Mineral Insulated Thermocouples - Type 12

A range of semi flexible mineral insulated thermocouples, suited to a wide variety of industrial applications up to 1400°C. Custom built to your specification and terminated in a large choice of end seal terminations and sheath materials from 0.25mm to 10.8mm diameter.
Type 12 Mineral Insulated Thermocouples

- High integrity construction suited to arduous operating conditions at temperatures from -200°C to +1400°C
- High accuracy and stability maintained throughout operating life
- Fast response and high insulation resistance
- UKAS calibration is available for our range of Mineral Insulated thermocouple assemblies
- The cable used to manufacture these assemblies conforms to BS EN 61515: 2016 / IEC 61515: 2016 and BS EN 60584 class 2, other tolerances are available on request
- Available in K, T, J, N, E, R, S, & B with sheath diameters from 0.25mm to 10.8mm and lengths from a few millimetres to 200 metres or more dependent on the sheath diameter selected
- Sheaths can generally be bent, twisted and flattened to suit particular installations without impairing performance
- Swaged end assemblies are available where fast response high strength sheaths or low displacement are a necessity

Typical Construction

The seamless metal sheath is available in a variety of materials with overall diameters from 0.25mm to 10.8mm. Sheath materials include: a range of stainless steels, Inconel 600®, Incoloy 800®, Chrome/Iron, Hastelloy X®, Nicrotherm 2® and other materials. Additionally these assemblies can be supplied with the sheaths bonded with a variety of fluoroplastic claddings to suit particular corrosive environments.

The complete assembly is a compact, self armoured, hermetically sealed, semi flexible probe providing the conductors with complete protection against oxidation and corrosion. They are ideally suited for use in extreme environmental conditions of high vibration, high pressure/vacuum and over a wide operational temperature range of -200°C to +1400°C.

The thermocouple junction is arc welded in an inert atmosphere. The junction may be insulated from the sheath, grounded to it or may be exposed from the sheath depending upon the application.

The conductors are insulated from one another and the sheath by very tightly compacted magnesium oxide powder. With an insulated junction, the insulation resistance between the conductors and sheath is in excess of 100 MΩ.

The length of the sheath of the finished assembly is to suit customer requirements (any length from a few millimetres to 200 metres or more dependent on the diameter).

A wide range of adjustable brass or stainless steel compression fittings screwed BSP or BSPT are available to suit the various sheath sizes for mounting Type 12 thermocouples. A selection of popular fittings is shown in section 7.

The length of the sheath of the finished assembly is to suit customer requirements (any length from a few millimetres to 200 metres or more dependent on the diameter).

A wide range of end seal terminations are available within which the hermetic seal is effected.

Quality Control. All materials and assemblies are subject to rigorous quality checks during manufacture through to final test and inspection in accordance with our approval to ISO 9001.

UKAS calibration is available as an additional service for our range of Mineral Insulated Thermocouple assemblies.

Approximate Transition Lengths (T’ mm) for given Ø ‘A’ mm

<table>
<thead>
<tr>
<th>ØB</th>
<th>6.0mm</th>
<th>4.5mm</th>
<th>3.0mm</th>
<th>2.0mm</th>
<th>1.5mm</th>
<th>1.0mm</th>
<th>0.5mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.0mm</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>4.5mm</td>
<td>6</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>3.0mm</td>
<td>12</td>
<td>6</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>2.0mm</td>
<td>16</td>
<td>10</td>
<td>4</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>1.5mm</td>
<td>18</td>
<td>12</td>
<td>6</td>
<td>2</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>1.0mm</td>
<td>20</td>
<td>14</td>
<td>8</td>
<td>4</td>
<td>2</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>0.5mm</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>6</td>
<td>4</td>
<td>2</td>
<td>–</td>
</tr>
</tbody>
</table>

Swaged Reduced Tip

Swaged end reduced tip temperature sensors provide a unique fast response, high strength, low displacement, homogenous solution to many problematical temperature measurement applications. The technique combines the advantages of having a rugged large diameter metal sheath over most of its length with a low thermal mass, fast response, reduced diameter tip.

The length of the reduced tip (X) can be any length up to 900mm and virtually any diameter between 0.5mm and 5.2mm with the most popular sizes are shown in the table. Please contact us for other sizes.
**Types of Sensing Junction**

- **2I**
  - Insulated
  - Hot junction insulated from sheath. Gives floating output with typical insulation resistance in excess of 100 megohms (or 200 if Duplex element is required and 21T if triplex element is required).

