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process control systems are used in everything from advanced manufacturing to turn-of-the-table activities at home, like heating your house and brewing your beer. (You do brew your own beer, don't you?) A control system that manufactures a product requires monitoring and control of many different process variables, while some at home require more than a timer. For example, in manufacturing we may use flow meters to make sure fluids flow through pipes at a certain rate, or float meters to ensure ingredients fill a vat to a specified level. When I brew beer at home, I may use a temperature sensor in my mash tun, wired to a controller that controls my heating element to keep the mash tun at just the right temperature for optimum starch-to-sugar conversion. This is an example of a closed-loop control system. (To see how small closed-loop control principles are scaled up to build industrial process control applications, check out the New Belgium Brewery case study and see how they use Opto 22 gear to brew their world-famous Fat Tire and other beers.) On the other hand, if you look at how a basic clothesdryer operates, it uses an open-loop control system. When you put your wet laundry into the dryer and start its drying cycle, it uses a single setpoint in the form of an internal timer to determine when to turn off your dryer. Throw the wet clothes in, turn the dial, and after an hour or so your dryer automatically shuts off, whether the clothes are dry or not. To produce a finished product of repeatable quality and consistency, you have to combine many individual processes and run them simultaneously. In manufacturing and industrial automation, each process must be precisely controlled by some type of automatic controller. For example, an Opto 22 SNAP PAC controller. Open-Loop Control So process control is performed automatically to help ensure consistent and repeatable results. If a process is controlled only by setpoint commands without any feedback measurement signals, the system is referred to as open loop. Open-loop control is used in applications with simple processes. Timing functions and setpoints typically control the operation. We find open-control systems in industrial dishwashers, laundry machines, and printed circuit board burn-in chambers. These types of equipment are often manually configured and set to run. The advantage to open-loop systems is that they're typically pretty cheap, simple, and quick to implement. The major drawback, however, is that it's without a feedback loop, there's no way to change output states if the process deviates from its required state. For that, we need to use closed-loop control. Closed-Loop Control For more advanced automation and process control applications, we turn to closed-loop control. In closed-loop control we add some form of a feedback loop, which is attached to a process controller. The feedback loop provides information on the status of the process to the process controller, which then adjusts the process to become self-regulating. For example, in our beer brewing application above, we need to keep the temperature of the mash tun just right for optimum starch-to-sugar conversion. During this conversion, external variables work against our attempt to control the process. For example, the temperature in the room may fluctuate, or ingredients added to the mash tun may change the mash tun water temperature. To control the process, we need to use a feedback loop. For example, we may add a temperature sensor in the mash tun and wire it to an input module, which sends data to a process controller like a SNAP-PAC-R1. We could then wire the heating element to an output module controlled by the SNAP-PAC-R1. That way, when the temperature in the mash tun is out of the desired setpoint, the controller can output a value to the mash tun heating element and bring the process back into the desired temperature setting. Several different types of controllers can be used for process control. For a great article that compares the different types of technologies available today, check out Food Engineering's article "PLCs and PACs: Know When and Where to Use Them." SNAP PAC controllers are programmed to perform an operation using a human-readable, visual flowchart programming language. This easy-to-understand language makes building an industrial automation application pretty simple, even for someone with little to no industrial automation or process control experience. Interested in adding a temperature feedback loop to your process? Download the temperature sensor primer. Manufacturer: Learning Center A control system can be described as a system that can control the output quantity. Basically, it is a device or a set of the device which can manage, command, and regulate the operation of the other device or a system. A system consists of different elements and devices that are interconnected to do a process. The control system is formed by the component interconnection and thus a system configuration is achieved and it will control the system. The major components of a control system are actuators, sensors, reference input, and the system. The system is the process or plant which needs to be controlled and the actuator would convert the control signal to a power signal. The sensor would measure the system output and the reference input represents the required output. What is the need for an automatic control system? It can meet environmental safety regulations such as it can reduce pollution and also can ensure safety. With the help of a control system, it can be done really easily in many industrial processes. What is a set point change and disturbance change? Set point change: This is the predetermined value for the control variable, so if there is a change in the set point then, certain adjustments would be done in order to achieve the new operating conditions. Disturbance change: This is the change in the process because of a disturbance, so the control system must be capable to return the controlled variable to the set point. What are the hardwares of a control system? Sensor: The sensor would measure the system variable, in the automatic control this would act as a signal source. Controller: The controller would do the comparison and the computation process. Control element: It is the equipment to do the control action in a process, the control element would receive signals from the controller and according to that, it will perform certain actions. In most cases, the control element would be the control valve. What are the functions of a control system? The control system must be able to do the measurement, and it compares the measured value to the required value. The control system should be able to compute the difference between the required value and the measured value. So while comparing the measured value and the desired value, if the measured value is not close to the desired value then correction must be done and all these are the major functions of a control system. What are the requirements of a control system? The control system should be accurate. It must be really sensitive to external noise but it must be sensitive to the input commands. It must be stable. It should have a good frequency response. The control system must operate very quickly. Why automatic control system or what is the purpose of an automatic control system? Productivity can be increased. Quality can be increased. Energy optimization. Comfortable operation. The remote control can be done. The input can be controlled. The automatic control system will use, for the regulation and quality control of processes and the environment. The control system is used in many industrial processes, a process is a device, plant, or system which is under control. The process control is done by a control system, the control system would convert the variable to the required variable. There are manual and automatic control systems if a human operator is required to give input throughout the process then it is