



PENTRONIC NEWS

It's about temperature!



THE SUN PRODUCES MORE ENERGY PER SQUARE METRE THAN AN OILFIELD



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Joakim Byström in the production line for solar collectors, which Absolicon aims to sell worldwide in cooperation with ABB.

Sustainability for ourselves!

In times of uncertainty and reports about how we are treating our home, the earth, which we can neither easily leave nor renovate by driving to the building supplies centre and buying wallpaper and paint, we need to think about how we approach issues of resource use and efficient solutions. Our products are often used to optimise processes, reduce energy consumption, and improve product quality – and we are very proud of this. But we need to do more. Like the idea suggested by one of our employees a while ago: to reuse expensive plastic wrapping rather than just using it once and then sending it off to be recycled. Unfortunately, recycling plastic still mainly involves incineration. Such measures are small but they make a difference to the whole picture. Thanks for the idea!

Let us all do something, so that we can constantly become a little better. In this issue you can read more about how we can use the energy we receive from our only energy source: the sun. The project is one of many promising initiatives that we are seeing our customers working on and that can have a big impact in future.

Until the next time we are in touch, I would like to thank all of our fantastic employees, customers, suppliers and other business partners, and wish you a really pleasant and relaxing Christmas and New Year holiday season. And, of course, let's not forget to wash our hands often and stay home if we feel ill, in order to lessen the spread of virus infections and so that health care and home care workers can have a chance to recuperate. That's also about sustainability!



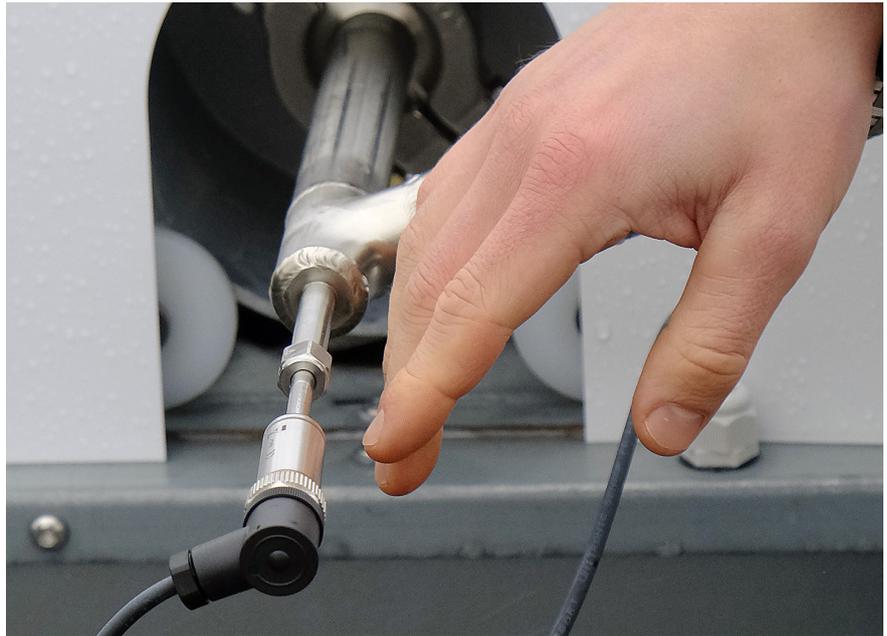
Rikard Larsson
Managing Director

THE SUN PRODUCES MORE ENERGY PER SQUARE METRE THAN AN OILFIELD

Half of all energy is used for heating.

Yet people have almost forgotten about using the sun to produce heat.

Absolicon in the Swedish municipality of Härnösand wants to change that. At the end of September, the company opened Sweden's largest installation for concentrated solar energy.



Pentronic's smart Pt100 sensors with an integrated transmitter and 4–20 mA signal output.

THE PILOT SOLAR PARK has been financed with support from the Swedish Energy Agency. When fully developed, the facility will have 1.5 MW of power and will supply an estimated one million kWh to Härnösand's district heating network. This means that the wood chips burned by the heating plant during the summer can be used for something else.

Absolicon was founded in 2005 with the idea of increasing the yield by concentrating the sun's rays, which reduces the losses. Today the optical yield is a full 76 percent. The idea was to produce electricity and heat simultaneously, but because all other resources today are focused on electricity production, Absolicon chose to work only on heating.

"At hotter latitudes, solar concentrators produce more energy than an oilfield," says Joakim Byström, CEO and innovator (see picture on the front page).

In Spain, the power output is equivalent to 100 litres of oil per square metre. Even in Sweden it is worthwhile to produce heat instead of electricity. In the global energy balance, half of all consumption is used for heating, with 20 percent going to electricity and 30 percent to transport.

