Programmable Logic Controllers (PLCs)

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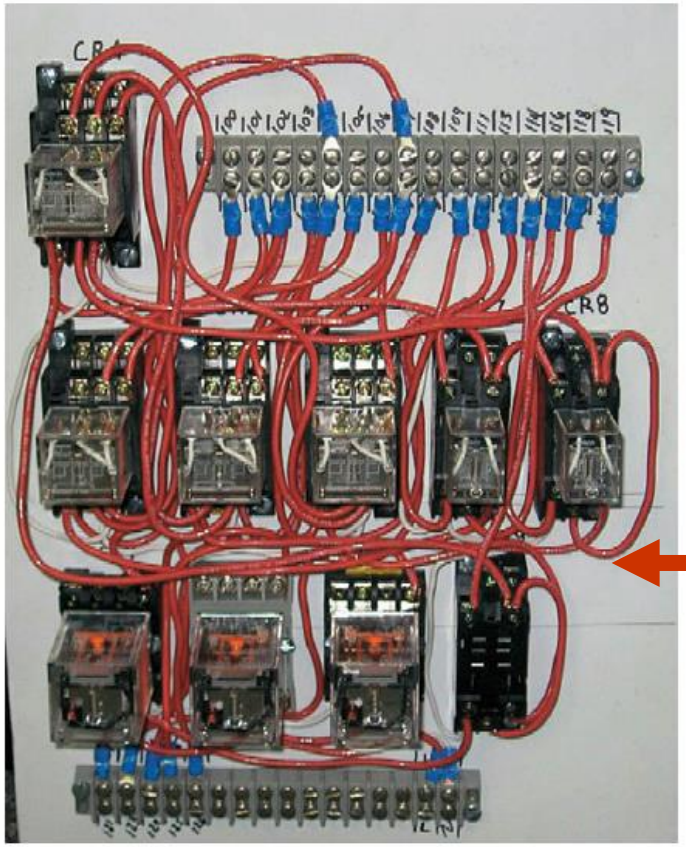
Definition

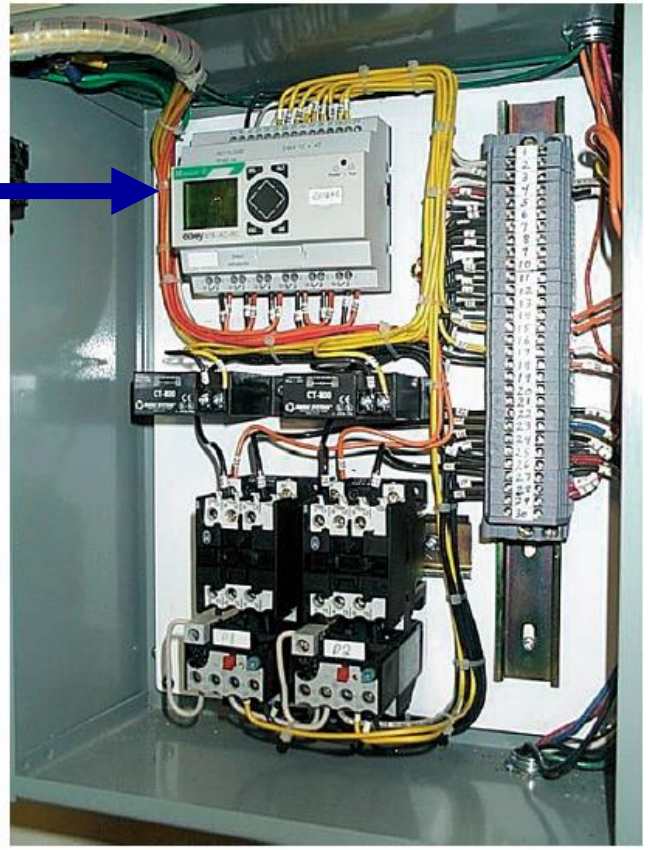
- **A PLC is a digital computer designed for use in machine control.**
  - **Designed to operate in the industrial environment.**
  - **Equipped with special input/output interfaces and a control programming language.**
- **PC (Programmable Controller): Original Acronym**

