

# New standard for Pt100 sensors is an update to today's reality

The standard governing Pt100 sensors, IEC60751 (1995), has now been updated to 2008 edition 2.0. The temperature/resistance ratio is unchanged but the tolerance classes have been increased to four and there are different temperature intervals for wirewound and film resistors.

The German Institute for Standardization (DIN) and later the International Electrotechnical Commission (IEC) traditionally standardised platinum measurement resistors into two classes, A and B, with the measurement intervals of -200 to 650 and -200 to 850 °C respectively. Film resistors have been further developed and are now widely used in white goods and various industrial contexts. Traditional wirewound platinum resistors have also been increasingly refined by leading manufacturers. In addition, the market has varying requirements for accuracy and measurement intervals. The old situation of having only two classes could lead to confusion because customers typically requested Class A without specifying their requirements more closely.

Diagrams 1 and 2 show the new IEC 60751 (2008) standard as a graph and table respectively. One new feature is that film resistors are specified separately in the table, and are indicated in red in our graph. It is evident that film resistors have different properties than wirewound resistors, and the former are therefore limited in Class A to the interval from -30 to 300 °C.

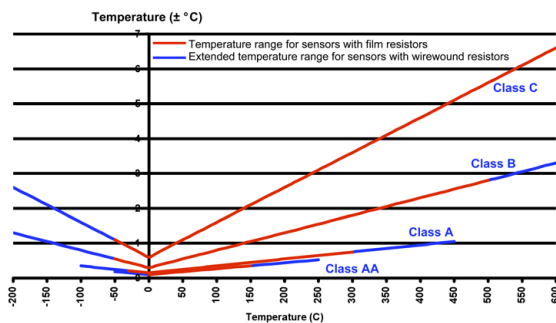


Diagram 1. IEC 60751 (2008-2) depicted as a graph. The new measurement intervals have been adapted to the range of resistors now available on the market. The temperature/resistance ratio has not been altered.

Tolerance class	Temperature range of validity for assembled sensors (°C)		Tolerance values °C
	Wire wound resistors	Film resistors	
AA	-50 to 250	0 to 150	$\pm (0.1 + 0.0017  t )$
A	-100 to 450	-30 to 300	$\pm (0.15 + 0.002  t )$
B	-196 to 600	-50 to 500	$\pm (0.3 + 0.005  t )$
C	-196 to 600	-50 to 600	$\pm (0.6 + 0.01  t )$

Diagram 2. The graph in table form. Note that wirewound and film resistors have different measurement intervals due to their differing properties.

## NEW CLASSES

Another innovation is that the new standard introduces an entirely new class, AA, which corresponds to the old "1/3 DIN" or "Class B/3" with a deviation of  $\pm 0.1$  °C at 0 °C. The tolerance is also reduced to 1/3 of Class B's (0.0050) to 0.0017 of a degree per °C but within a limited interval: -50 to 250 °C for wirewound resistors and 0 to 150 °C for film resistors.

In addition to these classes, a previous Class C for film resistors has been given official status with an interval from -196 to 600 °C and with double tolerance compared with Class B across the whole interval. Worth noting is that -200 °C has been abandoned for the boiling point of nitrogen, which is approximately -196 °C and is more practical when calibrating.

The new standard does not affect the measurement resistors that have already been manufactured; rather, it reflects the variety of products now available on the market. It is fully permissible to manufacture products which exceed the requirements of the standard's classes (such as wirewound resistors with partially supported platinum wires that comply with Class A up to 550 to 600 °C) or which have steeper tolerance slopes and intervals lower than those of the specified classes. However, the relevant specifications including the temperature interval and tolerance(s) must be agreed on with the user and stated in the accompanying product data sheet.

## COLOUR CODING IS SUPPLEMENTED

Until now there have not been any standardised colour coding for dual Pt100 sensors. The

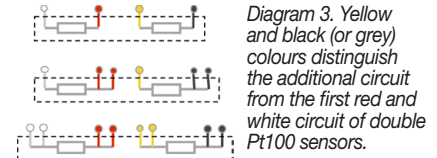



Diagram 3. Yellow and black (or grey) colours distinguish the additional circuit from the first red and white circuit of double Pt100 sensors.

conductors of the second circuit will be yellow and black (or grey). (See Diagram 3).

One noteworthy point is that the IEC requires traceability of calibration done during acceptance testing between the manufacturer and user. This means that manufacturers must take total standardised measurement uncertainty into account if they want to claim that a sensor lies within or outside the required interval [Ref. 1]. In practice, this means that the measurement uncertainty limits must lie within the tolerance or, alternatively, lie completely outside the tolerance in order for the manufacturer to be able to claim that a temperature sensor is approved or not approved respectively (See Diagram 4).

The new standard contains descriptions of various tests that must be done when checking that the specified requirements have been met. Further, the standard stipulates the information that should accompany measurement resistors and assembled temperature sensors. 

[Ref. 1] Pentronic News 2009-3 page 4.

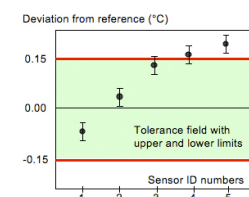


Diagram 4. The sensors in positions 1 and 2 are clearly approved as measured by the manufacturer. The only one of the series that a customer can reject is the sensor in position 5.

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