- **2G**
  - Grounded
  - Hot junction welded to sheath tip giving earthed output and faster response to temperature changes (or 202 if Duplex element is required and 202T if triplex element is required).

- **2X**
  - Exposed
  - Fastest response mainly for the measurement of air temperature in ducts. Restricted to a maximum operating temperature of 600°C (or 200°C if Duplex element is required and 202X if Triplex element is required).

**Sheath Specifications**

- **Sheath Diameter (mm)**
  - 0.25mm
  - 0.5mm
  - 0.75mm
  - 1.0mm
  - 1.5mm
  - 1.6mm (1/16”)
  - 2.0mm
  - 3.0mm
  - 3.2mm (1/8”)
  - 4.0mm
  - 5.5mm*
  - 6.0mm
  - 6.35mm (1/4”)
  - 8.0mm
  - 9.5mm
  - 10.0mm*
  - 10.5mm*

- **Sheath Diameter (inches)**
  - 0.010"
  - 0.020"
  - 0.030"
  - 0.039"
  - 0.039"
  - 0.079"
  - 0.150"
  - 0.177"
  - 0.216"
  - 0.236"
  - 0.290"
  - 0.315"
  - 0.374"
  - 0.425"

**Sheath Materials**

- **Type 12**
  - Nickel Chromium vs Nickel Aluminum
  - Copper vs Constantan
  - Iron vs Constantan
  - Iron vs Nicrosil
  - Nickel Chromium vs Constantan
  - Platinum - 13% Rhodium vs Platinum
  - Platinum - 10% Rhodium vs Platinum
  - Platinum - 30% Rhodium vs Platinum
  - Platinum - 6% Rhodium

**Operational Properties**

- **Grade 321 Stainless Steel**
  - Type: Nickel-Chromium/Titanium Stabilised
  - To BS EN 10088
  - Werkstoff No: 1.4541
  - Very good corrosion resistance throughout the operating temperature range. Suited to a wide range of industrial applications. Enjoys high ductility.

- **Grade 316L Stainless Steel**
  - Type: Nickel-Chromium/Molybdenum Stabilised
  - To BS EN 10088
  - Werkstoff No: 1.4404
  - Good high temperature corrosion resistance and suitable for use in sulphur bearing atmospheres. 316L stainless steel has high oxidation resistance.

- **Grade 310 Stainless Steel**
  - Type: Nickel-Chromium/Iron Stabilised
  - To BS EN 10088
  - Werkstoff No: 1.4410
  - Good high temperature corrosion resistance and suitable for use in sulphur bearing atmospheres. 310 stainless steel has high oxidation resistance.

- **Inconel 600**
  - Type: Nickel-Chromium/Iron alloy
  - To BS EN 10088
  - Werkstoff No: 1.4600
  - Used in severely corrosive atmospheres to elevated temperatures. Has good resistance to oxidation. Not recommended for use above 800°C when used with Type R, S or B thermocouples. Do not use in sulphur bearing atmospheres above 500°C.

**Typical Response Times**

- **Ømm**
  - 0.25mm
  - 0.5mm
  - 0.75mm
  - 1.0mm
  - 1.5mm
  - 2.0mm
  - 3.0mm

- **Time**
  - 0.015 seconds
  - 0.030 seconds
  - 0.050 seconds
  - 0.150 seconds
  - 0.300 seconds
  - 0.400 seconds
  - 0.800 seconds

- **Typical Response Time**
  - 3.2mm (1/8”)
  - 4.5mm
  - 6.75mm
  - 10.8mm

- **Time**
  - 0.080 seconds
  - 1.400 seconds
  - 4.000 seconds
  - 3.000 seconds
  - 3.450 seconds
  - 5.500 seconds
  - 9.000 seconds

**Max. Temp.**

- **800°C**
- **1100°C**
- **1200°C**
- **1400°C**

**Other special measuring junction configuration requirements can be met upon request.**

---

**TC Ltd. Tel: 01895 252222 · International: +44 1895 252222 · info@tc.co.uk · www.tc.co.uk**
## Type 12 Mineral Insulated Thermocouples

