Programmable Logic Controllers
Disadvantages of RLL

► Relay Ladder Logic (RLL) is "hard-wired" by the interconnection of the relays, limit switches, timers, counters, etc.

► Changing the “program” requires physically moving the wires from the relays and limit switches.
  ▪ not terribly easy or convenient!
Programmable Controllers

- Programmable Logic Controllers (PLC) were developed in the early 60's to overcome the deficiencies of RLL.
  - Uses small programmable microcomputer.
- Programming can still be done in ladder logic, just like hard-wired RLL.
- Electricians and technicians can readily adapt to this familiar type of programming.
PLC Direct DL205

DL 250 CPU  Input Module (X0 to X7, X10 to X17)

Output Module (Y0 to Y7)
Simple Pneumatic System

Pneumatic System

Relay Ladder Logic (RLL) Control System
PLC physical wiring diagram

+24VDC

PB-1

LS-1

Inputs

X1

X2

Outputs

Y2

Sol-A

+24VDC
Simple Pneumatic System

Pneumatic System

PLC “Ladder” Logic
Simple Pneumatic System

External pushbutton switch connected to bit X1

External limit switch connected to bit X2

 Reads internal coil (bit) C5

PLC “Ladder” Logic

Internal coil (bit) C5

Writes internal coil (bit) C5

External (bit) Y2

Writes external (bit) Y2
PLC Memory

- Digital memory consists of individual “bits” (either “on” or “off”, “1” or “0”)
- Bits can be written to or read from
- Organized in groups of 8 bits = 1 byte
PLC External Output - NPN

PLC Output (simplified)

“0” = off
“1” = on

External Load (solenoid coil)

External $V_{DC}$ Typically +24V
PLC “Building Blocks”

Internal N.O. Contacts (C0 - C1777)

Internal N.C. Contacts (C0 - C1777)

External N.O. Inputs (X0 - X17)

External N.C. Outputs (X0 - X17)
PLC “Building Blocks”

Internal Control Relays
(C0 - C1777)

External Outputs
(Y0 - Y17)
Control circuit for a “one shot”
Simplified control circuit for a “one shot”
Simplified control circuit for a “one shot”

IF (X1 is true)
OR { (Y2 is true) AND (not X2 is true) }
THEN (Y2 will be set true)
ELSE (Y2 will be set false)
Timers (T0 - T377)

► When contacts C6 close, timer T1 will count for 2.5 seconds (K25 = 25 tenths)

► After 2.5 sec, contacts T1 will close (and stay closed until C6 opens and turns timer off)
Counters (CT0 - CT177)

► Each time contacts X0 close, counter increments by 1
► When counter reaches 6 (K6 = 6 counts), counter output CT2 closes
Counters (CT0 - CT177)

► When contacts C9 close, counter will reset to zero (and the contacts CT2 will open)