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# What is a PLC?

VID: L-PLC-001

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# PLC stands for Programmable Logic Controller


## Definition:

**A PLC can be defined as an industrialized computer that includes the hardware and software required to automatically control production equipment, machinery, processes, and other types of mechanical, electrical, and electronic devices typically found in industry. It also includes the flexibility to reprogram its decision making behavior through the software as often as needed. The PLC is the key element behind today's industrial automation.**

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# PLC uses:

**Most likely you encounter PLC based controls every day without even realizing it. Where? In simple applications such as car washes, elevators, even amusement parks, to more complex applications such as…**

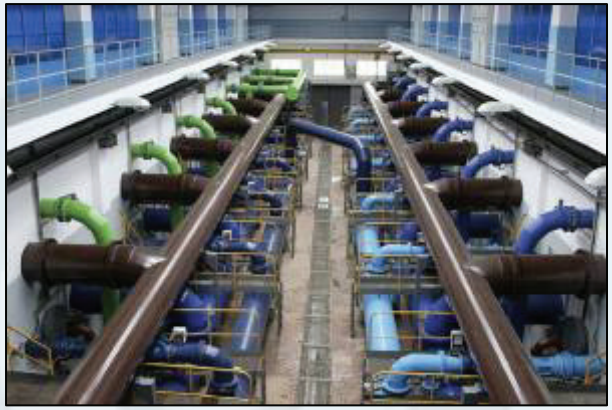
**Elevators**


**Car Washes**

**Amusement Parks**

# and more:

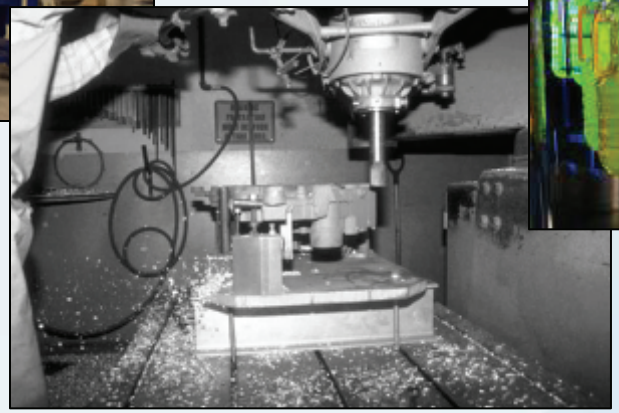
**water and waste water treatment plants, manufacturing assembly lines, machinery, and bottling lines, just to name a few.**



**Water Treatment Plants**

**Assembly Lines**

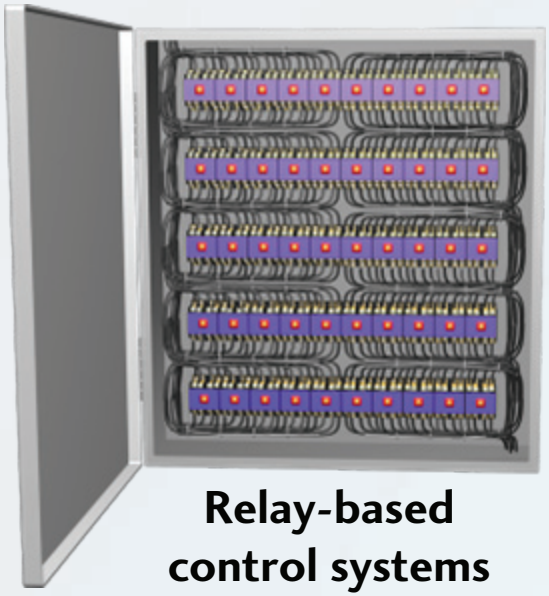
**Bottling Lines**



**Machining**

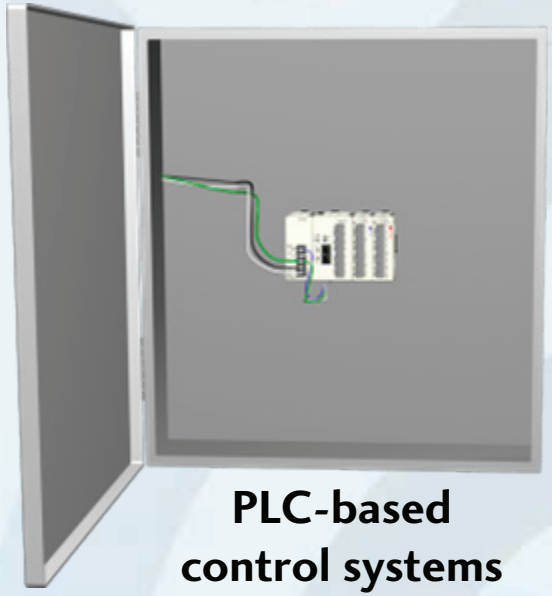
# PLC History:

