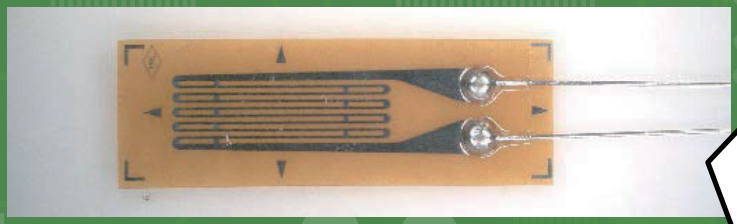
TML

Linear Expansion Coefficient Measurement

Strain Gauge CTE Series

Easy to determine the **linear expansion coefficient** of a material!

Pat. Pend.



NEW

Patent pending (JP 2023-179142)

The CTE series of strain gauges for measuring the coefficient of linear expansion is a product in which the temperature-compensated material of the strain gauge is adjusted to 0×10^{-6}/°C so that the **coefficient of linear expansion of any material can be easily calculated.**

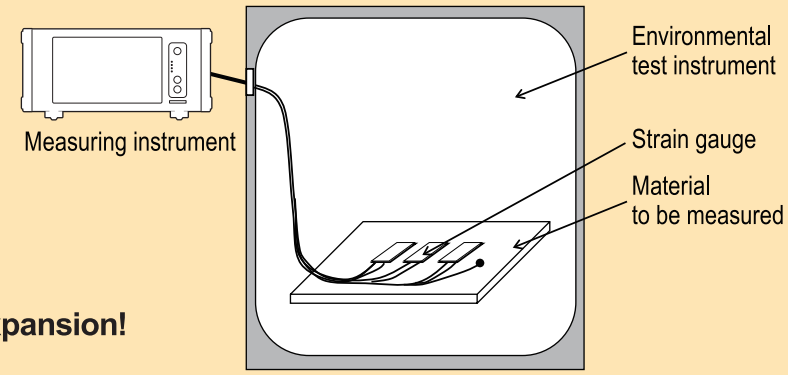
They can also measure **total elongation** (strain due to external force + thermal strain), making them effective for measuring strain on electronic circuit boards.

Measurement method:

Temperature test under no-load conditions

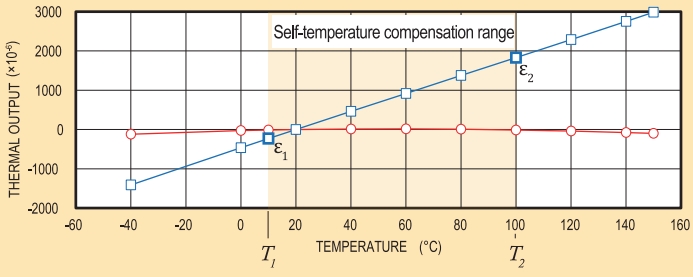
It can be calculated only on the slope of the heat output of the material

Easily determine the coefficient of linear expansion!



Examples of verification

The thermal output of a CTE strain gauge when affixed to aluminium material (A2024) is shown in the diagram below



Linear expansion coefficient of certain materials in the self-temperature compensation range (10-100°C).

$$\text{Linear expansion coefficient} = \frac{\varepsilon_2 - \varepsilon_1}{T_2 - T_1}$$

Test temperature (°C)	Thermal output when affixed to aluminium
$T_1 = 10$	$\varepsilon_1 = -231$
$T_2 = 100$	$\varepsilon_2 = 1831$

$$= \frac{1831 - (-231)}{100 - 10} \fallingdotseq 22.9 \times 10^{-6}/°C$$

—□— Thermal output when CTE gauges are used on aluminium materials

—○— Thermal output when using a CTE gauge on a material with a coefficient of linear expansion βs≒0×10^{-6}/°C → Regard as almost flat

Tokyo Measuring Instruments Laboratory Co., Ltd.

Specification

Operational temperature (°C)	Temperature compensation range (°C)	Applicable adhesive	Material		Strain limit	Fatigue life at room temperature
			Backing	Element		
-30 to +200°C	+10 to +100°C	CN (-30 to +120°C) NP-50 (-30 to +200°C) EB-2 (-30 to +200°C)	Polyimide	Ni-Cr	1% (10000με)	±1500με ≧1×10⁵ times

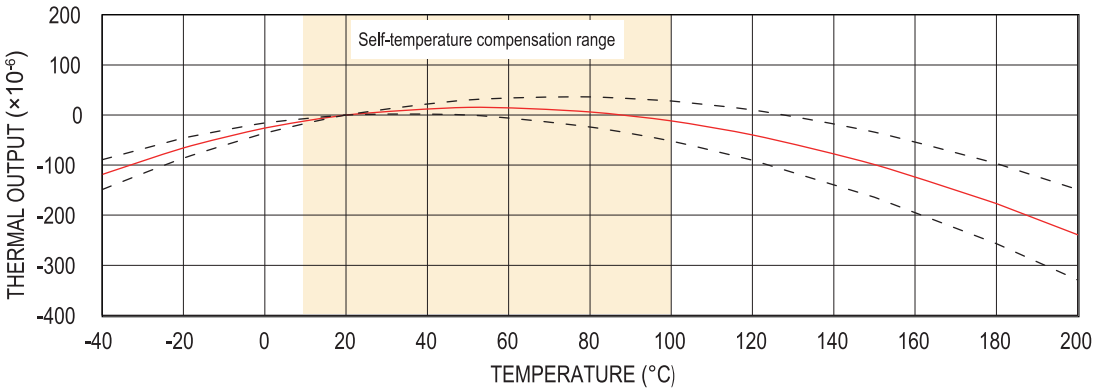
Type	Gauge size(mm)		Backing size(mm)		Resistance Ω
	Length	Width	Length	Width	
CTELA-3	3	1.8	10.5	3.5	120
CTELA-6	6	2.5	15.5	4.5	120
CTELA-3-350	3	3.1	10.2	5.2	350
CTELA-6-350	6	2.8	16	5.3	350

Example of CTE series thermal output

THERMAL OUTPUT (ε_{app} : APPARENT STRAIN)

$$\varepsilon_{app}=-2.62\times10^{1}+1.62\times T^{1}-1.68\times10^{-2}\times T^{2}+2.29\times10^{-5}\times T^{3}-2.98\times10^{-8}\times T^{4}$$

TOLERANCE : ±0.5 [×10⁻⁶/°C)], T : TEMPERATURE



The contents of this catalog are subject to change without prior notice.
The contents of this catalog are as of September 2024. TML Pam E1026A.

TML
URL www.tml.jp/e
8-2, Minami-ohi 6-chome, Shinagawa-ku, Tokyo 140-8560, JAPAN
TEL: +81-3-3763-5614 FAX: +81-3-3763-6128