manual control. In an automatic control system, there will be a controller which can replace the human operator and this controller is set to control the process accurately. In most cases, the function of the control system is to control the physical variables such as temperature, voltage, frequency, flow rate, current, position, speed, etc, and all these are called the controlled variables. In a manual control system a machine will be operated by a person but in the case of an automatic control system machine will do the operation automatically. The automatic control system has a controller so it can perform the operation on its own. Basically, the control system is a combination of elements and subsystem which needs to maintain a quantity. The control system can maintain a process with the help of feedback control, this would help to maintain the specific variables close to the required values. So the control system can meet the requirement of the process by adjusting the selected variables in the system. The feedback control can make use of an output of the system to influence the input of the same system. The automatic control system would have electronic equipment and it uses current and voltage to communicate. Control will be implemented in the sensors, valves, and other equipment in the process. What are the disturbance in a control system? In a control system, the disturbance is a signal which would affect the system output value. There are two types of disturbance one is an internal disturbance that is generated within the system and the other one is external disturbance and which is generated outside the system. What are the different types of control system? Open loop system: This is also known as a non-feedback system, in this type of control system the control action is not dependent on the output of the system. These systems are not capable to take into account the disturbances. So it can only make changes in the output by making changes in the input. What are the advantages and disadvantages of an open loop control system? Advantages: Simple construction. Economical. Easy to maintain. Stable. Disadvantages: Not accurate. It is not reliable. Any change in the output cannot be corrected automatically. Closed loop control system: In this type of control system, there is a sensor that would measure the output and it uses feedback of the sensed value to influence the control input variable. In this type of control system, the output would have an effect on the input quantity in a way that it can maintain the required output value. So with the help of the feedback in a closed-loop control system makes it an automatic control system. In this type of control system, the output is checked all the time so that it can be compared with the desired input and if it is not close to the desired input then there would be an error signal. So by checking the error signal the control elements in the system will do the required actions and thus the required output can be achieved. What are the advantages and disadvantages of a closed-loop control system? Advantages: High bandwidth range. Accurate. This is very accurate even in the presence of non-linearity. Stability is increased by decreasing the sensitivity. The system is not affected by noise. Disadvantages: Costlier. Design is complicated. More maintenance is needed. Due to the feedback, the gain is reduced. Less stable. What is a feedback and feed-forward control? The feedback control takes the system output to the controller and the controller would compare this output to the required value. The feed-forward control would detect the disturbances directly and it would take proper actions to remove the effect of this disturbance from the output. What are the advantages and disadvantages of a feedback control? Advantages: It would measure the controlled variable. It would take proper actions regardless of the disturbance source. It would decrease the sensitivity of the controlled variable to the disturbances and also to the change in process. Disadvantages: Corrective action will only take place after the disturbance. The response is not stable. What are the advantages and disadvantages of a feed-forward control? Advantages: Disturbance variable. It would correct the disturbance before it makes any changes in the process. Disadvantages: It is not really sensitive so sometimes it can't measure the disturbance. What are the advantages and disadvantages of an automatic control system? It can reduce the consumption of energy. Production labor will be decreased. There won't be any human errors. It can also maintain the operational constraints. Protection of the equipment. Smooth plant operation. Profitable. What are the applications of an automatic control system? Automobile Refrigeration Air conditioning: It is used in transportation systems such as railways, planes, etc. It is used in many process industries such as chemical, steel, power, flow rate, etc. An industrial automation system is a system used to control and monitor a process, machine, or equipment in a computerized manner, often performing repetitive functions or actions. Automation systems and automation solutions operate in a wide range of applications, such as control and monitoring systems, data security applications, factory automation systems, manufacturing, automatic message response systems, and more. The operation of automated systems uses sensor systems, feedback control circuits, and automatic actuators. Automation system operation is the part of automation system control where manual processes are fully automated using special control machine schemes and logic. An automated system is a computer-controlled machine that uses a computer to perform control operations by collecting, processing, calculating, and controlling process variables. At the same time, various automation tools such as CNC machine tools and industrial robots are used to automate the entire production process (including production, planning and control). The entire machine systems, from planning and design to product shipment, is fully integrated and automated. Industrial automation relies on various control systems for integrating each piece of process equipment or equipment into a larger system. Industrial automation uses control systems and equipment, such as computer software and robots, to perform tasks that used to be done manually. Industrial automation is the use of control systems and information technology such as computers or robots to control various processes and machines in an industry to replace humans. Automation includes the use of various control systems to operate equipment such as machines, factory processes, thermal boilers and furnaces, ignition of telephone networks, etc. In the case of programmable automation, the production equipment can change the sequence of operations to be able to handle different product configurations. In this type of automation, modification of a certain type of product, as well as assembly or mechanical operation, can be modified by changing the control program in the automation equipment. Stationary automation systems are mainly used in discrete mass production systems and continuous flow systems such as paint shops, distillation processes, conveyor lines and conveyor belts. In a factory, we can automate production machines and tools, material handling equipment, control equipment, and even computer systems that therefore in improving the quality and uniformity of the products offered. 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What is the role of distributed control system in automation. What type of automation is defined as an on off control system. Vad är automation. What is distributed control system in industrial automation. What is building automation control systems. In automation what is a control system used for. What is control automation. What is the difference between control system and automation system. What is industrial automation and control systems.

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