**Although PLCs evolved concurrently by different organizations, it is recognized as first being introduced by Bedford Associates in 1968. It was the product of choice to meet GM's Hydra-matic Division's specifications as a replacement for traditional relay-based machine control systems. The Modicon, as it was called, being an electronic device, also reduced wiring and troubleshooting time. Because it is programmable, the PLC also allows quicker changes to the equipment's control behavior.**



**Relay-based control systems**

**Replaced by**



**PLC-based control systems**

# What do the individual words mean?

**It may make more sense to look at the words in reverse order.**

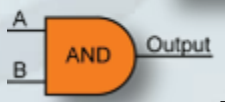
**Controller**

***CONTROLLER*** **– This is the key word. A PLC monitors various conditions, and based on these conditions, it determines an outcome. In other words it has the ability to 'control' the outcome based on the status of different inputs such as sensors, switches, and numeric values from analog signals, etc.**

Truth Table

| A | B | Output |
|---|---|---|
| 0 | 0 | 0 |
| 0 | 1 | 0 |
| 1 | 0 | 0 |
| 1 | 1 | 1 |

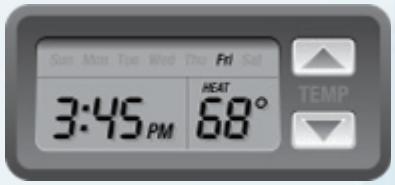
***LOGIC*** **– How the PLC determines an outcome is based on the logical rules it has been taught. A simple example: it is night time, AND the door is open, then turn on the light.**




**Logical**

***PROGRAMMABLE*** **– The PLC is taught the rules to how it should use the input conditions to create an outcome though its programming software. Being programmable makes it versatile, so if needs or conditions change, the PLC can be reprogrammed to meet these changes.**

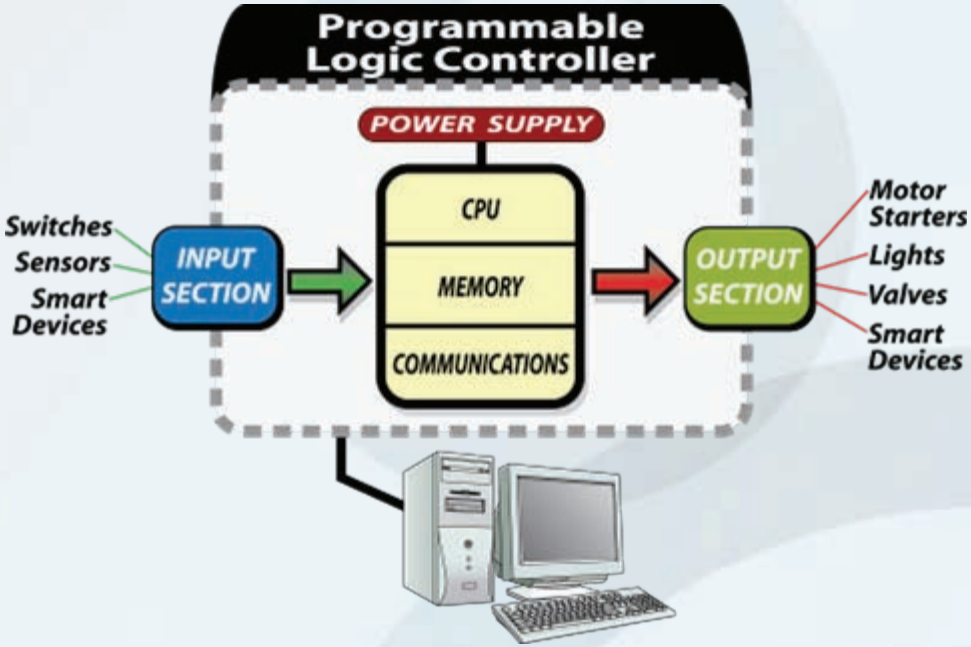
**Programmable**



# PLC Overview:

## Four internal areas:

- CPU – Decision making, controls other areas.
- Memory – User's control program stored in nonvolatile section of memory. Also I/O status and data is kept in memory.
- Communications ports – load user's program from PC, also exchange data with external devices, including other PLCs.
- Input/Output – handles interface of signals to real world devices.



