Coaxial Thermocouple MCT

Micro Thermocouples for High Frequency Short Term Measurements Adaptable to any Surface Shapes

Typical Applications

This coaxial thermocouple is designed for measurements of high frequency surface temperature changes during hypersonic wind tunnel experiments or similar short events. It was developed for the experiment with the European space shuttle “Hermes” in 1985.

The probe is small enough for mounting in the wing tip and can be shaped and adapted to the surface by grinding. The dust by grinding makes the connection between the two metals. Alternatively the conjunction on the tip can be reached by a vacuum disposition of a metal coating, with the advantage of a longer survival time in a very hot environment, but with the disadvantage of a fixed geometry.

From the measured surface temperature signal the convective heat flux is deduced. The probe has to be seen as a half infinite body. The sensor measures the model surface temperature changes. With the knowledge of the sensor material the heat flux into the sensor can be calculated. This calculation is valid so far the back side of the thermocouple does not heat up. It wind tunnel experiments with high Mach numbers or explosion tests in an explosion chamber the maximal measurement times for heat flux calculation is limited 40 to 100 ms. Our Heat Flux Calculator HFC can help you very much to calculate the heat flux from of the temperature changes.

The application of this thermocouple is not only limited to wind tunnel investigations, it can be used for all cases where high frequency surface temperature measurements are required. With its short response time (only some µs) applications in explosion tests and many other short term experiments with only one event are possible. This coaxial thermocouple has demonstrated its reliability and durability in multiple experiments in Germany and worldwide.

In cases of very high temperatures the surface will oxidize and lead to signal loss. A new grinding with sand paper renovates the probe for nearly unlimited lifetime. In cases of hypersonic wind tunnel test with Mach 30 our experienced durability for type E is about 35 min at 615°C and 8 min. by 715°C. For much longer durability in such high temperatures at 3000°C the metal coated version is recommended.

Technical Data

Type:	**Type E (Type K as a special design)**
Material:	**Chromel - Constantan, coaxial**
Temperature range:	**Type E: - 200 to 900 °C** **Type K: - 200 to 1170°C**
Temperature sensitivity:	**0.5 K**
Heat flux:	**20 KW/m² to 20 MW/m²**
Response time:	**3 µs**
$\sqrt{\rho c k}$	**About 9000 $\frac{W}{}\sqrt{s}/m^2K$**
Diameter:	**1.9, 3.6 and 4.8 mm**
Size:	**MCT 19: d = 1.9 x 26 mm** **MCT 36: d = 3.6 mm x 17 mm** **MCTB 48: d = 4.8 mm** **Special version with bore hole for pressure measurement, diameter for adjustment between 1-3 mm.**
Sensitivity:	**About 60 µV/K for type E, 39.9 µV/K for type K , (s. IEC-584 T1)**
Calibration:	**Calibrated by the University of Aachen**
Tip:	**Can be individually shaped by the user.**
Specials:	**For the thermocouple MCTB 48 a coaxial borehole with d = 0.8 mm for connecting a pressure probe with a diameter of 1.9 to 3 mm is possible (e.g. M60-1L-M3)**
Connection:	**Via 2 m temperature resistance coaxial cable with BNC pos.**
Amplification:	**Amplifier is needed. We recommend our MVA 10 plus 1 MHz filter**

Article 100-001-0:	**HFC Heat Flux Calculator program**
Article 100-001-1:	**MCT 19, type E, diameter 1.9 mm**
Article 100-001-2:	**MCT 36, type E, diameter 3.6 mm**
Article 100-001-3:	**MCTB 48, type E, diameter 4.8 mm**
Article 100-001-6:	**Surcharge for metallic surface**
Article 100-001-7:	**Surcharge for a short 20 cm cable plus connection to a 2 m extension cable with BNC pos. for sensor with screw for easy screwing**
Article 100-001-8:	**Surcharge for thread for easier mount, M2, M3.5 and M5 with counter nut**
Article 100-001-9:	**Surcharge for type K instead of type E**

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