<table>
<thead>
<tr>
<th>Specification</th>
<th>Diagram</th>
<th>Types of End Seal Configuration</th>
<th>Diagram</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>3P1</td>
<td><img src="image1.png" alt="Diagram" /></td>
<td>Internal Seal with Bare Conductors for all sheath diameters</td>
<td><img src="image2.png" alt="Diagram" /></td>
<td>Micro Die Cast Alloy Head for diameters 3.0mm to 8.0mm</td>
</tr>
<tr>
<td>3P1B</td>
<td><img src="image3.png" alt="Diagram" /></td>
<td>Maximum end seal temperature 135°C</td>
<td><img src="image4.png" alt="Diagram" /></td>
<td>Weatherproof die cast alloy, epoxy coated, screw down terminal head with tube entry and cable entry at a right angle to each other, with a ceramic terminal block. Suitable for simplex and duplex assemblies. Supplied with a 16mm x 1.5mm ISO metal pinch gland on the cable entry for cables from 4mm to 8.5mm diameter.</td>
</tr>
<tr>
<td>3P1C</td>
<td><img src="image5.png" alt="Diagram" /></td>
<td>Maximum end seal temperature 650°C</td>
<td><img src="image6.png" alt="Diagram" /></td>
<td>Weatherproof die cast alloy, epoxy coated, screw down terminal head with tube entry and cable entry at a right angle to each other, with a ceramic terminal block. Suitable for simplex and duplex assemblies. Supplied with a 16mm x 1.5mm ISO metal pinch gland on the cable entry for cables from 4mm to 8.5mm diameter.</td>
</tr>
<tr>
<td>3P2L</td>
<td><img src="image7.png" alt="Diagram" /></td>
<td>Crimp on Stainless Steel Pot Seal for sheath diameters up to 3.0mm</td>
<td><img src="image8.png" alt="Diagram" /></td>
<td>Miniature Die Cast Alloy Head for diameters 3.0mm to 8.0mm</td>
</tr>
<tr>
<td>3P2LX</td>
<td><img src="image9.png" alt="Diagram" /></td>
<td>Pot Seal rated to 135°C</td>
<td><img src="image10.png" alt="Diagram" /></td>
<td>Weatherproof die cast alloy, epoxy coated, screw down terminal head with tube entry and cable entry at a right angle to each other, with a ceramic terminal block. Suitable for simplex and duplex assemblies. Supplied with a 16mm x 1.5mm ISO metal pinch gland on the cable entry for cables from 4mm to 8.5mm diameter.</td>
</tr>
<tr>
<td>3P3L</td>
<td><img src="image11.png" alt="Diagram" /></td>
<td>Pot Seal rated to 220°C</td>
<td><img src="image12.png" alt="Diagram" /></td>
<td>Weatherproof die cast alloy, epoxy coated, screw down terminal head with tube entry and cable entry at a right angle to each other, with a ceramic terminal block. Suitable for simplex and duplex assemblies. Supplied with a 16mm x 1.5mm ISO metal pinch gland on the cable entry for cables from 4mm to 8.5mm diameter.</td>
</tr>
<tr>
<td>3P4CL</td>
<td><img src="image13.png" alt="Diagram" /></td>
<td>Pot Seal rated to 300°C</td>
<td><img src="image14.png" alt="Diagram" /></td>
<td>Weatherproof die cast alloy, epoxy coated, screw down terminal head with tube entry and cable entry at a right angle to each other, with a ceramic terminal block. Suitable for simplex and duplex assemblies. Supplied with a 16mm x 1.5mm ISO metal pinch gland on the cable entry for cables from 4mm to 8.5mm diameter.</td>
</tr>
<tr>
<td>3P4CTRL</td>
<td><img src="image15.png" alt="Diagram" /></td>
<td>Pot Seal rated to 300°C</td>
<td><img src="image16.png" alt="Diagram" /></td>
<td>Weatherproof die cast alloy, epoxy coated, screw down terminal head with tube entry and cable entry at a right angle to each other, with a ceramic terminal block. Suitable for simplex and duplex assemblies. Supplied with a 16mm x 1.5mm ISO metal pinch gland on the cable entry for cables from 4mm to 8.5mm diameter.</td>
</tr>
<tr>
<td>3P5</td>
<td><img src="image17.png" alt="Diagram" /></td>
<td>Pot Seal rated to 600°C</td>
<td><img src="image18.png" alt="Diagram" /></td>
<td>Weatherproof die cast alloy, epoxy coated, screw down terminal head with tube entry and cable entry at a right angle to each other, with a ceramic terminal block. Suitable for simplex and duplex assemblies. Supplied with a 16mm x 1.5mm ISO metal pinch gland on the cable entry for cables from 4mm to 8.5mm diameter.</td>
</tr>
<tr>
<td>3P6</td>
<td><img src="image19.png" alt="Diagram" /></td>
<td>Standard 2-pin (round) Plug for sheath diameters between 1.0mm &amp; 8.0mm</td>
<td><img src="image20.png" alt="Diagram" /></td>
<td>Standard Plastic Head for diameters 4.5mm to 10.8mm</td>
</tr>
<tr>
<td>3P6M</td>
<td><img src="image21.png" alt="Diagram" /></td>
<td>Miniature 2-pin (flat) Plug for sheath diameters between 0.25mm &amp; 3.2mm</td>
<td><img src="image22.png" alt="Diagram" /></td>
<td>Weatherproof plastic, screw top terminal head with the tube entry and cable entry at a right angle to each other, with a plastic terminal block. Suitable for simplex, duplex and triplex assemblies. Supplied with a 16mm x 1.5mm ISO plastic pinch gland on the cable entry for cables from 3mm to 8mm diameter.</td>
</tr>
<tr>
<td>3P7</td>
<td><img src="image23.png" alt="Diagram" /></td>
<td>Standard 2-pin (round) Socket for sheath diameters between 1.0mm &amp; 8.0mm</td>
<td><img src="image24.png" alt="Diagram" /></td>
<td>Standard Plastic Head for diameters 4.5mm to 10.8mm</td>
</tr>
<tr>
<td>3P7M</td>
<td><img src="image25.png" alt="Diagram" /></td>
<td>Miniature 2-pin (flat) Socket for sheath diameters between 0.25mm &amp; 3.2mm</td>
<td><img src="image26.png" alt="Diagram" /></td>
<td>Weatherproof plastic, screw top terminal head with the tube entry and cable entry at a right angle to each other, with a plastic terminal block. Suitable for simplex, duplex and triplex assemblies. Supplied with a 20mm x 1.5mm ISO plastic pinch gland on the cable entry for cables from 3mm to 8mm diameter.</td>
</tr>
</tbody>
</table>