The Härnösand pilot facility supplies heat to the district heating network during the six months when Sweden has warmer weather. But heating the shower water of consumers is not the company's most important market. Instead, its target group is industries worldwide.

"Our business partners include two major brewing companies, who plan to replace fossil fuel with our technology", Joakim explains.

One industrial area that illustrates the climate benefit of this technology is textile manufacturing, where heat is an important part of the process. Currently, two kilos of coal are burned to produce one kilo of jeans fabric. With the sun's help, fabrics can become fossil free.

Temperature is a key parameter in the project, partly for monitoring and controlling the solar power facility, and partly for calculating how much to charge for the



Plans are being made to develop the measurement process in the solar collectors. From left: Sebastian Rosander and Christophe Zaninotti, Pentronic, and Benjamin Ahlgren, Absolicon.

energy supplied to the district heating network. This is where Absolicon is collaborating with Pentronic.

“We needed sensors with a small diameter in order to minimise the disruptions in the flow,” explains project manager Benjamin Ahlgren. “The sensors also had to be easy to install, without separate signal transmitters but with a 4–20 mA signal output direct from the sensor.”

The specification also includes four-wire connected Pt100 sensors.

Pentronic’s smart sensors with an integrated transmitter met the requirements. They are also designed to allow for future development. For example, it is possible to digitalise the entire measurement chain in order to increase the accuracy and further simplify the installation process.

Sebastian Rosander and Christophe Zaninotti from Pentronic attended the opening ceremony of the solar power facility. Their visit was more than just a courtesy one. After the ceremonies ended, Benjamin took them into the facility to discuss how the measurement processes can be developed.

“We are currently measuring the outgoing flow but in the next stage we plan to also measure the ingoing flow and to monitor the temperature inside the concentrators,” he explained.

Half of the solar park’s planned area is now complete. It will be extended in two more stages, at which time the latest models of the product will be used. Today’s version can produce hot water and steam with temperatures up to 160 °C. A version that can achieve 200 °C is being developed.

Absolicon has around 40 employees and its own robot-



“Pentronic had the measurement system that met our requirements,” says project leader Benjamin Ahlgren.

ised production line. But the company’s business concept is not to sell its concentrators. Instead, the idea is to develop them and then to sell robotised production lines worldwide in cooperation with ABB.

The strategy is not only justified on commercial grounds. Joakim Byström says there is an even more important reason:

“To meet the Paris climate goals, every country and region needs to produce mass produce solar collectors itself.”

When the solar heating facility is fully built, it will supply a million kWh to the district heating network.



NEW EMPLOYEES AT PENTRONIC

Pentronic welcomes several new colleagues into the organisation. A great group of people with lots of knowledge and experience from previous workplaces has reinforced Pentronic's organisation this autumn.



*Standing from the left: Mats Runermark and Jacob Almqvist.
Sitting from left: Linda Andersson and Joacim Vikström.*

Joacim Vikström succeeds Lars Björkvik in the position of Operations Manager in Västervik and Verkeback. Joacim comes from Aura Light, where he worked with business development. He brings with him many years of experience from positions including Technology and Product Development Manager and head of Enterprise Resource Planning. Our Production Manager for many years, Göran Österberg, has joined our preparation department and is replaced by Mats Runermark. Mats comes from Saab AB in Linköping, where he was a line manager in the aviation industry. He also has many years of experience as a technical officer with the Swedish Armed Forces.

The sales department has been reinforced with Linda Andersson, who will work with sales support. Linda has worked at Pentronic as an assembler since 2017 and has now brought her knowledge to our customer support team. Pentronic's accredited laboratory also has a new employee: Jacob Almqvist. Jacob has a degree in laboratory science and his previous work includes doing laboratory analyses within Region Kalmar.

We welcome them all to Pentronic and to their new work roles!

WE'RE LOOKING FORWARD TO MEETING YOU AT TRADE FAIRS AGAIN!

During the first quarter of 2022 we will be exhibiting at the following events:

26–27 January Euro Expo Karlstad
30–31 March Euro Expo Skellefteå

You are most welcome to our stand to discuss temperature measurement with our experts.

We hope to see you on one of these occasions!



CONTACT US

www.pentronic.se



PRODUCT INFORMATION

EX-APPROVED PROCESS SENSOR COMES SEVERAL VERSIONS

We would like to draw your attention to Pentronic's 7610900 temperature sensor. This Pt100 sensor comes in an flameproof Ex d (ATEX/IECEX) version for measuring the temperatures of gases and liquids in the process industry.