PLC Advantage



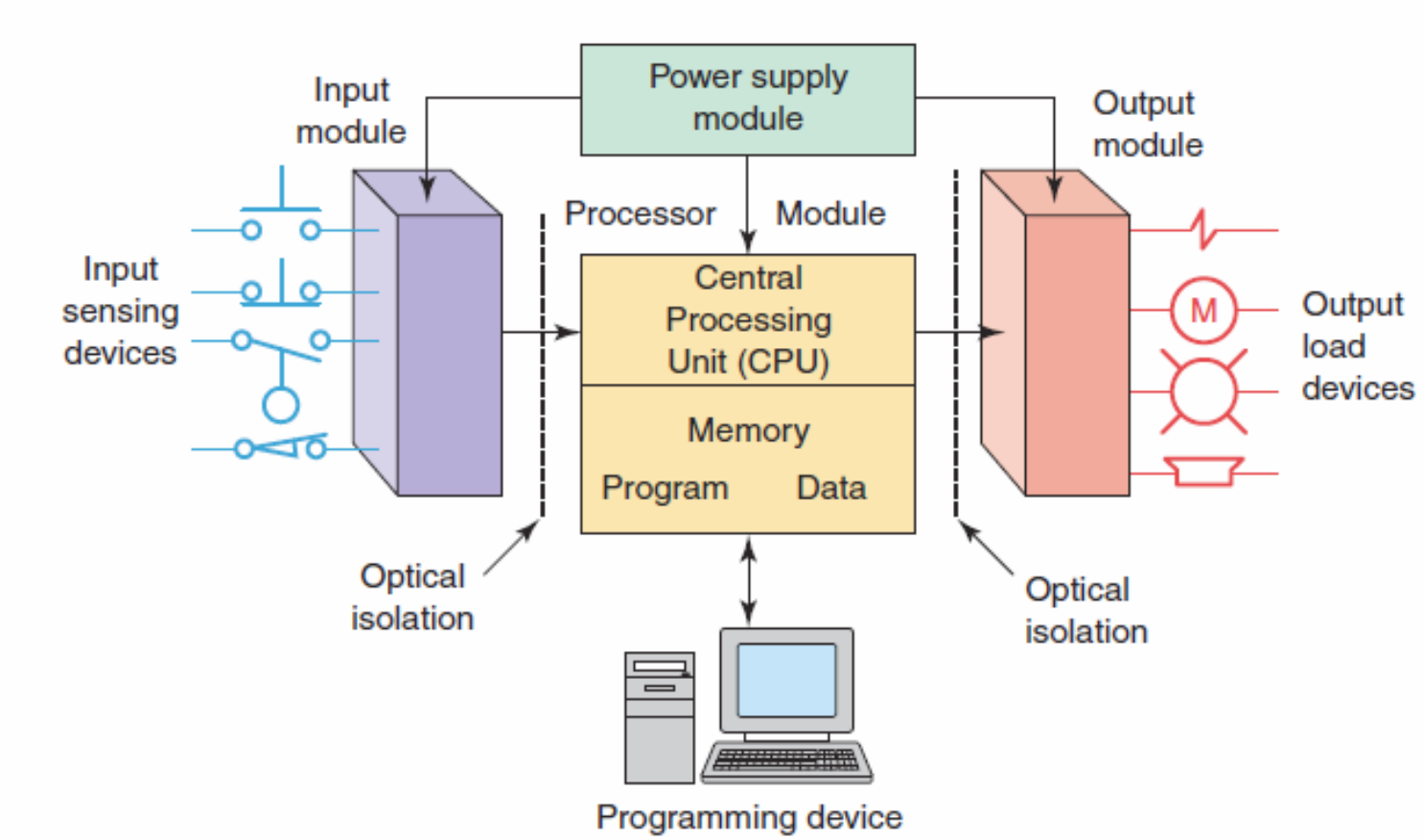
Relay control panel

PLC control panel



