WEST Control Solutions

White Paper

Controller Specification

With an increasing range of temperature and process controllers on the market it can be hard to select the most appropriate controller for your application.

This whitepaper will walk you through the different criteria to consider when choosing your controller, helping you identify where cost savings may be possible as well as recognizing which features will be essential for your application.

Display and HMI

A key decision when specifying a controller is, ‘what level of user interaction do I need?’ If there’s very little user interaction required a controller with a basic display is often sufficient; this could be a simple seven-segment LED. The advantages are that the controller display is not cluttered and easy to read from distance.

If a lot of user interaction is needed, such as frequent setpoint changes, regular tuning, accessing process information or running programs, then controllers with text and graphic-based displays become more useful. They allow the possibility to apply text labels that match the operation of the machine and make process data easier to understand , rather than a mnemonic code that can be confusing.

A graphic display offers an additional level of simplicity for the user with pictures, charts and icons

showing information in a familiar and logical format. Often, there is the capability to hide certain parameters and settings from view of the operator, or promote a given page to the main operating page for that particular machine further reducing complexity.

Control Performance

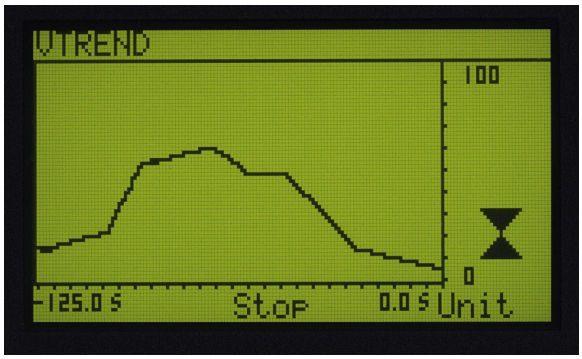
The next step is to select the best control type for the application. If the level of regulation required is high, PID [Proportional Integral Derivative] control should be specified; if it is basic then simple a on-off mechanmism will suffice. Today, most controllers offer both levels of operation but the control type is still a consideration for implementation, if not the selection itself.

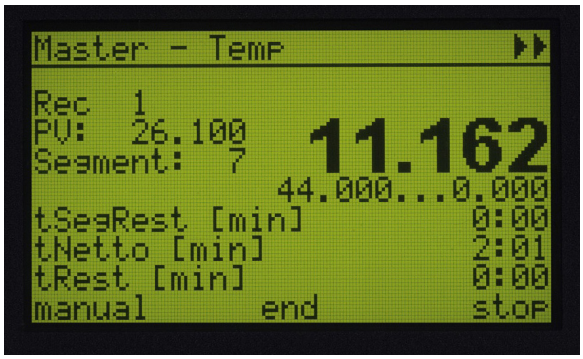
Many modern controllers have the ability to manage a cool control strategy in addition to heating via a secondary output. If the process material or product doesn’t naturally cool quickly enough you can enforce it. In an application this could mean turning a fan on, removing the heat rather than waiting for the temperature to naturally fall. Heating and cooling can share the same PID parameter but this doesn’t give the control performance needed for some applications so some of the more sophisticated controllers also offer a separate PID setting for the cool function.

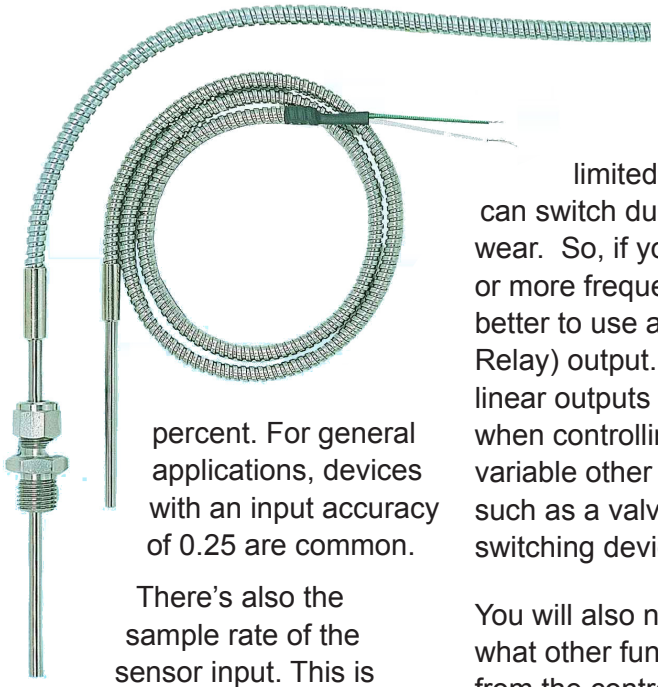
All controllers now tend to have auto tuning but what is often needed is the capability to tune easily for a given application. Advanced features allow you to minimize overshoot or apply a faster set point; there are also certain adaptive tuning methods that are available in some controllers that allow it to respond quickly if there’s any disturbance.

Interfacing

The next point to consider is system accuracy. Some applications, such as heat treating, define a system accuracy needed over the operating set point range, so the input accuracy can be very important. Where high level of input accuracy is needed devices are available with an accuracy of 0.1







percent. For general applications, devices with an input accuracy of 0.25 are common.