*Note: Only suitable as a temporary seal for applications adding an alternative seal later.*
Mineral Insulated Thermocouples Type 12

Optional Stainless Steel Compression Fittings

<table>
<thead>
<tr>
<th>Dia.</th>
<th>1/8” BSPT</th>
<th>1/4” BSPT</th>
<th>1/2” BSPT</th>
<th>Dia.</th>
<th>1/8” BSPT</th>
<th>1/4” BSPT</th>
<th>1/2” BSPT</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.5mm</td>
<td>SFS18T05</td>
<td>-</td>
<td>-</td>
<td>3.0mm</td>
<td>SFS18T30</td>
<td>SFS14T30</td>
<td>SFS12T30</td>
</tr>
<tr>
<td>0.7mm</td>
<td>SFS18T75</td>
<td>-</td>
<td>-</td>
<td>4.5mm</td>
<td>SFS18T45</td>
<td>SFS14T45</td>
<td>SFS12T45</td>
</tr>
<tr>
<td>1.0mm</td>
<td>SFS18T10</td>
<td>SFS14T10</td>
<td>SFS12T10</td>
<td>6.0mm</td>
<td>SFS18T60</td>
<td>SFS14T60</td>
<td>SFS12T60</td>
</tr>
<tr>
<td>1.5mm</td>
<td>SFS18T15</td>
<td>SFS14T15</td>
<td>SFS12T15</td>
<td>8.0mm</td>
<td>–</td>
<td>SFS14T80</td>
<td>SFS12T80</td>
</tr>
</tbody>
</table>

Order Code - Example

<table>
<thead>
<tr>
<th>Style No.</th>
<th>Thermocouple Type (see section 1)</th>
<th>Sheath Material (see section 2)</th>
<th>Sheath Diameter (see section 3)</th>
<th>Sensing Junction (see section 4)</th>
<th>End Seal Termination (see section 5)</th>
<th>Extension Cable (see section 6)</th>
<th>Optional Compression Fitting (see section 7)</th>
<th>Reduced Tip Dimensions (if required)</th>
<th>Optional Transmitter (see section 8)</th>
</tr>
</thead>
<tbody>
<tr>
<td>12</td>
<td>K</td>
<td>450</td>
<td>310</td>
<td>6.0</td>
<td>212</td>
<td>3P4CL</td>
<td>2 MTRS A30KX</td>
<td>-</td>
<td>SFS18T30</td>
</tr>
</tbody>
</table>

Other sizes and materials are available, please contact us for details.

TC Ltd. Tel: 01895 252222 · International: +44 1895 252222 · info@tc.co.uk · www.tc.co.uk