WHAT IS A PLC?

What are PLCs and how do they work?
PLCs are often defined as miniature industrial computers that contain hardware and software used to perform control functions. A PLC consists of two basic sections: the central processing unit (CPU) and the input/output interface system. The CPU, which controls all PLC activity, can further be broken down into the processor and memory system. The input/output system is physically connected to field devices (e.g., switches, sensors, etc.) and provides the interface between the CPU and the information providers (inputs) and controllable devices (outputs).

To operate, the CPU “reads” input data from connected field devices through the use of its input interfaces, and then “executes” or performs the control program that has been stored in its memory system. Programs are typically created in ladder logic, a language that closely resembles a relay-based wiring schematic, and are entered into the CPU’s memory prior to operation. Finally, based on the program, the PLC “writes” or updates output devices via the output interfaces. This process, also known as scanning, typically continues in the same sequence without interruption, and changes only when a change is made to the control program.

Discrete applications
PLCs are often used to control machines or processes that are sequential in nature, using “discrete” inputs and outputs that have defined states. For example, if a limit switch detects the presence of an object, it provides an “ON” signal to the PLC; if no object is detected, it provides an “OFF” signal. The machine or device typically performs actions based on time or events in a predefined order. The expected sequence is typically interrupted only when an abnormal condition occurs.

Process control applications
PLCs can also control continuous processes that use analog I/O. For example, a temperature sensor may provide a variable signal, such as 0-10 volts, based on the measurement of an actual temperature. The PLC program monitors the sensed values continuously and operates devices that may also be analog in nature. This could include setting the position of a valve between 0-100% open, or controlling the speed of a motor. Continuous applications are so called because they typically have no defined start or end once they are initiated; they maintain a process in a “steady” operating state.

Today’s PLC
As PLC technology has advanced, so have programming languages and communications capabilities, along with many other important features. Today’s PLCs offer faster scan times, space efficient high-density input/output systems, and special interfaces to allow non-traditional devices to be attached directly to the PLC. Not only can they communicate with other control systems, they can also perform reporting functions and diagnose their own failures, as well as the failure of a machine or process.

Size is typically used to categorize today’s PLC, and is often an indication of the features and types of applications it will accommodate. Small, non-modular PLCs (also known as fixed I/O PLCs) generally have less memory and accommodate a small number of inputs and outputs in fixed configurations. Modular PLCs have bases or racks that allow installation of multiple I/O modules, and will accommodate more complex applications.

Which PLC is right for you?
Choosing the most effective PLC for your application depends on a number of factors. To begin the selection process, a drawing of the machine or process is a good start. This can help identify field devices and physical requirements for hardware locations. From the drawing, you can determine how many analog and/or discrete devices you will have.

Once the field device requirements and hardware locations are defined, you can review PLCs that will meet your requirements. See the PLC Selection Worksheet in this section that will help you work through the considerations for determining the type of PLC you will need, regardless of which manufacturers you are evaluating.