As your business grows and technology evolves, depend on Top Edge Consulting industrial automation consulting services to help you optimize your plant floor operations. Industrial automation consulting adds value at any point along your organization's timeline — as a part of greenfield facility startups, or modernization projects, user requirements and functional specifications, hardware and software vendor analysis, system upgrades and periodic process automation assessments. We have the automation, the industry work process and the bestpractices
expertise needed to address your operational concerns and to provide comprehensive recommendations for improvement. Plants in all major industries have benefited from our industrial automation consulting.

Control System Architecture Evaluation

Our industrial automation consulting teams provide helpful insight for optimizing your control system architecture. We evaluate your current architecture and match it to your needs. For many clients, this results in a consensus-based approach to defining a to-be state and gap analysis. Working as your industrial automation consulting partner, we help you:

- Evaluate and refine your architecture to meet your control requirements.
- Align workflow and communication protocol with business processes.
- Define flexible, growth-oriented architecture to achieve your future automation goals.
- Improve reliability and performance of SCADA, PLC and DCS systems.

Modernize and optimize your control system architecture with Top Edge Consulting industrial automation consulting services.

Controls Assessment

Depend on our industrial automation consulting team for complete controls assessment. Our automation expertise enables us to effectively evaluate inputs, outputs and logic — recommending advanced controls where appropriate. Learn how to become a state-of-the-art, low-cost manufacturing producer by controlling operational costs, managing energy consumption, minimizing waste and reducing downtime with the help of Top Edge Consulting industrial automation consulting services.

Change Management and Planning

When you're planning a system migration or line expansion, our industrial automation consulting teams help you develop a solid plan for seamless transition on the plant floor. We assist with all aspects of forward thinking as you prepare to:

Reliable Solutions for Your Plant Floor

Top Edge Consulting goes beyond industrial automation consulting by implementing the technologies needed to achieve the improvements we recommend.

Top Edge Consulting provides services like conceptualising, designing, helping in procurement of state-of-the-art products, supervising installation and commissioning. We also provide support in stabilizing the entire process automation.

Process Automation & Controls is dedicated to provide process automation solutions for highly production oriented industries. We understand the production based industry from design to installation. Our approach is always meticulous in the field of automation, instrumentation and electrical services.

We at Top Edge Consulting have experience in development and implementation of various process automation systems in the Iron and steel sector predominantly. Some of our experiences are appended below:-

Complete Blast Furnaces and Hot Blast Stoves automation including DCS system.
Rolling Mills Automation of various sections from rolling to finishing areas.
Coke Oven and Sinter plant automation.
Automation of Steel Melting shop and its logistics.
Inventory control systems, logistics and despatches of finished goods from the industry.
Automation of Oxygen plants, Power plants, power distribution etc.

Industrial process control system (IPCS) is a general term that encompasses several types of control systems used in industrial production, including supervisory control and data acquisition, (SCADA) systems, DCS, and other smaller control system configurations such as skid-mounted PLC often found in the industrial sectors and critical infrastructures.

IPCSs are typically used in industries such as electrical, water, oil, gas and data. Based on information received from remote stations, automated or operator-driven supervisory commands can be pushed to remote station control devices, which are often referred to as field devices. Field devices control local operations such as opening and closing valves and breakers, collecting data from sensor systems, and monitoring the local environment for alarm conditions.

Industrial process control system technology has evolved over the decades. DCS systems generally refer to the particular functional distributed control system design that exist in industrial process plants (e.g., oil and gas, refining, chemical, pharmaceutical, some food and beverage, water and wastewater, pulp and paper, utility power, mining, metals). The DCS concept came about from a need to gather data and control the systems on a large campus in real time on high-bandwidth, low-latency data networks. It is common for loop controls to extend all the way to the top level controllers in a DCS, as everything works in real time. These systems evolved from a need to extend pneumatic control systems beyond just a small cell area of a refinery.