The process sensor, which has a terminal head and neck, can also now be ordered with a Ø3 mm diameter insert in addition to the existing Ø6 mm one.

A 3 mm sensor has a shorter response time and fits inside faster and thinner thermowells.

The new version is third-party approved and has also been revised to comply with the updated standards of both ATEX and IECEX.

Pentronic's Ex-classified Ex d sensor is approved for gas environments in the petrochemical industry. However, there are also other environments containing gases that can ignite and explode and



Part number 7610900.

where corresponding safety measures are justified. Examples include lacquering enterprises and processes handling medicines and chemicals. A need for Ex-classified temperature sensors can also arise in environments where there is both gas and dust which create an explosion risk. If you require other solutions for Ex-classified temperature sensors, contact Pentronic.

DATAPAQ'S TP6 DATA LOGGING SYSTEM

Datapaq® – the specialist in data logging systems for measuring furnace temperatures – has now updated its product range.

Pentronic presents Datapaq's new TP6 temperature profiling logger – the perfect solution for the most demanding heat treatment applications.

The TP6 has a stainless steel case, is available in 10 or 20 channel configurations, and has an IP67 rating.

It is equipped with a USB port and Bluetooth communication to enable quick and easy system installation from either a PC or a mobile phone.

The TP6 is compatible with Datapaq's Insight™ software for a mobile app. It also has the option of telemetry for real time measurement.

Datapaq's furnace tracker system saves you time when you install thermocouples for Temperature Uniformity Survey (TUS) measurements. It also optimises quality and productivity by providing thermal profiling throughout your entire process.

Yet another advantage is that you can use real time data to fine-tune / monitor the entire process while the tracker system is inside the furnace.

For more information contact Pentronic.



Part number 13-10100

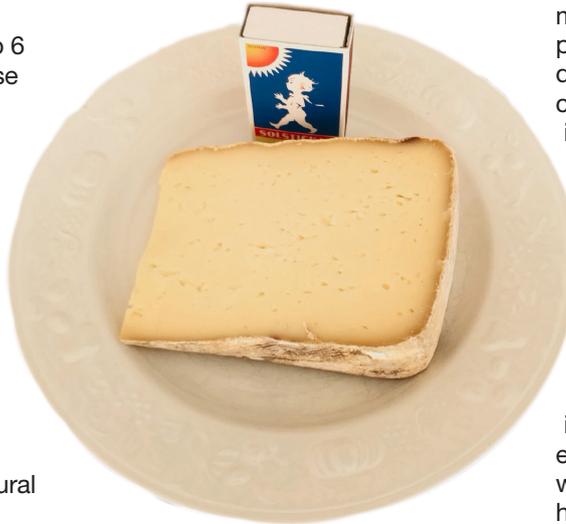
SERVE CHRISTMAS CHEESE LIKE THE EXPERTS

Christmas is one of the major food holidays in Sweden, and involves a number of interesting thermal problems in connection with food and food preparation. As a result, people need to measure or calculate the food's temperature as a function of time.

Cheese stored in the refrigerator acquires a temperature of 4 to 6 °C, which is too low for the cheese to have its optimal flavour. Many cheese lovers say that cheese tastes best when it is a few degrees below room temperature. There are probably as many recommended temperatures as there are cheese lovers.

When we warm cheese at room temperature, the question is how long it takes in terms of time before the cheese reaches the desired temperature. The dessert cheese in the photo acquires heat from the air via natural convection, and from the room's walls, ceiling and furnishings via radiation. Heat is also added from the dish via heat conduction. The dish starts out at room temperature. Inside the cheese, the heat transfer oc-

curs via heat conduction. At a room temperature of 22 °C and a fridge temperature of 6 °C, the cheese should be warmed by about 12 °C to reach a suitable temperature. The heat flow to the cheese is greatest at the beginning, when the temperature



difference between the room and the cheese is the biggest, about 16 °C. As the cheese warms up, this difference becomes smaller. As a result,

both the heat flow and rate of heating become less. The time required for the warming-up process also depends on the type of cheese and the geometry of the cheese.

The warming-up process takes a surprisingly long time. For the cheese shown here, it takes approximately 2½ hours before the thicker part of the cheese reaches the desired temperature. We must accept that some parts of the cheese – including the tip – will become a degree or two warmer. The simplest procedure is for the cheese lover to measure the temperature progression of some favourite cheeses of an appropriate size and decide on the warming-up time required. Another option is to calculate the temperature progression. In this case, however, it is difficult to estimate the parameters required for the calculation, which makes the calculation result highly uncertain.

