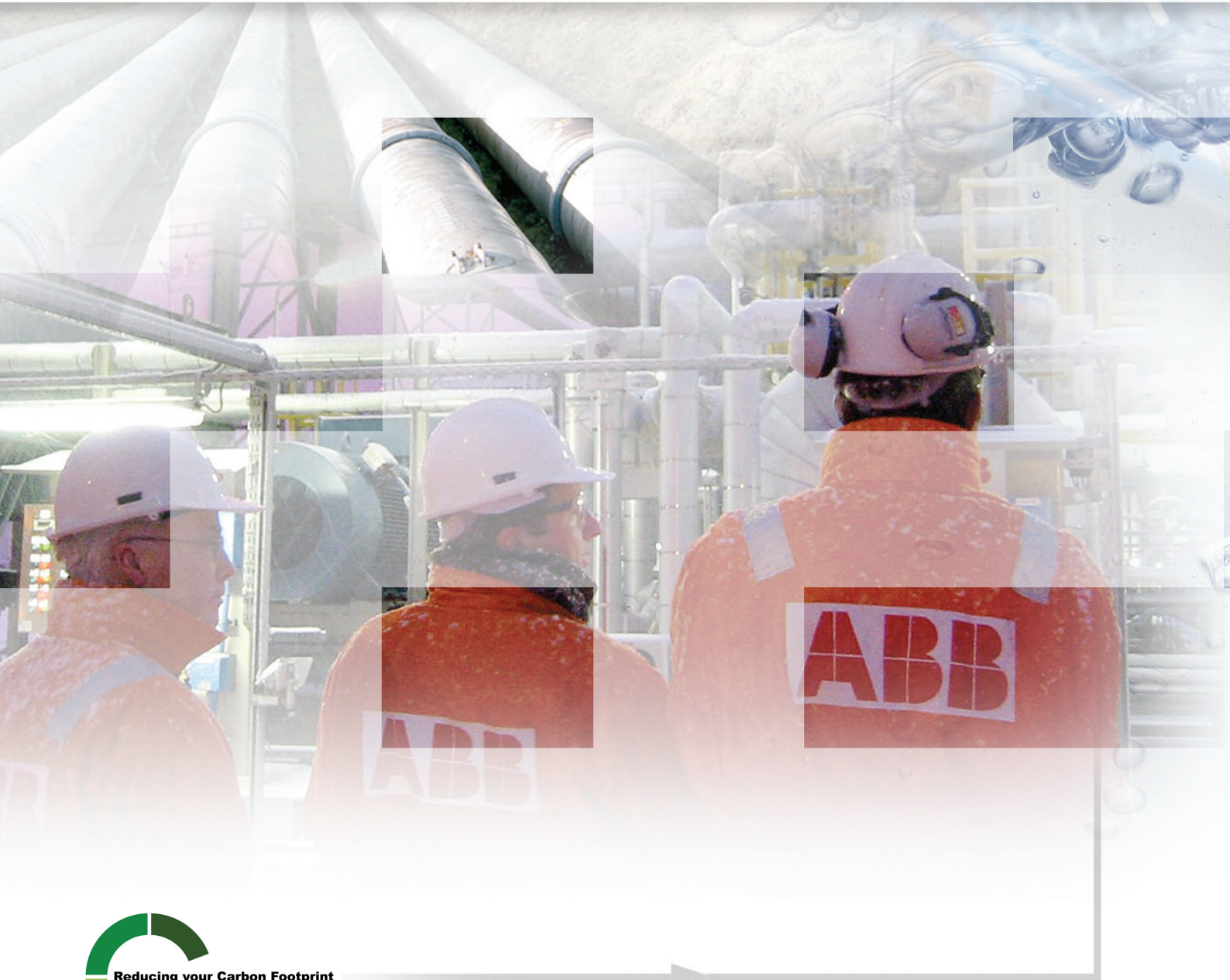




The Instant guide to Temperature Transmitter Selection



Reducing your Carbon Footprint

ABB Instrumentation



A useful guide to temperature technology selection

Temperature accounts for approximately half the measurements taken in industrial processes. And if you consider that raising the temperature of a chemical reaction by 10°C is enough to double its speed, it's easy to see why accurate temperature measurement is so important.

Choosing the sensor

When it comes to fundamental temperature sensing technologies, there are two contenders – thermocouples and resistance thermometers.

Thermocouples

Thermocouples rely on the thermoelectric effect. When two dissimilar metals are joined to form a closed circuit, an electric current flows when their two junctions are at different temperatures (hot & cold junction). The voltage at the junction also rises with temperature, so that heating one junction of a bimetallic circuit and keeping the other end cold generates a potential difference that can be translated into a temperature measurement.

Thermocouples are ideal for harsh conditions, such as applications with extreme amounts of vibration or rapid shifts in temperature.

Resistance thermometers

Resistance thermometers operate using resistance temperature detection (RTD), which measures how the resistance of a conductor changes with temperature. Platinum is normally used because it has a reliable, almost linear response to temperature change. The wiring required to turn this simple relationship into a reliable signal can be complex, but the instrument manufacturers take care of it within the sensor.