The PLC (programmable logic controller) evolved out of a need to replace racks of relays in ladder form. The latter were not particularly reliable, were difficult to rewire, and were difficult to diagnose.PLC control tends to be used in very regular, high-speed binary controls, such as controlling a highspeed printing press. Originally, PLC equipment did not have remote I/O racks, and many couldn't even perform more than rudimentary analog controls.

SCADA's history is rooted in distribution applications, such as power, natural gas, and water pipelines, where there is a need to gather remote data through potentially unreliable or intermittent lowbandwidth/high-latency links. SCADA systems use open-loop control with sites that are widely separated geographically. A SCADA system uses RTUs (remote terminal units, also referred to as remote telemetry units) to send supervisory data back to a control center. Most RTU systems always did have some limited capacity to handle local controls while the master station is not available. However, over the years RTU systems have grown more and more capable of handling local controls.

The boundaries between these system definitions are blurring as time goes on. The technical limits that drove the designs of these various systems are no longer as much of an issue. Many PLC platforms can now perform quite well as a small DCS, using remote I/O and reliable that some SCADA systems actually manage closed loop control over long distances. With the increasing speed of today's processors, many DCS products have a full line of PLC-like subsystems that weren't offered when they were initially developed.

This led to the concept of a PAC (programmable automation controller or process automation controller), that is an amalgamation of these three concepts. Time and the market will determine whether this can simplify some of the terminology and confusion that surrounds these concepts today.

DCSs

DCSs (Distributed Control Systems)a re used to control industrial processes such as electric power generation, oil and gas refineries, water and wastewater treatment, and chemical, food, and automotive production. DCSs are integrated as a control architecture containing a supervisory level of control, overseeing multiple integrated sub-systems that are responsible for controlling the details of a localized process.

Product and process control are usually achieved by deploying feed back or feed forward control loops whereby key product and/or process conditions are automatically maintained around a desired set point. To accomplish the desired product and/or process tolerance around a specified set point, only specific programmable controllers are used.

PLCs

PLCs provide boolean logic operations, timers, and (in some models) continuous control. The proportional, integral, and/or differential gains of the PLC continuous control feature may be tuned to provide the desired tolerance as well as the rate of self-correction during process upsets. DCSs are used extensively in process-based industries. PLCs are computer-based solid-state devices that control industrial equipment and processes. While PLCs can control system components used throughout SCADA and DCS systems, they are often the primary components in smaller control system configurations. They are used to provide regulatory control of discrete processes such as automobile assembly lines and power plant soot blower controls and are used extensively in almost all industrial processes.

Embedded control

Another option is the use of several small embedded controls attached to an industrial computer via a network.

Process control is extensively used in industry and enables mass production of continuous processes such as oil refining, paper manufacturing, chemicals, power plants and many other industries. Process control enables automation, with which a small staff of operating personnel can operate a complex process from a central control room.

For example, heating up the temperature in a room is a process that has the specific, desired outcome to reach and maintain a defined temperature (e.g. 20°C), kept constant over time. Here, the temperature is the **controlled variable**. At the same time, it is the **input variable** since it is measured by a thermometer and used to decide whether to heat or not to heat. The desired temperature (20°C) is the **setpoint**. The state of the heater (e.g. the setting of the valve allowing hot water to flow through it) is called the **manipulated variable** since it is subject to control actions.

A commonly used control device called a programmable logic controller, or a PLC, is used to read a set of digital and analog inputs, apply a set of logic statements, and generate a set of analog and digital outputs. Using the example in the previous paragraph, the room temperature would be an input to the PLC. The logical statements would compare the setpoint to the input temperature and determine whether more or less heating was necessary to keep the temperature constant. A PLC output would then either open or close the hot water valve, an incremental amount, depending on whether more or less hot water was needed. Larger more complex systems can be controlled by a Distributed Control System (DCS) or SCADA system.

Types of control systems

In practice, process control systems can be characterized as one or more of the following forms:

Discrete – Found in many manufacturing, motion and packaging applications. Robotic assembly, such as that found in automotive production, can be characterized as discrete process control.Most discrete manufacturing involves the production of discrete pieces of product, such as metal stamping.