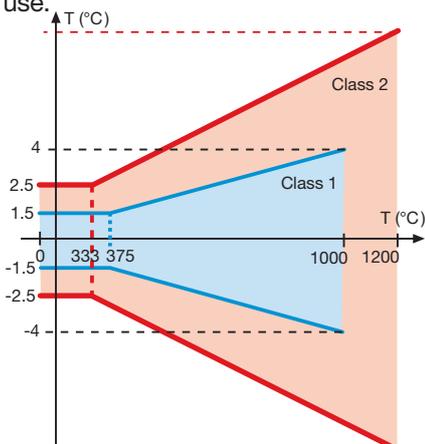
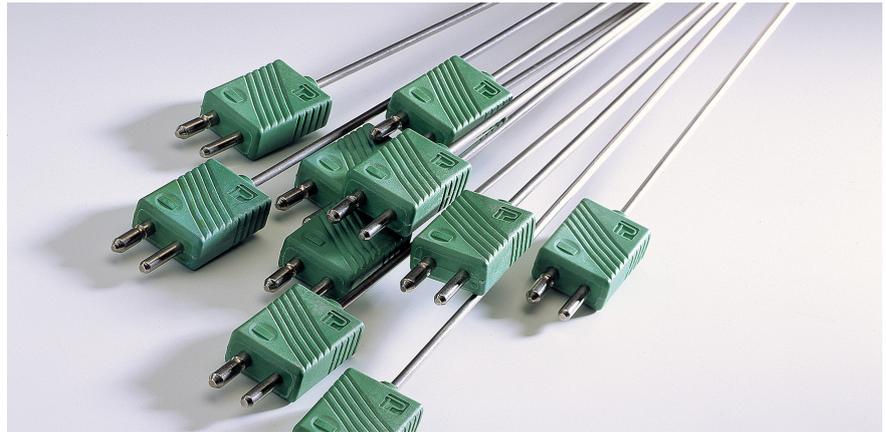
If you have questions or comments, contact Professor Emeritus Dan Loyd, LiU, dan.loyd@liu.se



SHEATHED THERMOCOUPLES – PRACTICAL ADVICE AND PROBLEM SOLVING, PART 2

The first part of *Pentronic News*' series on sheathed thermocouples gave an overall introduction to this type of sensor along with various kinds of construction and use. Part 2 gives information about some important error sources which you should know about when using sheathed thermocouples. The focus is on type K thermocouples, which is the most common type of thermocouple.

The legs/conductors of type K thermocouples consist primarily of a nickel/chromium and a nickel/aluminium alloy respectively. The designations used include NiCR/NiAl. Thermocouples are standardised in accordance with IEC 60584-1:2013 and have the tolerance classes 1 and 2 (see figure). However, it is very important to keep in mind that the tolerance limits only guarantee a thermocouple's properties at the time of delivery. A thermocouple is affected by its surroundings and its use.



Tolerances for types K thermocouples in accordance with IEC 60584-1:2013. (°C) Class 1: the greater of 1.5 or $0.004 \times t$. Class 2: the greater of 2.5 or $0.0075 \times t$.

For that reason, we present here a description of common error sources which are important to consider in your risk analysis or error budget, in addition to the stated tolerance classes.

HOMOGENEITY

A thermocouple is not a single-point sensor. Instead, it measures the temperature differences that are accumulated along the sensor's entire length from the measuring junction to the reference junction. The longer a sensor is, the greater the requirements that the legs' alloy and properties are totally homogeneous along the sensor's length. In demanding applications with long thermocouples, we recommend that you consult specialists to get the correctly selected and tested material for your sensors. Pentronic's experts can help you with the correct choice.

AGEING

In general, thermocouples should be regarded as perishable goods, even though in the absolute majority of the applications, they can maintain fully sufficient accuracy for many

years. However, you need to be aware that higher temperatures in particular accelerate the ageing process. Ageing involves a gradual alteration of the alloys' properties which worsens the accuracy over time. At high temperatures, especially above 1000 °C, the metal sheath can also no longer be regarded as a hermetic shield against contaminants, and the sensors age far faster.