There's also the sample rate of the sensor input. This is the frequency a sensor measurement is taken, thisis often less important for controlling temperature, which takes long periods to rise or fall. However, where you are measuring a fast reacting variable, such as pressure, which can suddenly rise or drop very quickly, you need the fast control response a higher speed input can help provide.

The most important criteria from an input point of view is to ensure that your particular sensor type is supported. With universal inputs most standard thermocouple or PT100 sensor types are supported. If it is an infra-red sensor or a special thermocouple type you may need to double check that it is useable with your particular controller.
Also, you must to consider the output device you need to drive. Simple controllers with relay outputs are less expensive to implement in a system but are limited in how often they can switch due to mechanical wear. So, if you need faster or more frequent switching it is better to use an SSR (Solid State Relay) output. There are also linear outputs that are often used when controlling a different type of variable other than temperature, such as a valve or some thyristor switching devices.

You will also need to consider what other functions needed from the controller, for example, a profiler that allows you to vary the temperature over time. You can select a simple profiler that sets a ramp rate, with a timer for holding at temperature, or you can have multiple programmes and segments for different recipes.

Mechanics and installation

Another key decision is whether to mount your controller(s) on the front panel or behind it. The advantage of a front-mounted controller is that you have an integrated display, although generally quite simple, which is easy to service; you can easily replace the unit by pulling from the front. So serviceability is good from a front panel controller. A behind-the-panel controller allows you to integrate with the display HMI (Human-Machine Interface) of your choice so it allows for better incorporation into your system but it can be more difficult from a servicing point of view. It also tends to require a higher level of engineering knowledge and development time to implement.

A front panel controller requires very little development time, but the downside is that you've got a limited HMI. A behind-the-panel controller can require a high upfront development time with complex integration but once developed it can save you money and enable you to optimise operation of the machine with an HMI panel.

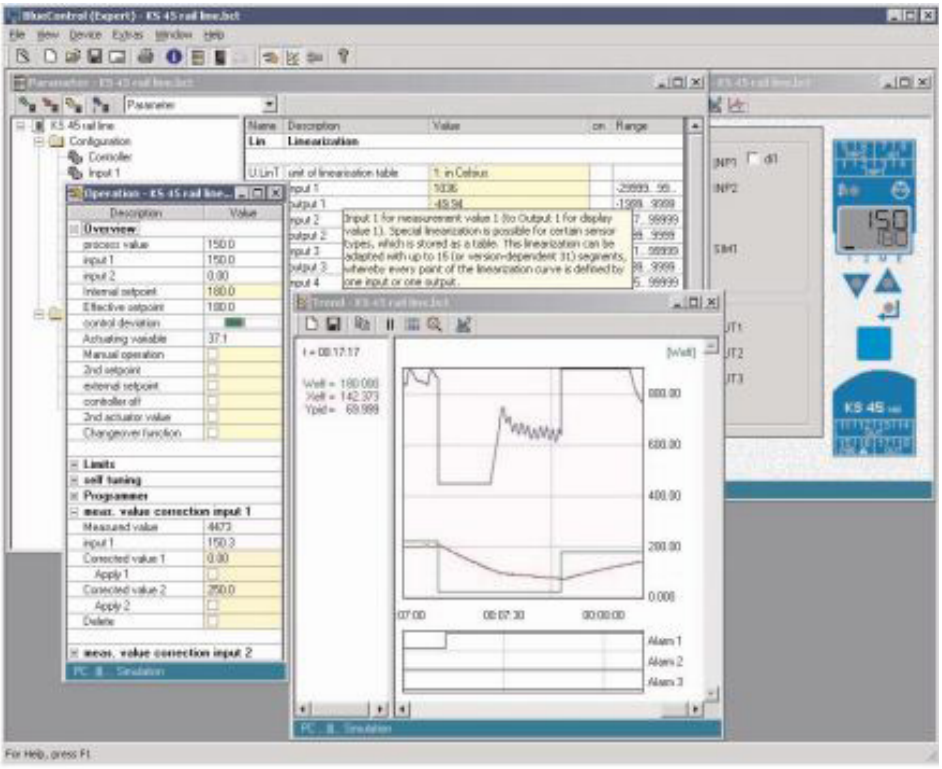
A consideration of mechanics and installation should also include environmental issues, with questions such as: What is the ambient temperature? What are the humidity requirements? Is a specific IP or NEMA rating required?

Configuration commissioning

Finally, since most users programme controllers by hand, you need to look at the user interfaces and the controller and consider whether they are easy to use. Basic controllers are programmed by hand but the more complex the customer requirements the more important the software becomes. Not only should the software offer configuration capability it should also offer extras, such as a trend/ data logging view, which is ideal when you're commissioning because it lets you see what's happening in the system.

Depending on the complexity of your application requirements you may wish to use more sophisticated software that provides functionality such as process simulation. The benefits of this allow complex configurations to be tested in a simulated environment preventing costly setup mistakes and ensuring complete peace of mind for your process application.

By considering the key issues described above you will ensure that the controller is well specified, cost-effective and tailored to meet the needs of your process.



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