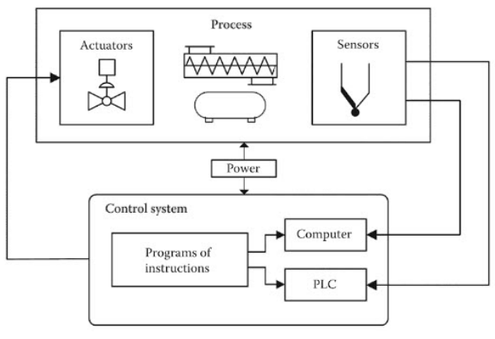
Reference Guide Industrial Automation



Industrial automation is the control of machinery and processes used in various industries by autonomous systems through the use of technologies like robotics and computer software. Automation adds control loops to machine operation. These can be open control loops that allow for human input or closed loops which are fully automated. Industrial control systems (ICS) allow for monitoring and control locally and remotely.

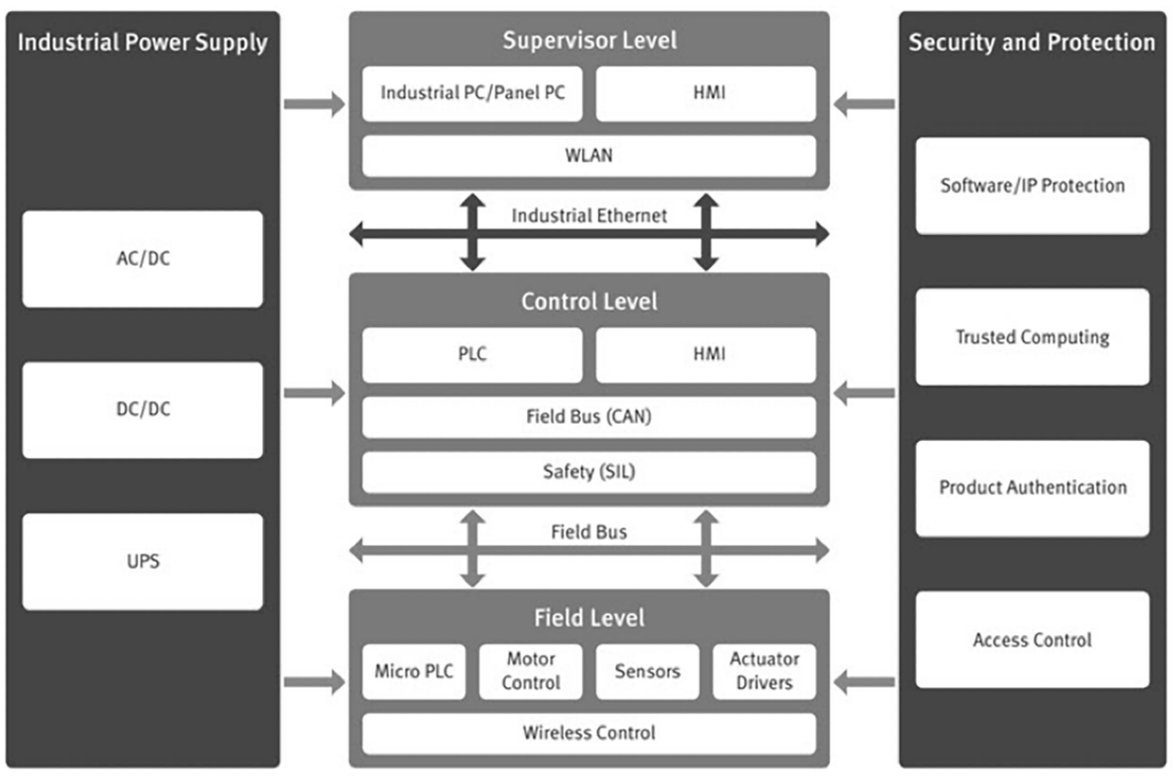
Evolution of Automation

The simplest type of an automatic control loop. A controller compares a measured value of a process with a desired set value and processes the resulting error signal to change some input to the process, in such a way that the process stays at its set point despite disturbances.

A relay logic circuit is an electrical network consisting of lines. The output is controlled by a combination of input or output conditions, such as input switches and control relays. The conditions that represent the inputs are connected in series, parallel, or series-parallel to obtain the logic required to drive the output.

With computer hardware becoming affordable, digital logic started to replace electro-magnetical relays, culminating in the development of programmable logic controllers (PLCs). PLCs are essentially ruggedized industrial computers.

Modern Automation Structure

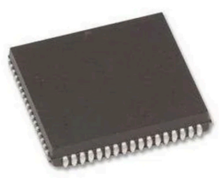


Supervisor Level: The supervisor level usually consists of an Industrial PC, which is usually available as a desktop PC or a Panel PC or a Rack-mounted PC. Communication usually runs over some form of Ethernet.

Control Level: All the automation related programs are executed. For this purpose, PLCs are used, providing real-time computing capability. PLCs are usually implemented using 16-bit or 32-bit microcontrollers and run on a proprietary operating system to meet the real-time requirements. PLCs are also capable of being interfaced with several I/O devices and can communicate through various communication protocols like CAN.

Field Level: The terminal equipment like Sensors and Actuators are categorized into Field Level in the hierarchy. The sensors like temperature, optical, pressure etc. and actuators like motors, valves, switches etc. are interfaced to a PLC through a field bus and the communication between a Field Level device and its corresponding PLC is usually based on a point-to-point connection. Both wired and wireless networks are used for communication.

PLCs vary in complexity



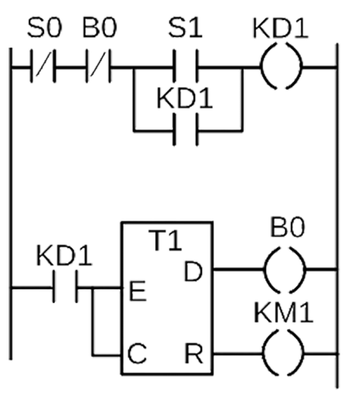
Microcontroller: Essentially, a PLC is an MCU with some special features, e.g. fieldbus communication.

SBC: Single-board computers using semi-customized or fully proprietary hardware for very demanding control applications. Soft PLCs can interface with industrial I/O hardware while executing programs within commercial operating systems.

PLR: Programmable Logic Relays have 8 to 12 discrete inputs, 4 to 8 discrete outputs, and up to 2 analog inputs. Many include a tiny LC screen for viewing simplified ladder logic.

Generally, a PLC consists of;

- A CPU which interprets inputs, executes the control program stored in memory and sends output signals,
- A power supply unit which converts AC voltage to DC,
- A memory unit storing data from inputs and program to be executed by the processor,
- An I/O interface, where the controller receives and sends data from/to external devices,
- A communications interface to receive and transmit data on communication networks from/to remote PLCs.



PLCs require programming device which is used to develop and later download the created program into the memory of the controller.

They can be programmed in a variety of ways, from the relay-derived ladder logic to programming languages such as specially adapted dialects of BASIC and C, adhering to IEC 61131-3.