# Thermo-Sensor

FT S 41-04-E-02.15

RÜEGER
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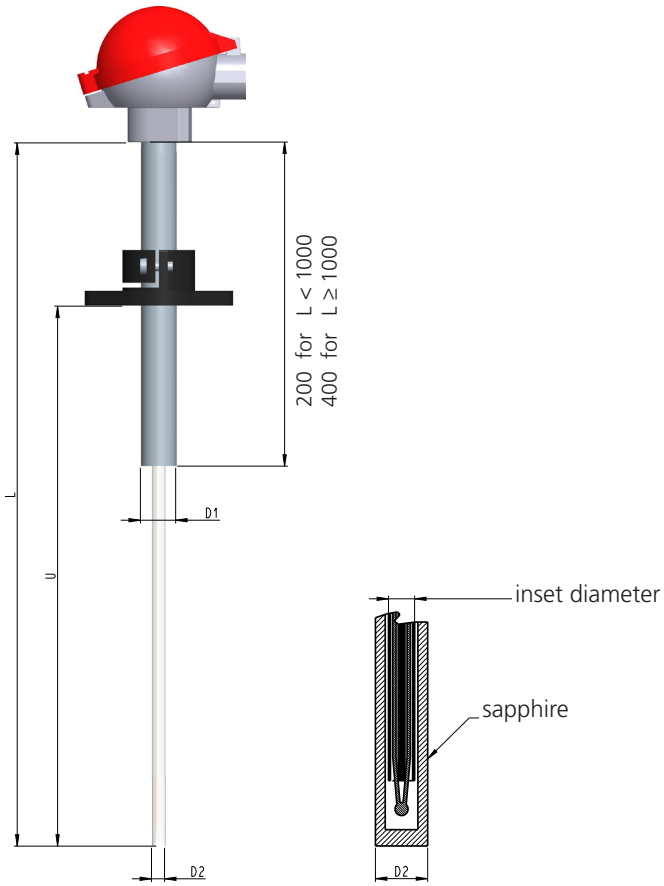
## Thermocouple probe type R, S, B or C for temperatures up to 2000°C, with precious or refractory metal probes in ceramic or sapphire insets, and with single-crystal sapphire thermowells.

Type **S 41-04**




### Applications

- Industrial ovens (heat treatment, incineration).
- Power engineering, reactors.
- Chimneys (combustion gases).
- Annealing and heat treatment process.
- Fusion baths for metal and glass.
- Special, certified executions for explosive environments.

### Description

These RÜEGER « Thermo-Sensor » probes are specially designed for both high temperatures up to 2000°C, and high pressures up to 200 bar. The thermowell is made from single-crystal sapphire. The inset is made from ceramics or sapphire and contains one or several thermocouple probes made of precious or refractory metals. It is possible to position the measurement points along several locations along the thermowell to create a multi-point probe. Each probe comprises a process connection (adjustable flange or welded flange) as well as a connection head.
As the sapphire thermowell is absolutely gas-tight, it is possible to replace the insets without any process interruption.

Two types of insets are available:

IC = KER 710 insert for one or two thermocouple sensors
IS = sapphire inset for one or several thermocouple sensors, with the possibility of distributing the measurement points along the length of the thermowell.

Special executions for explosive environments, meeting the requirements EN / IEC 60079-0: «electrical apparatus for potentially explosive atmospheres (general requirements)»,
EN / IEC 60079-11: «intrinsic safety (i)».

## Technical Data

**1. Limiting Temperatures (°C) for Thermocouples according to wire diameters**:
The permissible temperatures given below are for exposure to gases.

| **Type of Sensor** | S | R | B | C |
|---|---|---|---|---|
| **Temperature (°C)** | | | | |
| **for 0.35 mm dia. wire** | 1300 | 1300 | 1500 | 2000(*) |
| **for 0.5 mm dia. wire** | 1600 | 1600 | 1800 | 2000(*) |

** Limited by maximum permitted temperature for the thermowell. The thermocouple may only be exposed to inert gases or hydrogen.*

