ε

CTE-SERIE

Strain Gauges

Operational temperature range −30～+200°C Temperature compensation range +10～+100°C	Applicable adhesive NP-50 −30～+200℃ C-1/EB-2 −30～+200℃ CN −30～+120℃

GENERAL USE

CE

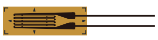
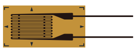
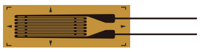
The CTE series of strain gauges for measuring the coefficient of linear expansion is a product in which the temperature-compensated material of the strain gauge is adjusted to 0×10-6/°C so that the coefficient of linear expansion of any material can be easily calculated. They can also measure total elongation (strain due to external force + thermal strain), making them effective for measuring strain on electronic circuit boards.

Please specify the type number as shown in the example below.

CTELA -3 (-350) -3LCT (-F)

- CTELA — Gauge series name
- -3 — Gauge length
- (-350) — Gauge resistance (blank for 120Ω)
- -3LCT — Length in meter and type of integral leadwire
- (-F) — Option F : LEAD-free soldering of leadwire

LINEAR EXPANSION COEFFICIENT MEASUREMENT

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

When calculating the linear expansion coefficient of the material to be measured, the test should be carried out in a free-expansion state so that no distortion is caused by external forces
Errors may occur on curved specimens
General strain measurement is also possible, but note the thermal output as the strain gauge adjusts the temperature-compensated material to 0 x 10^{-6}/°C

Dedicated leadwire recommended for CTE series strain gauges (made to order)

We supply various leadwires dedicated to strain gauges so as to meet our customers' requirements. Please refer to page 30 to 38 for the details of combination of a strain gauge and a leadwire.

Type and designation of leadwires

Usage	Leadwire name	Operating temperature range of leadwire (°C)	Type number example
General purpose	3-wire paralleled vinyl LJCT-F	−20 ～+80	CTELA-6-3 LJCT-F
High temperature	3-wire twisted FEP leadwire 6FA □ LT-F 3-wire twisted FEP single-core leadwire 6FB □ LT-F	−269 ～+200	CTELA-3- 6FA 3LJC-F CTELA-3- 6FB 3LJC-F

NB: □ shows the lead wire length in meter

Version | 08.2023

Simplified formula for calculating the linear expansion coefficient of the measured material

In case of this product ($\Delta\varepsilon_{appT} \fallingdotseq 0$)

$$\beta_r = \frac{\Delta\varepsilon_{measT}}{\Delta T}$$

Normal calculation formulae

$$\beta_r = \beta_S + \frac{\Delta\varepsilon_{measT} - \Delta\varepsilon_{appT}}{\Delta T}$$

β_r : Linear expansion coefficient of the object material between two measurement points

β_s : Linear expansion coefficient on the data sheet

$\Delta\varepsilon_{measT}$: Difference of actual measured value of thermal output between two measurement points

$\Delta\varepsilon_{appT}$:Difference in the value of thermal output on the data sheet between two measurement points

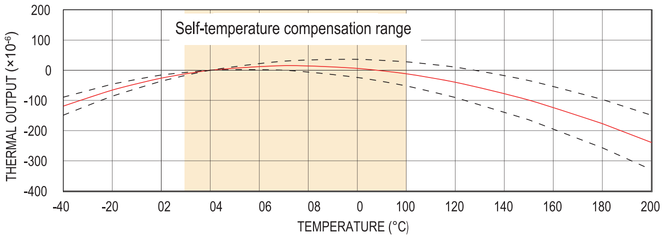
ΔT : Temperature difference between two measurement points (T1-T2)

Example of CTE series thermal output

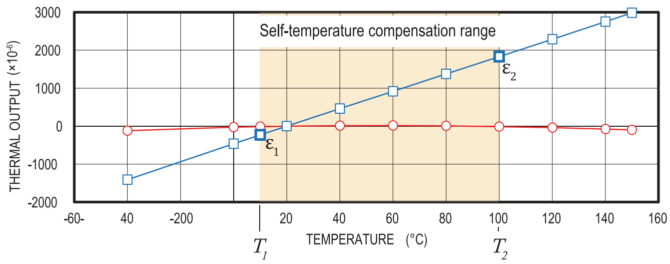
THERMAL OUTPUT (ε_{app} : APPARENT STRAIN)

$\varepsilon_{app} = -2.62 \times 10^{1} + 1.62 \times T^{1} - 1.68 \times 10^{-2} \times T^{2} + 2.29 \times 10^{-5} \times T^{3} - 2.98 \times 10^{-8} \times T^{4}$

TOLERANCE : ±0.5[×10^{-6}/°C)], T : TEMPERATURE



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



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 $\beta s \fallingdotseq 0 \times 10^{-6}$/°C → Regard as almost flat

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

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

$$= \frac{1831 - (-231)}{100 - 10}$$

$$\fallingdotseq 22.9 \times 10^{-6}/°C$$

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

Germany/Austria/Switzerland info@althen.de
Benelux sales@althen.nl
France info@althensensors.fr
Sweden info@althensensors.se
USA/Canada info@althensensors.com
Other countries info@althensensors.com