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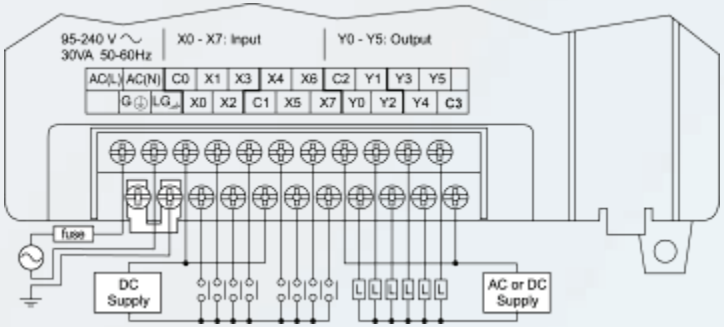
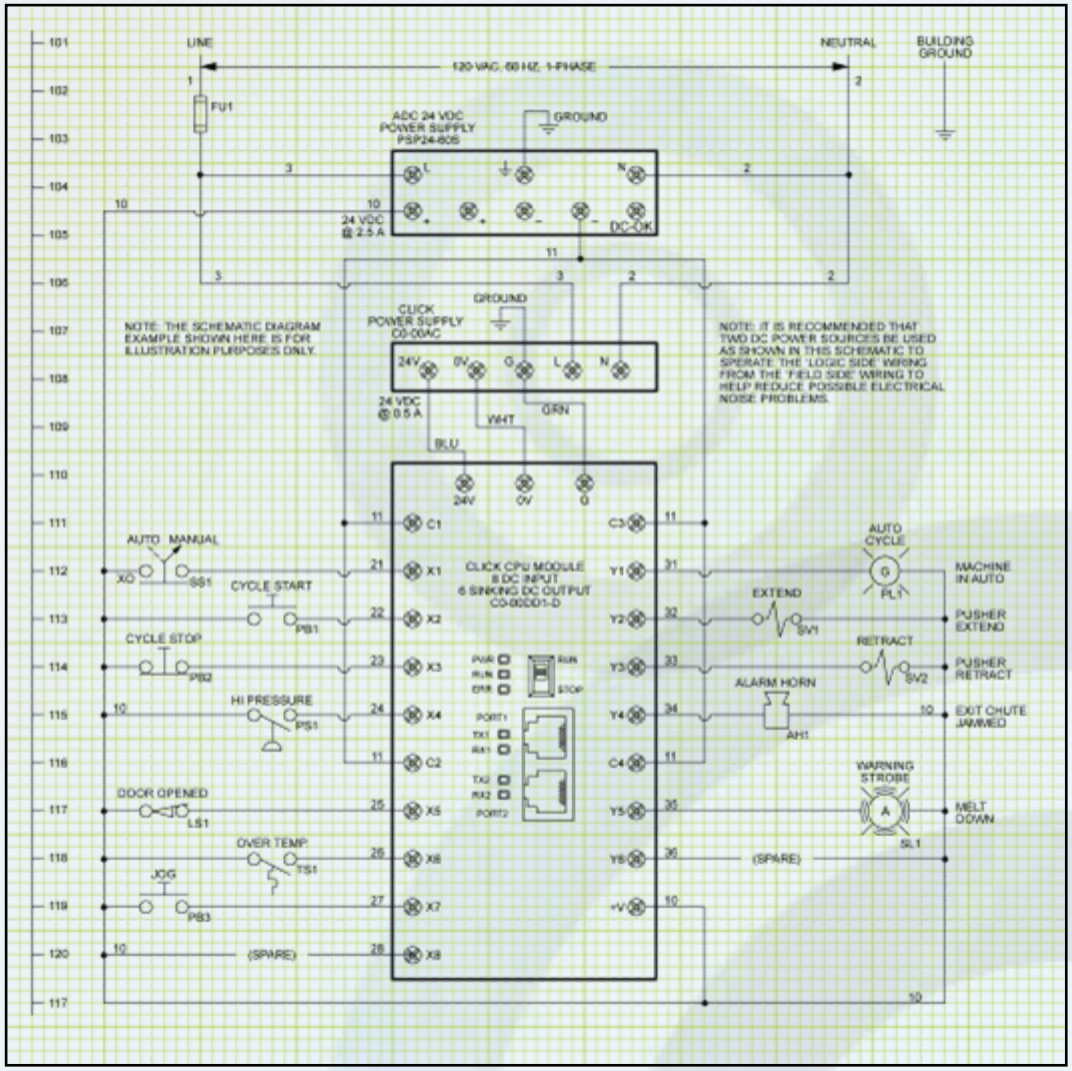
# PLC I/O:

**The input and output connections interface to the real world devices as seen in the schematic example. Conditions and status of the inputs are monitored, decisions made by the user's control program executing via the CPU , and outputs activated based on the outcome.**