**2. Precision Classes**:

**TC** according to IEC 60584-2

class 1
S: 0 ... + 1600 [°C] ±1°C or ±[1+0.003x(t-1100)]°C (1)
R: 0 ... + 1600 [°C] ±1°C or ±[1+0.003x(t-1100)]°C (1)
B: n/a
C: n/a

class 2
S: -40 ... + 1600 [°C] ±1,5°C or ± 0.0025•|t|°C (1)
R: -40 ... + 1600 [°C] ±1,5°C or ± 0.0025•|t|°C (1)
B: +600 ... + 1700 [°C] ±1,5°C or ± 0.0025•|t|°C (1)
C: 0 ... + 2000 [°C] ± 4.5°C or ± 0.01•|t|°C (1)

class 3
S: n/a
R: n/a
B: +600 ... + 1700 [°C] ±4°C or 0.005•|t|°C (1)
C: n/a

*ItI = absolute value of measuring range*
*ISA MC 96.1 on request.*
*(1) Highest of the two values applicable.*

**3. Identification of Measurements Circuits**:
**Colors for thermocouples IEC 60584-2**:
The type of the thermocouple is identified by color code.

| **Type** | **conductor "+"** | **conductor "-"** |
|---|---|---|
| S | orange | white |
| R | orange | white |
| B | grey | white |
| C | on request | |

According to ISA MC 96.1 on request.

**4. The maximum permissible temperature for sapphire thermowells is 2000°C.**
Please also refer to DIN EN 50446.

**Sapphire Thermowells**:
Single-crystal sapphire is absolutely gas-tight and stands temperatures of up to 2000°C, in combination with pressures of up to 200 bars. Its extremely high surface hardness (HV 2500, Mohs 9) yields an excellent resistance to abrasion. It is chemically inert to most substances, with the exception of hydrofluoric and phosphoric acid, potassium hydroxide and molten salts.

**5. Connection Head**:
Form A or equivalent, according to DIN EN 50446.
For ambient temperatures: -40...+85°C; -50°C on request.
Degree of protection: IP 54.
Thermowell and process connection tube fixed by two screws.
Cable gland with PG 16 thread or M20 x 1.5, to be chosen according to the cable entry.
Terminal block: ceramic, with 2 or 4 screw terminals.

**6. Mounting Instruction**:
In cases where the process involves large amounts of residual deposits, it is advisable to mount the sensor vertically.
The connection head should be located as far as possible from the hot medium.

**7. Process Connection Tube**:
The metalic process connection tube can be fitted with either an adjustable flange or a compression fitting, and provides extra protection for the thermowell.
The flange according to DIN EN 50446 cannot fullfil any sealing requirements. In the case that sealing is required, a compression fitting must be used, and the interface between the process connection tube and the thermowell must be sealed with an appropriate material.

**8. Nominal Length "L"**:
500 mm
710 mm
1000 mm
1400 mm
Other lengths on request.
Maximum length: 1800 mm.

**9. Transmitters**:
Because this type of probe is used for high temperatures, it is preferable to install transmitters outside the connection head. For the AUZH head however, which has a raised cover, a transmitter may be placed inside, provided that the temperature attained in the connection head does not exceed the 85°C mentioned under point 5. The advantage of the transmitter being mounted in the head is an improved reliability of the signals, as no extension/compensation cable is required. The cold junction compensation is included in all universal transmitters.

**10. Important**:
Sapphire thermowells are sensitive to strong mechanical shocks as well as to thermal quenching. Handle with care.



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**Manufacturer of Sensors and Gauges for Temperature & Pressure**

**RÜEGER SA**
Ch. de Mongevon 9
P.O.Box 98
1023 CRISSIER 1
SWITZERLAND
Tel + 41 (0)21 637 32 32
Fax + 41 (0)21 637 32 00
E-mail info@rueger.ch

**RÜEGER GmbH**
Plieninger Strasse 58
70567 STUTTGART
GERMANY
Tel + 49 (0)711 16-163-0
Fax + 49 (0)711 16-16333
E-mail rgmbh@rueger.com

**RÜEGER Sdn Bhd**
No 22-5, Jalan Wangsa Delima 10
D'Wangsa, Wangsa Maju
53300 KUALA LUMPUR
MALAYSIA
Tel + 603 - 4142 3808
Fax + 603 - 4142 3909
E-mail sales@rueger.com.my

**BEIJING RÜEGER PRECISION INSTRUMENT Co. Ltd**
No. A135 Chengshousi Road
Nansanhuan, Chaoyang District
100164 BEIJING, P.R. CHINA
Tel + 86 10 8767 7502 / 3379
Fax + 86 10 8761 3727
E-mail sales@bjrueger.com