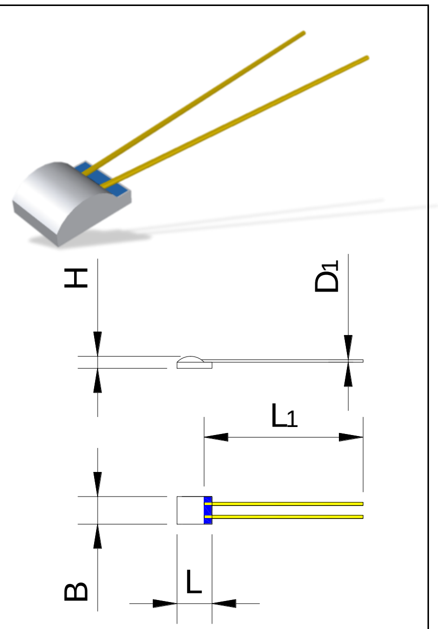
# Platinum-Resistance-Temperature-Detector: CRER / CREBR Series

Platinum-chip temperature sensors of the CRER / CREBR version can used universally and can used for a large number of applications in low and higher temperature ranges up to 500 ° C. The sensor can used up to 550 ° C for a short time. The gold-plated connecting wires are suitable for all common connection technologies: welding, soldering and crimping. The application temperature range is -70°C… + 500°C. The CRER or CREBR sensor has connecting wires leading to the center of the sensor (see illustration) and can optionally be provided with a solderable nickel-gold metallization on the back / underside (type CREBR). The direct thermal contact to another body can made via the metallization by means of a soldered connection.

| **Type** | **CRER / CREBR Series** | |
|---|---|---|
| **Operating temperature range** | **-70°C … +500°C (temporarily 550°C)** | |
| **Validity of the tolerance classes according to DIN EN 60751** | 1/3B (F 0.1) | -50°C … +200°C |
| | A (F 0.15) | -70°C … +300°C |
| | B (F 0.3) | -70°C … +500°C |
| | 2B (F 0.6) | -70°C … +500°C |
| **Resistance value** | Pt100<br>Pt1000 | |
| **Measuring/maximum current** | Pt100: 0,5 mA … 2 mA<br>Pt1000: 0,05 mA … 0,2 mA | |
| **Measuring point** | 2mm in front of the open wire end | |
| **Temperature coefficient** | 3850 ppm/K | |
| **Long-term stability** | 1000h @ 350°C $R_0$-drift < ± 0.05K | |
| **Horizontal pull force at wires** | ≤4N | |
| **Backside metallization (CREBR)** | Nickel/Gold, optimized for reflow-soldering | |




| **Available Models** | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Temperature Sensor** | | | | | **Lead wire** | | | | **Tolerance class** | | | |
| Type | $R_0/\Omega$ | B | L | H | Material | D1 | L1 | $R_L$ in mΩ/mm | 1/3B | A | B | 2B |
| CRER-1702-100 | 100 | 1,7 | 2,2 | 1,0 | Nickel/Gold | 0,15 | 10 | 4,4 | | | ● | |
| CREBR-1702-100 | 100 | 1,7 | 2,2 | 1,0 | Nickel/Gold | 0,15 | 10 | 4,4 | | | ● | |
| CRER-1702-1000 | 1000 | 1,7 | 2,2 | 1,0 | Nickel/Gold | 0,15 | 10 | 4,4 | | | ● | |
| CREBR-1702-1000 | 1000 | 1,7 | 2,2 | 1,0 | Nickel/Gold | 0,15 | 10 | 4,4 | | | ● | |

Dimension tolerances: ΔB = ±0,2 / ΔL = ±0,5 / ΔH = ±0,2 / ΔS = ±0,1 / ΔD1 = ±0,01 / ΔL1 = ±0,5
Dimensions in mm

| **Self-heating coefficients and response times** | | | | | | |
|---|---|---|---|---|---|---|
| **Type** | Self-heating E in K/mW | | Response times in seconds | | | |
| | Water (v = 0,2 m/s) | Air (v = 2 m/s) | in water (v = 0,4 m/s) | | in air (v = 1 m/s) | |
| | | | $t_{0,5}$ | $t_{0,9}$ | $t_{0,5}$ | $t_{0,9}$ |
| CRER-1702-100 | 0,041 | 0,2 | 0,1 | 0,3 | 3 | 8 |
| CREBR-1702-100 | 0,041 | 0,2 | 0,1 | 0,3 | 3 | 8 |
| CRER-1702-1000 | 0,041 | 0,2 | 0,1 | 0,3 | 3 | 9 |
| CREBR-1702-1000 | 0,041 | 0,2 | 0,1 | 0,3 | 3 | 9 |



