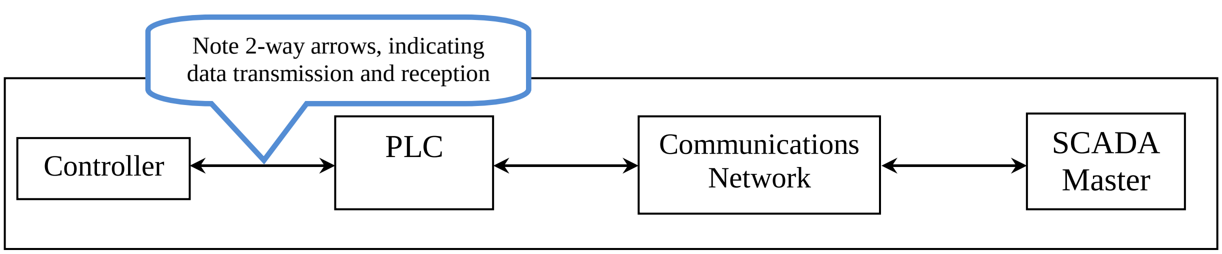
PROGRAMMABLE LOGIC CONTROLLER (PLC)

The basic alternative to the RTU is the programmable logic controller (PLC). While PLC's are generally more expensive than RTUs, they also require less communication with a central host computer. A programmable logic controller is actually a control computer. The typical components include: 1) a CPU, 2) memory, 3) control software, 4) power supply, 5) input modules, and 6) output modules. Control of all auxiliary components is accomplished by use of the control software in the memory of the PLC. PLCs can be programmed in a variety of ways depending upon the particular model chosen. Available formats include: Ladder Logic, Boolean, Flowchart, and Graphic (Nollet, 1986). While the last three formats are generally more flexible, the Ladder Logic format is generally more standard and familiar to maintenance technicians or engineers. Historically, PLC vendors have supplied electronic relay banks for controlling a number of operation sequences without much consideration for reporting or collecting data. Today most PLCs can be connected to a master station by the addition of an appropriate communication device, such as a modem. This communication link can be used to transmit data back to a central host or to download new control strategies from the host to the PLC. However, since the data reporting and hierarchical control functions of PLCs are generally considered to be a secondary requirement, such concepts as “report by exception” and alarming have generally not been developed as well as they have been on RTUs.

A PLC is a digital computer used to monitor and control certain aspects of equipment, such as motor speed, valve actuation, and other functions. Typically, a PLC has a range of functions, based on the electrical signal it receives from the sensor. For example, if the pressure drops 10 psi from optimum level in a distribution system, the PLC may “tell” the variable frequency drive (VFD) on the electric motor to turn the pump motor faster, which would drive the pump to produce an extra 25 GPM. Similarly, if the pressure in the same system drops by 20 psi, the PLC may drive the pump to produce an extra 50 GPM in order to make up for the increased “demand” being sensed. This programming is referred to as “ladder logic” and there are limits to this system. In this example, all of these pump speed changes are occurring on-site, without supervisory control, because the PLC has been pre-programed to react to a certain condition.

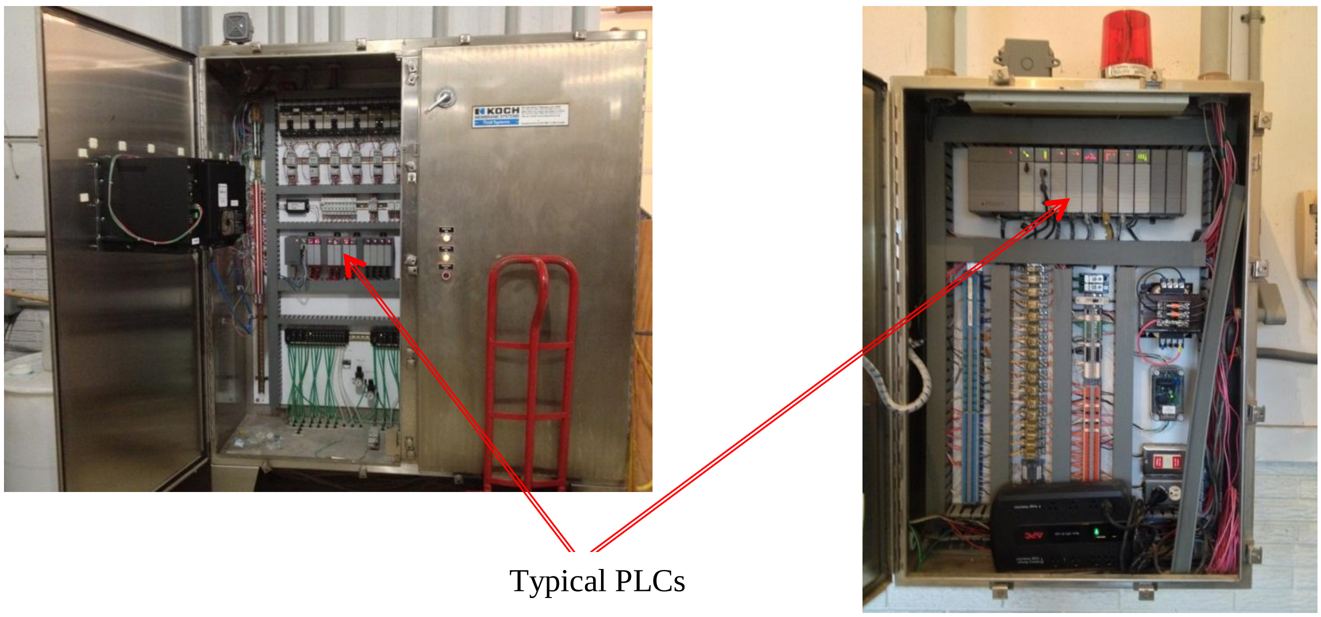
Although PLCs are intended to control equipment, if a condition comes up that is “outside” the PLCs programming, then supervisory control would need to be exercised.

A key difference between the remote terminal unit (RTU) and the PLC is illustrated in the figure below. In this figure, note that the machine language, and hence the data, moves in <u>both</u> directions, thus allowing for not only data acquisition, but also control.



Simplified Illustration of PLC Function in a SCADA System

The figure below shows two photographs of open SCADA PLC panels. The PLCs in the first photo appear in the center of the panel, while the PLCs in the second panel appear in the upper portion of the panel. A key to identifying the PLC is to identify the wires coming from the sensor(s), and the wires going to the communications network, by default, the PLC is in between these two features.



Example PLC installations.