What is two-wire control?

By: Admin - May 07, 2021

Two-wire control offers design engineers several thermal process operational benefits. This article offers information about a two-wire system to see how it can improve the efficiency of your thermal process and reduce complexity in your application.

How two-wire control works

Two-wire control describes an improved system design to reduce or eliminate the number of sensors and sensor wires required in an application and can streamline your thermal process. Unlike a traditional system consisting of a discrete sensor used to monitor an application's process temperature, two-wire uses the lead wires powering the heater to detect resistance and calculate the operating temperature. Compare two-wire and traditional thermal loop alternatives to better understand the unique advantages.

Traditional thermal loop

The most basic heating process involves a heater, controller and sensor. Once you activate the thermal loop with your controller, the heating element begins the heating process. A sensor monitors the changes in operating temperature from a nearby location and communicates this information to the controller to determine when the heater should be turned on and off.

There are several inconveniences and inefficiencies in a traditional thermal system including the risk of thermal lag. In other applications, additional sensing equipment can create the potential for leaks within the reservoir being heated and make it difficult to replace worn out or damaged sensors. These issues and other inefficiencies in traditional thermal systems can be overcome with two-wire technology.

A common issue is the lag between the heater and the sensor. Unless the thermocouple is positioned relatively close to the heater, there can be a range of temperatures across your application. Depending on the placement of the sensor, this can result in a temperature variation of several degrees from where the heating element is located to where the sensor is located. A related concern to this is inaccurate sensor placement. Having the sensor out of position and not aligned to where the work needs to occur can result in poor controlling and ultimately reduced heater life.

Two-wire loop

Additional sensors are not always the best answer in a thermal system. A two-wire solution leverages feedback received from the heater to achieve the desired temperature for your application. Resistance along the same wire used to power the heater can be measured and essentially becomes the sensor. Comparing this resistance and leveraging Watlow's materials science and thermal expertise, the heater can be better controlled. The resistance and temperature relationship are dependent on several things such as material property, heater type, application, etc. Understanding the complex inter-relationship between all these variables is where Watlow's thermal expertise resides.

Advantages of two-wire control

There are a range of inconveniences when using traditional thermal equipment for advanced thermal processes. These include time-consuming installation, inaccurate thermal readings and unnecessarily complex systems. Two-wire control can resolve many of these troubling challenges.

Convenient installation

Separate sensors and heaters can take up a significant amount of available space within a thermal application. In these more compact environments, added wiring and componentry can sub-optimize the heating process. Two-wire systems require less wiring because the heater also serves as the sensor. When space is not a concern another option could be to simply leave the current thermocouple in place and combine it with a two-wire system to get more information from your application potentially improving performance even further.

Streamlined operations

The more complex your thermal system is, the more susceptible it can become to failures. OEMs need reliability in their thermal process, and a two-wire solution eliminates the wiring complexity typically required with a separate sensor. Reducing the number of wires required in a thermal system can

reduce both complexity and costs. Some applications are more sensitive to electromagnetic interference (EMI). Two-wire systems can also help address this concern by reducing additional sensors and wires that commonly contribute to EMI issues.

Examples of two-wire heaters

Find out how design engineers are already using two-wire technology to enjoy these advantages. This system can be installed virtually anywhere a traditional thermal loop is used. Here are a few examples where two-wire technology can improve thermal processes.

Process heating

Circulation heaters can experience temperature inaccuracies between the heater sheath and the sensor. Due to thermal lag, your controller may not be able to maintain the optimal temperature without cycling the heater more often. Increased heater cycling – frequent powering of the heater on and off to maintain the desired set point – is one of the more common contributors to premature heater failure. Using a two-wire system can provide more accurate system readings and prolong the life of your thermal equipment.

Foodservice equipment

Fry pots are used in most fast food restaurants to cook a wide variety of foods. Holes must be drilled into the side of the fry pot, providing access for temperature sensors to be inserted directly into the cooking oil. Any type of additional encroachment to a fry pot like this represents a potential weak spot where leaks can occur over time. A two-wire solution essentially eliminates this vulnerability altogether and greatly reduces the risk of burned or scorched oil due to sheath temperatures overshooting desired set points to accommodate for thermal lag.

These are just a few ways two-wire technology can be used in critical heating applications. Contact your Watlow sales representative (https://www.watlow.com/en) to see if a two-wire solution is right for your application.