**DL05 PLC Showing I/O Wiring Connections**

## Schematic Diagram Example

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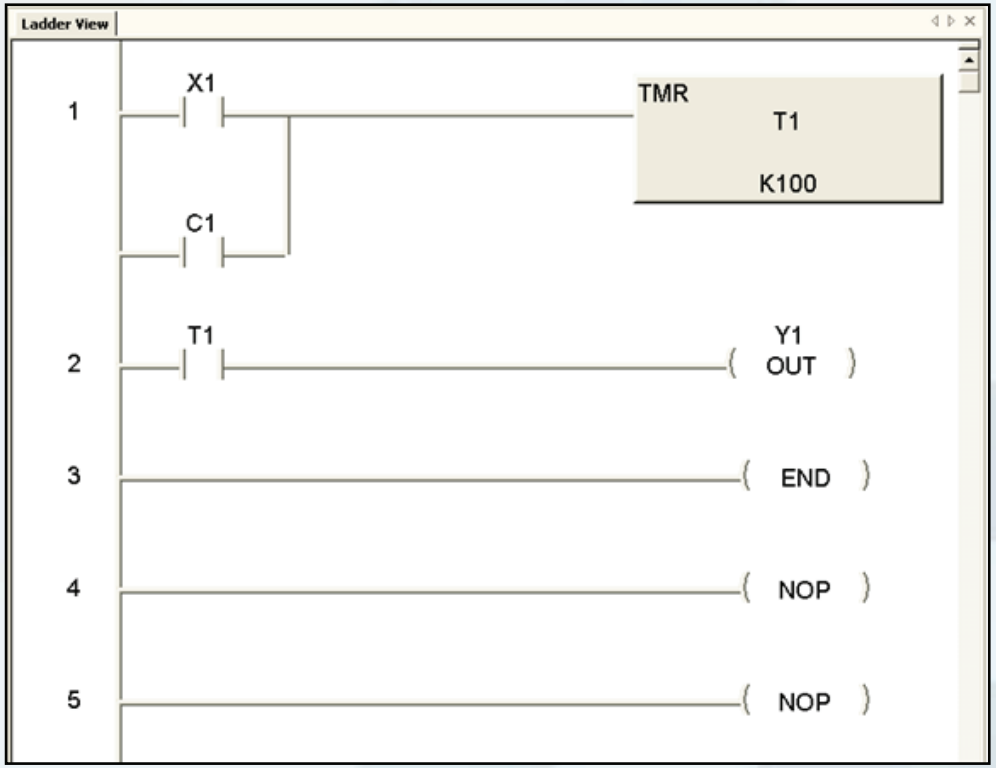
# PLC Ladder Logic:

A PLC is programmed using application software running on a PC. The most widely used programming method, carried over from relay-based control systems, is Ladder Logic. Made up of contacts, coils, and other functions that are arranged as rungs on a ladder.

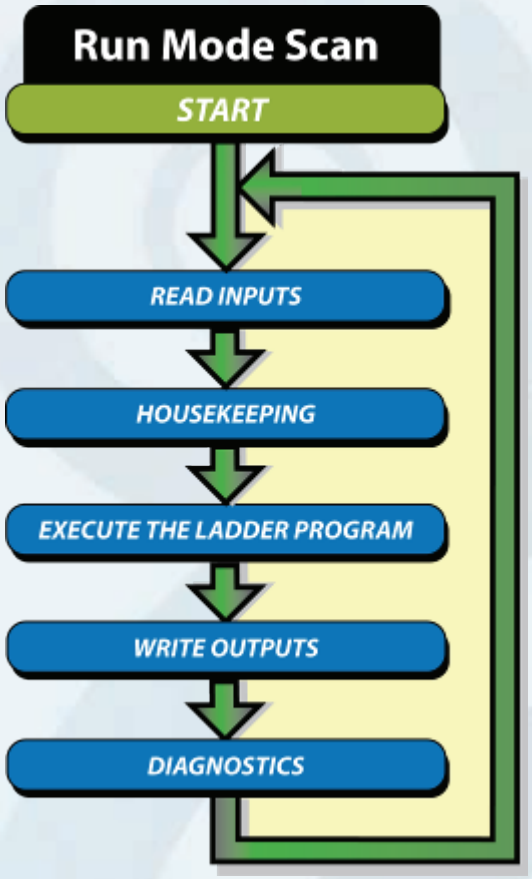
Shown here is a simple example of three ladder logic rungs. Externally wired input 'X1' OR internal control relay 'C1' activate timer 'T1". After 10 seconds the timer signals completion by its 'T1" contact, and activates output 'Y1', which is wired to a real world device. The 'END' coil tells the program 'scan' to start over.



# Program Scan:

It is helpful when programming a PLC to understand how the Ladder Logic program is 'scanned'. Once the PLC is in RUN mode, the CPU executes in the order shown in the flow diagram.

- Status of the inputs devices are read and stored in data registers.
- Housekeeping of any peripheral devices.
- 'Scan' the user's ladder logic left to right, sequencing through the 'rungs'.
- Compute the results and write updates to the outputs.
- Do diagnostics and if all is well, repeat the scan.



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