RTD elements come in three types,

- wire-wound ceramic elements
 - The wire is fused into a ceramic block, making it suitable for general duties.
 - Wire-wound glass elements
 - The wire is embedded solidly into glass so they are more suitable for extreme conditions.
 - Thin film elements
 - These deposit a thin film of platinum to a ceramic former, giving smaller overall dimensions and offering more versatility for various temperature ranges and applications.
- RTD devices have a temperature range of around -200°C to +600°C (although special versions are available up to +850°C). As a family, thermocouples can cope with a wider range of up to +1800°C, although different types of thermocouple are best suited to different parts of the temperature spectrum.

Providing protection

Protecting the measuring sensor from the external process conditions is essential when operating in harsh environments. Within a typical temperature assembly, the chosen sensor element is usually housed in a protective tube called a **thermowell**. The thermowell may be machined from a single

piece of material for arduous duties or fabricated for general duties. A drilled version can usually withstand up to around 550°C and 600bar, while a welded version is suitable up to 400°C and 80bar.

When **choosing the thermowell**, it's important to take other factors into account, such as how chemically aggressive the medium may be and how much mechanical strain the assembly is likely to have to put up with from erosion, vibration and so on. The acceptable working life of the thermowell will vary tremendously depending on the application and could be anything from a few days up to 20 years. A supplier such as ABB, which has over 120 years of expertise in this area, can do all the relevant calculations to ensure end users make the right choice in order to optimise performance.



Choosing the correct thermowell is also crucial for very high temperature applications. While base metal thermocouples can cope with temperatures up to 1200°C with the protection of a metal or ceramic thermowell, a precious metal thermocouple with a ceramic thermowell is needed for higher temperatures.

The basic rule of thumb is simple. The thermowell must always be at a specification that matches or exceeds the construction in the surrounding pipeline or vessel. However, it may still be worth getting advice from the instrument supplier for difficult or unusual applications.

Accessing the data

The thermowell is secured via an extension tube to the connection head, which connects the **sensor** probe to the **transmitter**. The transmitter may actually be housed in the head, or it may be mounted nearby in the field or even remotely in a separate control panel.

Head-mounted transmitters are usually enclosed in one housing and connected to the sensor probe, which makes them suitable for most process environments. **Field-mounted** versions are robust, enclosed units that can be mounted in a wide range of environments ranging from cold rooms to offshore applications such as oil rigs. **Rail and rack-mounted transmitters** are sited remotely in control panel-type installations.

Whichever option suits the application, it's important to check with the supplier about the transmitter's long-term stability. For example, the transmitters in ABB's range are known as 'fully-potted', which means they are completely encapsulated in epoxy resin. This makes them relatively invulnerable to the vibration, contamination, humidity and changes in ambient temperature that can cause drift in some of the other transmitters on the market.

And if the application is critical, it's probably worth paying for a unit that includes the latest self-diagnostic capabilities. You may also have special requirements, for example, for explosion-proof or intrinsically safe transmitters for hazardous areas.



The standard output from transmitters has traditionally been a 4-20mA signal, but this is increasingly being replaced in many industries by **fieldbus communications**. Fieldbus is now a mature technology in many industries and is enabling companies to take a far more strategic, centralised view of controlling their plants and buildings, not to mention helping to reduce maintenance costs.

The tricky thing for instrument suppliers is knowing which communication standard to work with. There are three main contenders – **HART®**, **Profibus** and **Foundation Fieldbus** – and none of them has yet managed to achieve real dominance in every market. At the moment, the US seems to be favouring Foundation Fieldbus, while Profibus is more popular in Europe.

It's worth bearing this in mind by adopting transmitters that will be as flexible as possible about connecting to any new control systems that may be installed in the future. For example, ABB transmitters can communicate with systems using any of the three standards.

It pays to get it right

Measuring temperature may be commonplace, but that's only because it is so vital. And if something is so vital, it pays to take a little time to make sure you're making the right choice. If you're at all unsure, contacting a reputable instrument supplier for advice could well be the best option.

What ABB can offer

ABB offers an extensive range of temperature technology equipment, for a variety of applications.

Call our Customer Support Centre on **0870 600 6122** for more information or email: moreinstrumentation@gb.abb.com ref. 'temperature technology'.

Recommended reading:

Technical articles:

['Thermowells - a lesson in performance under pressure'](#)
['Fieldbus into the future'](#)

Guides:

[FOUNDATION fieldbus solutions](#)
[PROFIBUS fieldbus solutions](#)

Jargon busters:

[Temperature Terms jargon buster](#)

Other links:

[ABB temperature products portal](#)



ABB Limited

Howard Road, Eaton Socon, St. Neots,
Cambridgeshire PE19 8EU
Tel: +44 (0) 1480 475321
Fax: +44 (0) 1480 470787
www.abb.com/instrumentation
e-mail: moreinstrumentation@gb.abb.com