Alpha Therm GmbH
Gewerbering 7
68723 Plankstadt
Germany
Tel: +49 (0) 6202 / 575688 - 0
Fax: +49 (0) 6202 / 575688 - 10
E-Mail: sales@alpha-therm.de
Web: www.alpha-therm.com

# Application Notes for Platinum-Chip Temperature Sensors

## 1. Introduction

Thin-film platinum-chip temperature sensors from Alpha Therm are basically formed from a ceramic substrate on which a thinly structured layer of platinum is applied. A glass layer seals off the platinum layer and thus protects the temperature sensor to a certain extent from chemical and mechanical influences. During subsequent fabrication, the materials that are used, and the type and method of the processing, have a decisive effect on the functionality and long-term stability of the temperature sensors. In specific cases it may be necessary to carry out qualification tests for the selected design, to ensure that technical specifications for measurement accuracy are met over the temperature range of the application. The following application notes have been put together by Alpha Therm as a result of many years of experience in processing and handling platinum-chip temperature sensors, and are to be taken as recommendations.

## 2. Mechanical strength of the connecting wires

### 2.1. Wired Platinum-Chip Temperature Sensors

The connecting wires of the temperature sensors can be subjected to the maximum tensions shown below, without the functionality being affected. Ensure that the wires are not loaded laterally. Please refer to the data sheet for the maximum admissible horizontal tensile load on one individual wire. If the connecting wires have to be bent, then care must be taken that the bend is not made directly at the point where the connecting wire enters the component sealing. If necessary, use a suitable tool to keep the mechanical stress away from this point. Continuous force on the connecting wires, or tight bends (kinking) must also be avoided, since this not only increases the resistance (leading to a systematically higher temperature indication) but also makes the wires fragile and liable to break under temperature stress.

### 2.2. CRKL Series

These temperature sensors have terminal clamps which are soldered on and especially stiff. It is therefore particularly important that the connections are not subjected to a sideways loading during processing. The maximum permissible horizontal tension is 10 newtons per terminal clamp. Bending or kinking of the terminal clamps is not permissible.

## 3. Connection methods

Basically, the connecting wires of the temperature sensors can be fabricated with all the usual connection methods. These are: soft soldering, brazing, crimping, resistance welding and laser welding. In practice, the relevant parameters for a good connection vary according to the type of wire used (see data sheet). It is therefore advisable to make some test welds to obtain the best results. During welding or soldering, care must be taken that there is no concentrated local heating of the sealing points of the connecting wires. If this occurs, the differences in thermal expansion of the materials can lead to strains or cracks and thus failure at some later time. Furthermore, the maximum operating temperature of the temperature sensors must not be exceeded during handling and processing. It is recommended that a heat shunt or similar tool is used to prevent excessive heat reaching the temperature sensor via the connecting wires. Please also note that the nominal values given are valid for the standard lengths of connecting wires, whereby the point of measurement is always 2 mm from the open end of the connecting wires. Alteration to the length of the connecting wires will therefore change the resistance. This may have the result that the tolerance class limits are no longer met.

## 4. Mounting and installation

### 4.1. Handling

Soft plastic clamps or tweezers should be used for handling temperature sensors. Metal pliers or coarse gripping/clamping devices can cause damage to the temperature sensors.