SRO HYSTERESIS

SRO hysteresis is perhaps not a commonly known term, but Pentronic uses the expression to describe a phenomenon that primarily affects thermocouples of base metal alloys (e.g. type K). SRO stands for "Short Range Ordering" and refers to variations in the alloys' crystal structures. Type K thermocouples are affected by this phenomenon primarily during cycling within the temperature range of 200–600 °C. What happens is that when cycling occurs between high and low temperatures, the signal response from the sensor is different on the way up compared with on the way down in temperature. SRO hysteresis is an often unknown factor behind surprisingly large errors, mainly when calibrating. We recommend additional reading on this topic:

Error source for thermocouple K	Deviation max temperature (°C)		
	<200 °C	<600 °C	<1200 °C
1 Homogeneity	≤ 0.1	0.1-1	2-6
2 Ageing	≤ 0.1	< 2	1-50
3 Hysteresis	–	2-5	2-5
4 Green rot	–	–	10-100
5 Reference junction	0.3-3	0.3-3	0.3-3

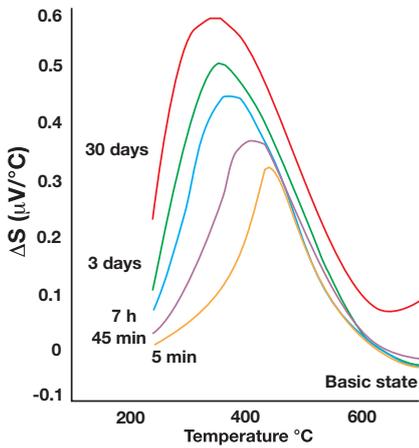
Measurement errors that can affect type K thermocouples within various temperature ranges. The sizes of the errors are estimated relatively roughly but they can still act as guidelines for where to look for the biggest sources of error in an installation.

years. However, you need to be aware that higher temperatures in particular accelerate the ageing process. Ageing involves a gradual alter-



[READ MORE:](#)

Type N thermocouples give a smaller calibration error than type K.



Changes in the Seebeck coefficient for type K thermocouples as a function of temperature level and exposure time. The critical zone is 200–600 °C.

GREEN ROT

For type K thermocouples, there is a risk within the range of 800–1050 °C that the legs are affected by green rot. This term is used to describe an oxidation process on the legs that produces a green-coloured chromium oxide. The reason why it is very important to know about this, is that it can be a major error source which is fairly unnecessary to risk. Oxidation at these temperatures depletes the alloy, which rapidly affects the

measurement results. As mentioned before, it is important to keep in mind that using a sheathed thermocouple gives no significant benefit, because at these temperatures the sheath provides no appreciable protection. However, it is easy to solve this problem by using a type N thermocouple instead.

THE REFERENCE JUNCTION

A thermocouple always has a reference junction or “cool junction” as it is often called. This is placed as close as possible to where the thermocouple is connected (signal converter, logger or indicator). In order to be able to interpret signals from a thermocouple, regardless of type, the cool junction must have a known temperature. It is therefore always crucially important that during the installation process you know what specification your cool junction has in terms of accuracy, and that you regularly evaluate the point itself: can its accuracy over time have been affected due to its environment or handling?

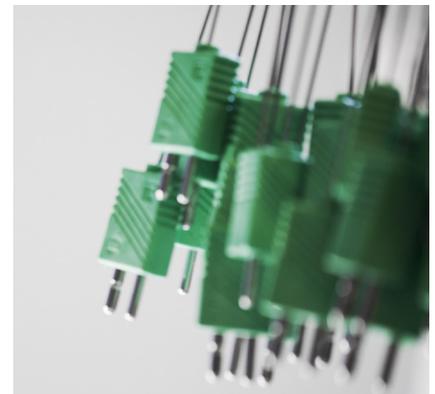
INSTALLATION

Also remember to always analyse the installation of thermocouples as a part of your error budget. For

example, measurement accuracy is easily affected if you use extension cables or if the cabling is drawn through different temperature ranges. For example, inside a furnace, where the temperature can be much higher close to the heaters at the edges of the furnace compared with the point where you have the material you want to measure.

Electromagnetic influences and insulation problems are also common error sources.

If you are planning for an application that has high requirements or if you are currently experiencing problems with your measurement processes, don't hesitate to contact one of Pentronic's experts for support!



HAPPY HOLIDAYS!

CHRISTMAS 2021 TOGETHER WITH

MÉDECINS SANS FRONTIÈRES
LÄKARE UTAN GRÄNSER

Foto: Vincenzo Livieri

A GIFT HAS BEEN MADE TO MÉDECINS SANS FRONTIÈRES

Momo, seven months old, is being examined at our pediatric hospital in Kenema, Sierra Leone. Together we give children like him life saving healthcare in areas where access is otherwise lacking.

PENTRONIC'S PRODUCTS AND SERVICES

Temperature sensors
Temperature transmitters
Temperature indicators
Dataloggers
Temperature calibration services
Moisture and thickness monitors
GFM Glass flow meters

Connectors and cables
IR pyrometers
Temperature controllers
Temperature calibration equipment
Training courses in temperature
Flow meters
Electro-optical test systems