How to Set Up a Control Loop in an F4T

By: - May 18, 2020

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OEM design engineers face the uphill task of setting up control loops in controllers.

Complex set parameters make it difficult to achieve proper operation, increasing the risk of operator errors. Setting up a control loop in PID controllers is an intricate process. Industrial processes require interaction with power and temperature controllers, so precision is critical. After all, these controllers are used in industries such as medical, power generation, and petrochemical refining.

A control loop is a mechanism that corrects the inconsistencies between the variable and the desired setpoint which drives the process variable up and down, depending on the error in place. All steps in the loop are unified to accomplish the process. All power and temperature controllers demand the right set up for maximum functionality.

Understanding Watlow's F4T Controllers

The F4T controller (/en/products/controllers/temperature-and-process-controllers/f4t-integrated-controller) combines functions of many devices that are integrated into one system. These functions include over/under temperature limit, temperature PID, and power switching. It has three fundamental parts: input, output, and function blocks.

It is also worth mentioning COMPOSER®, Watlow's new easy-to-use software for customizing and configuring controllers (/en/products/controllers/software/composer-software). This software will allow you to optimize the F4T for specific applications and task-specific views simplify all aspects of commissioning new controls, including setting up control loops. Learn more here. (https://youtu.be/tag4Nk98dMQ)

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Function blocks

Design engineers can customize the power and temperature controller by connecting several function blocks. A transmitter of one function is commonly connected to a receiver of another by use of the COMPOSER's function block diagram editor, commonly called the "canvas". Connections between two blocks, otherwise referred to as signal, carries coded information from one function block to another.

The function block has the following features:

- -**Function block library** shows the available function blocks for this type of controller. The number below each icon represents the remaining available function blocks for this particular power and heat controller.
- -**Parameter list** is a movable window that indicates the function blocks parameters customizing the behavior of the application.
- -**Navigator** allows users to adjust the view of the canvas.
- -**Help** is a movable window which allows users to view detailed function block information and short informational videos describing more about function blocks and their parameters.
- -The **Function block** feature allows the user to customize the functionality of the power and heat controller.
- -The **Receiver** is the part of a function block which is connected to supply data function.
- -**Transmitter** is the part from which a signal is connected to carry data to other function block.

Getting started with the function block

The three-basic setup steps of the function block for any application are:

1. From the library, add the functions block to the canvas required to interpret any signal from both physical input and output.
2. Connect transmitters to receivers on the function blocks that need data.
3. Set each function block parameters as required by the power and heat controller application as expected.

Detailed descriptions of each function block parameters are accessed in the online help for the function block.

Advanced thermal products require special function blocks for performing sophisticated functions that can be added to the canvas from the library. These include such function blocks as: cascade, alarm and math blocks.

Connecting function blocks together

To connect a transmitter to receiver, click and drag a signal form an function blocks transmitter to a receiver on another function block within the Composer canvas. To change the function block parameter, double-click on the function block and locate the parameter from the parameters window. To set the loop parameters, the name edited on the control loop is displayed on both the F4T home page and controller.

Checking the parameter list

Control loop function blocks are initially located in the library and can be dragged to the canvas. The initial signal from the universal input carries the process value to the PV receiver on the control loop block where it is used to serve as feedback to the control algorithm.

The signal from HT, when controlling a heated system, on the loop to the output block controls the heater by signaling when the heater should be on or off, or how much it should be on with a 0 to 100 percent signal for the PID controller. The signal from CL on the loop to the output block controls cooling by signaling when the chiller should be on.

Input block

The input block houses the logic to interpret a sensor's data, which provides feedback of the measured process values from the sensor to the control block. **There are two different types of input blocks: universal process and thermistor**.

- -Universal process input blocks can read sensor signals like thermocouples, pressure and humidity.
- -Thermistor input blocks can only read signals from thermistor temperature sensors.

A thermocouple (/en/products/sensors/thermocouples)is a type of sensor that is calibrated to read mV/volts or pressure for other advanced thermal processes. For advanced heating products, configure the input with other devices to enable the user to read humidity and other values.

The universal input block is used to interpret the temperature signal produced by a thermocouple in heating processes. The universal input block, when connected to a control loop, sends the sensor signal it interpreted to the control block.

Please note: Make sure the input block's sensor type and other parameters are set correctly. The Watlow F4T will default to a Type J thermocouple in Composer®, so one must ensure this parameter of the input block is correct before turning the system on.

Disconnect and lock out all the energy sources until you have configured and tested the application. This is because when the function block is connected to the output, the control starts to function immediately.

Output block

Watlow's output function blocks receive a signal from the transmitter of the control loop function block to execute many different functions. The output block receives the command from the control loop function block, and then the output block drives an action, such as: a door opening or closing, a heater being fed more or less power or a light turning on or off. It is this variety of functions that a F4T's control loop and output function blocks are capable of that make the F4T a diverse process and temperature controller.

Advanced heating products can have power and temperature controllers with an output that requires either a fixed or a variable time base. For heating products where the power and temperature controller drive a high resistive load, it is recommended to use a variable time base, which improves the performance.

The bottom line

When dealing with power and temperature controllers like the F4T, following this process is imperative. With safety a key factor, it makes work easier for design engineers working with OEMs to set control loops. If you have more questions on this or other setup processes, contact the Watlow team (https://www.watlow.com/contact-us).

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