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Process Control in Manufacturing

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Annotation: Process control is a set of procedures designed to ensure that processes within a manufacturing plant are carried out correctly and that the desired output will be achieved. It's been around since the 1980s, but new technologies such as artificial intelligence (AI) and machine learning (ML) in manufacturing have made it more powerful and impactful. Today, process control automatically manages production conditions to maintain quality, throughput, and efficiency in the plant. It both relies on AI and ML and makes it possible for plants to implement AI-powered automated processes. Automated systems need process control to ensure that they are operating as expected, while process control uses data from automated sensors and monitoring devices to set and adjust its controls.

Keywords: Artificial intelligence (AI), machine learning (ML), automated systems.

Process control involves feedback loops, which monitor a huge range of applications, activities, and variables, including temperature, vibrations, pressure levels, flow, and more, to spot unwanted variations from the norm and initiate action to adjust and correct each process. Plants also use process control to monitor or manage control connectors and analytical components. A series of linked feedback loops can cover highly complex systems, up to and including an entire plant, as long as the loops are interoperable. SCADA (Supervisory Control and Data Accusation) is one of the most popular and widely-adopted process control systems used in process manufacturing.

Process control is vital for any company that wants to run automated or semi-automated processes. It almost entirely removes the need for human intervention (apart from monitoring the process controls) to allow plants to operate autonomously despite minor variations in input, conditions, etc.

Even without widespread automation, process control systems enable plants to:

- Raise the quality of their products and consistently hit quality requirements
- Save energy and water by running equipment more efficiently
- Increase efficiency in the plant, limit rework and scrapped batches, and reduce the risk of human error
- Improve safety levels by ensuring that all equipment and processes are running correctly
- Lower manufacturing costs by maintaining a more efficient plant
- Same time previously spent on manual checks.

It's estimated that process manufacturing businesses could save up to 15% in energy costs through an effective process control system.

The first step is to consider which processes within your plant to include under your process control systems. You might begin with simpler processes and then work up to cover more complex ones, or begin with the processes that are most critical for production.

As mentioned above, process control relies on data from sensors and devices. Decide which metrics to track to spot variations in processes, and how to reliably gather data for those metrics.

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Your data will be coming in from numerous sources and in many different formats. You need to establish a robust system that brings all your data together in a single repository, and processes it to be accessible to your process control tools.

Examine your data to work out the limits within which variations can occur without affecting product quality, safety, or plant efficiency. These will be the control limits that your process control systems will enforce.

Implementing process control in manufacturing enables process plants to enjoy improved quality and efficiency while cutting costs and reducing waste. In the long term, it assists manufacturing organizations to step closer to full automation and lights-off manufacturing, saving employee time for more revenue-driving activities and ultimately increasing profits.

ICSs used to be “dumb” systems that operated on a closed circuit, but that changed with the advent of artificial intelligence (AI), machine learning (ML), and IIoT devices. Today, most ICS networks are “smart” internet-connected systems that enable plants to improve data-gathering and analysis and increase efficiency across manufacturing processes.

ICS technologies often used in process plants include:

- Supervisory control and data acquisition (SCADA);
- Distributed control systems (DCS);
- Industrial automation and control systems (IACS);
- Programmable logic controllers (PLCs);
- Programmable automation controllers (PACs);
- Remote terminal units (RTUs);
- Control valve diagnostics;
- Control servers;
- Intelligent electronic devices (IEDs);
- Sensors.

Process manufacturing plants are home to complex processes and intricate chains of equipment and machinery. They all need to work in synchrony for effective production. Industrial control systems ensure that all these moving parts are working together efficiently and safely.

For example:

- SCADA systems enable remote monitoring for field sites like oil rigs;
- DCS systems control production systems like valve management;
- IACS systems enable industrial automation across complex processes;
- A PLC supervises local operations of sensors and other gadgets;

Today’s ICSs are internet-connected, making them vulnerable to hacking attempts. Because they play such a critical role in manufacturing processes and vital infrastructure, they are also very tempting targets for opportunistic malicious actors and state-sponsored dirty warfare.

As a result, it’s crucial to ensure that these systems are secured against potentially harmful unauthorized access. Industrial Control System Security is a security framework designed to protect these systems from accidental damage or deliberate attacks, while allowing safe access for authorized personnel.

ICS Security uses a range of tools and tactics, including vulnerability management, network intrusion protection and detection, access permission controls, patch management, and asset inventory and

detection to secure ICS systems. This should go hand in hand with employee education about password management and system security, to mitigate human-enabled vulnerabilities.

Overall, Industrial Control Systems are a vital part of manufacturing processes, regulating the behavior of machinery and equipment and ensuring efficient and safe production. With effective ICS systems, process manufacturing plants can introduce and extend automation, improve productivity, and cut costs to ultimately boost profits.

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