Normally the output level of a controller (0 to 100%) is generated by a single actuator (0 to maximum output). In split-range operation the output is split over multiple actuators. For example, if two equally dimensioned actuators are used, for an output level of 0 to 50%, the output is increased by the first actuator. For output levels of 50 to 100%, the output will then be increased by a second actuator as well.

Split-range operation with refrigeration

The controller used for the supply temperature continuously calculates an output level between 0% and 100% corresponding to a value between “no cooling capacity” and “maximum cooling capacity”. With an output level of up to 50% the feed pump increases the flow rate quantity of the cooling medium. If an output level of 50% is not sufficient, a refrigerating machine provides additional cooling of the cooling medium. In this way small amounts of heat are dissipated through the cooling tower. The cost-intensive refrigerating machine is not used until maximum cooling capacity is reached.

Split-range operation: configuration

When actuators with continuous control are used, for example a converter each for the feed pump and refrigerating machine, a continuous controller with two analog outputs is used. The configuration is extremely simple for JUMO controllers such as the JUMO IMAGO 500 type: first the analog input of the controller is adapted to the sensor that is used. Generally RTD temperature probes are used in this case, occasionally thermocouples as well. Then the controller type is defined, “continuous controller”. The controller output level is assigned to the analog outputs as a function. Scaling for the example described here is arranged so that an output level of 0 to 50% controls one analog output from 4 to 20 mA and an output level of 50 to 100% controls another analog output from 4 to 20 mA in addition (see diagram). If necessary the refrigerating machine (output level > 50%) can also be suppressed for a defined period of time. Split-range operation is also possible for two-state and three-state controllers with cycling binary outputs. The JUMO IMAGO 500 is used for this application as are the controller series JUMO dTRON 300 and JUMO DICON.

Summary and outlook

There are many reasons for split-range operation. In the example shown here it is used to assign precedence to diverting heat energy via a cooling tower instead of with a refrigerating machine, thereby sustainably reducing energy use and saving money. The function can also be implemented without a control unit. In this case a single inexpensive JUMO controller then controls the supply temperature. It is responsible for controlling both actuators.

Additional information

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The diagram shows a possible application for a JUMO IMAGO 500 controller, ensuring energy-efficient split-range operation of a cooling plant with two analog outputs.