### 4.2. Potting, coating and gluing

During production processing of platinumchip temperature sensors, it is important to avoid any mechanical stresses between the temperature sensor and the potting compound or casting resin, which can arise from the difference between the coefficients of thermal expansion of the various materials that are used. It is therefore advantageous to use potting compounds that retain some elasticity after hardening. If not, it cannot be ruled out that signal shifts may occur, or even a total failure of the temperature sensor in extreme cases. Potting compounds and adhesives should therefore be qualified by testing before being used for series production. For instance, we recommend temperature cycling over the intended temperature range of the application. Care must also be taken that the potting or coating compounds provide electrical insulation and are chemically neutral with regard to the temperature sensor (ceramic substrate material [Al2O3] and various glass materials). The upper operating limit for the temperature sensor must also not be exceeded during the drying/hardening process. When the temperature sensor is placed in the protection tube and positioned, care must be taken that there is sufficient clearance between the sensor and the wall of the tube. If the sensor is skewed or fitted too tightly, it may be damaged.

### 4.3. Surface mounting

Platinum-chip temperature sensors can be affixed to flat surfaces by using various types of (SMD) adhesive, or double-sided adhesive tapes. The usual curing/hardening methods with UV radiation and/or heat do not create critical stresses for the sensors. The notes of 4.2 must be observed.

### 4.4. Unprotected application

The sealing (glass covering) and connecting wires of the sensors may be damaged if they are exposed to a corrosive atmosphere, especially in conjunction with moisture. Platinum-chip temperature sensors should therefore not be used in such an environment without protection. If bare sensors cannot be avoided, for instance in HVAC applications, then we recommend using our M series, or sensors that have been sealed by an additional protective coating. In this case, it is absolutely vital that the user carries out an appropriate qualification test of the functionality and operating life.

## 5. Thermal characteristics

### 5.1. Response times

We measure the response times of the platinum-chip temperature sensors in agitated water with a flow velocity of v = 0.4 meters/second, and the average values are: t0.5 = 0.2 sec and t0.9 = 0.4 sec. Subsequent fabrication, such as installation in a protection tube, will increase the response times, depending on the nature and mass of the materials that are used. Care must therefore be taken to ensure good heat transfer between the temperature sensor and the protection tube. Heat-conductive pastes and alumina powder have proved suitable as heat-conducting materials.

### 5.2. Self-heating

In order to measure the electrical resistance, a current must flow through the temperature sensor. This current will heat up the temperature sensors by an amount that can be larger or smaller, depending on external factors. The size of the resulting error caused by this self-heating depends on the applied power P = I2 x R, the amount of heat that is removed by the medium being measured, the heat capacity of the temperature sensor and its surface. These specific characteristics are combined in the self-heating coefficient E, so that the error caused by self-heating is given by Δt = I2 x R x E. Self-heating coefficients of platinum-chip temperature sensors are measured in air at v = 2 m/sec and agitated water at v = 0.2 m/sec. The average coefficients are: in air 0.2°C/mW, in water 0.02°C/mW. Precise details on items 5.1 and 5.2 can be found in the appropriate data sheets.

### 5.3. Measuring current

To avoid self-heating effects and possible damage to the temperature sensors, we recommend the following maximum currents:
≤ 1.0mA for Pt100 temperature sensors,
≤ 0.7mA for Pt500 temperature sensors, and
≤ 0.1mA for Pt1000 temperature sensors.

## 6. Cleaning

Our temperature sensors come readycleaned from the factory. Further cleaning is not normally required. However, if additional cleaning operations are necessary during processing, then the sensors can be cleaned in baths containing mild cleaning agents, such as ethanol. A quick cleaning by ultrasonics is also permissible.

## 7. Storage

In the (standard) belt packaging, our temperature sensors can be stored for several months in a normal environment. But storage in a corrosive atmosphere or corrosive medium or under high-humidity conditions is not permissible.

## 8. Delivered quality

The electrical characteristics of our temperature sensors are 100% tested in accordance with EN 60 751 during manufacture, with a measurement uncertainty of 0.030°C (95% confidence interval) for the tolerance classes. The testing procedure includes the mechanical strength of the connecting wires and the conformity to dimensional tolerances. After the tolerance selection and cleaning, all (standard) temperature sensors are individually belt-packaged and stored for dispatch. High quality, comprehensive information and fast delivery capability are just a few of the advantages of using our temperature sensors.



Alpha Therm GmbH
Gewerbering 7
68723 Plankstadt
Germany

Tel: +49 (0) 6202 / 575688 - 0
Fax: +49 (0) 6202 / 575688 - 10
E-Mail: sales@alpha-therm.de
Web: www.alpha-therm.com