Batch – Some applications require that specific quantities of raw materials be combined in specific ways for particular durations to produce an intermediate or end result. One example is the production of adhesives and glues, which normally require the mixing of raw materials in a heated vessel for a period of time to form a quantity of end product. Other important examples are the production of food, beverages and medicine. Batch processes are generally used to produce a relatively low to intermediate quantity of product per year (a few pounds to millions of pounds).

Continuous – Often, a physical system is represented through variables that are smooth and uninterrupted in time. The control of the water temperature in a heating jacket, for example, is an example of continuous process control. Some important continuous processes are the production of fuels, chemicals and plastics. Continuous processes in manufacturing are used to produce very large quantities of product per year (millions to billions of pounds). Applications having elements of discrete, batch and continuous process control are often called *hybrid* applications.

Statistical process control

Statistical process control (SPC) is an effective method of monitoring a process through the use of control charts. Much of its power lies in the ability to monitor both the current center of a process and the process's variation about that center. By collecting data from samples at various points within the process, variations in the process that may affect the quality of the end product or service can be detected and corrected, thus reducing waste as well as the likelihood that problems will be passed on to the customer. It has an emphasis on early detection and prevention of problems.

Multivariable Process Control is a type of Statistical Process Control where a set of variables (manipulated variables and control variables) are identified and the joint variations within this set are captured by a step test. The Dynamics captured in the model curves are used to control the plant.

Reliability and precision

The earlier focus on using automation simply to increase productivity and reduce costs was seen to be short-sighted, because it is also necessary to provide a skilled workforce who can make repairs and manage the machinery. Moreover, the initial costs of automation were high and often could not be recovered by the time entirely new manufacturing processes replaced the old.

Automation is now often applied primarily to increase quality in the manufacturing process, where automation can increase quality substantially.

Health and environment

The costs of automation to the environment are different depending on the technology, product or engine automated. There are automated engines that consume more energy resources from the Earth in comparison with previous engines and those that do the opposite too. Hazardous operations, such as oil refining, the manufacturing of industrial chemicals, and all forms of metal working, were always early contenders for automation.

Convertibility and turnaround time

Another major shift in automation is the increased demand for flexibility and convertibility in manufacturing processes. Manufacturers are increasingly demanding the ability to easily switch from manufacturing Product A to manufacturing Product B without having to completely rebuild the production lines. Digital electronics helped too. Former analogue-based instrumentation was replaced by digital equivalents which can be more accurate and flexible, and offer greater scope for more sophisticated configuration, parametrization and operation. This was accompanied by the fieldbus revolution which provided a networked (i.e. a single cable) means of communicating between control systems and field level instrumentation, eliminating hard-wiring.

Discrete manufacturing plants adopted these technologies fast. The more conservative process industries with their longer plant life cycles have been slower to adopt and analogue-based measurement and control still dominates. The growing use of Industrial Ethernet on the factory floor is pushing these trends still further, enabling manufacturing plants to be integrated more tightly within the enterprise, via the internet if necessary.

Limitations to automation

- Current technology is unable to automate all the desired tasks.
- As a process becomes increasingly automated, there is less and less labor to be saved or quality improvement to be gained. This is an example of both diminishing returns and the logistic function.
- Similar to the above, as more and more processes become automated, there are fewer remaining non-automated processes. This is an example of exhaustion of opportunities.

Applications

Automated video surveillance
Automated highway systems
Automated manufacturing
Home automation
Industrial automation

Agent-assisted Automation

A **distributed control system** (DCS) refers to a control system usually of a manufacturing system, process or any kind of dynamic system, in which the controller elements are not central in location (like the brain) but are distributed throughout the system with each component sub-system controlled by one or more controllers. The entire system of controllers is connected by networks for communication and monitoring.

DCS is a very broad term used in a variety of industries, to monitor and control distributed equipment.

- Electrical power grids and electrical generation plants
- Environmental control systems
- Traffic signals
- Radio signals
- Water management systems
- Oil refining plants