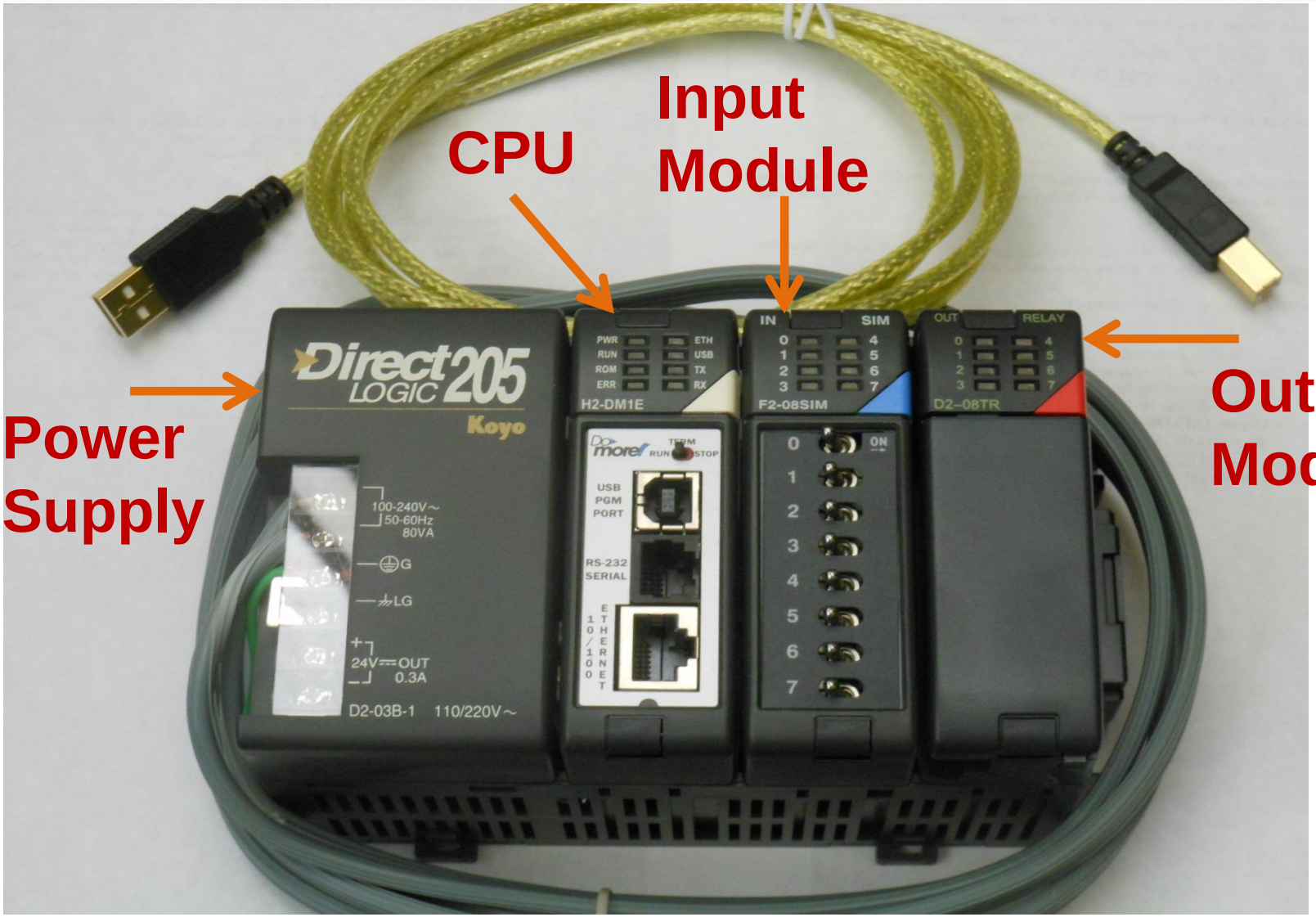
- Originally, to replace hardwired control relay

PLC System



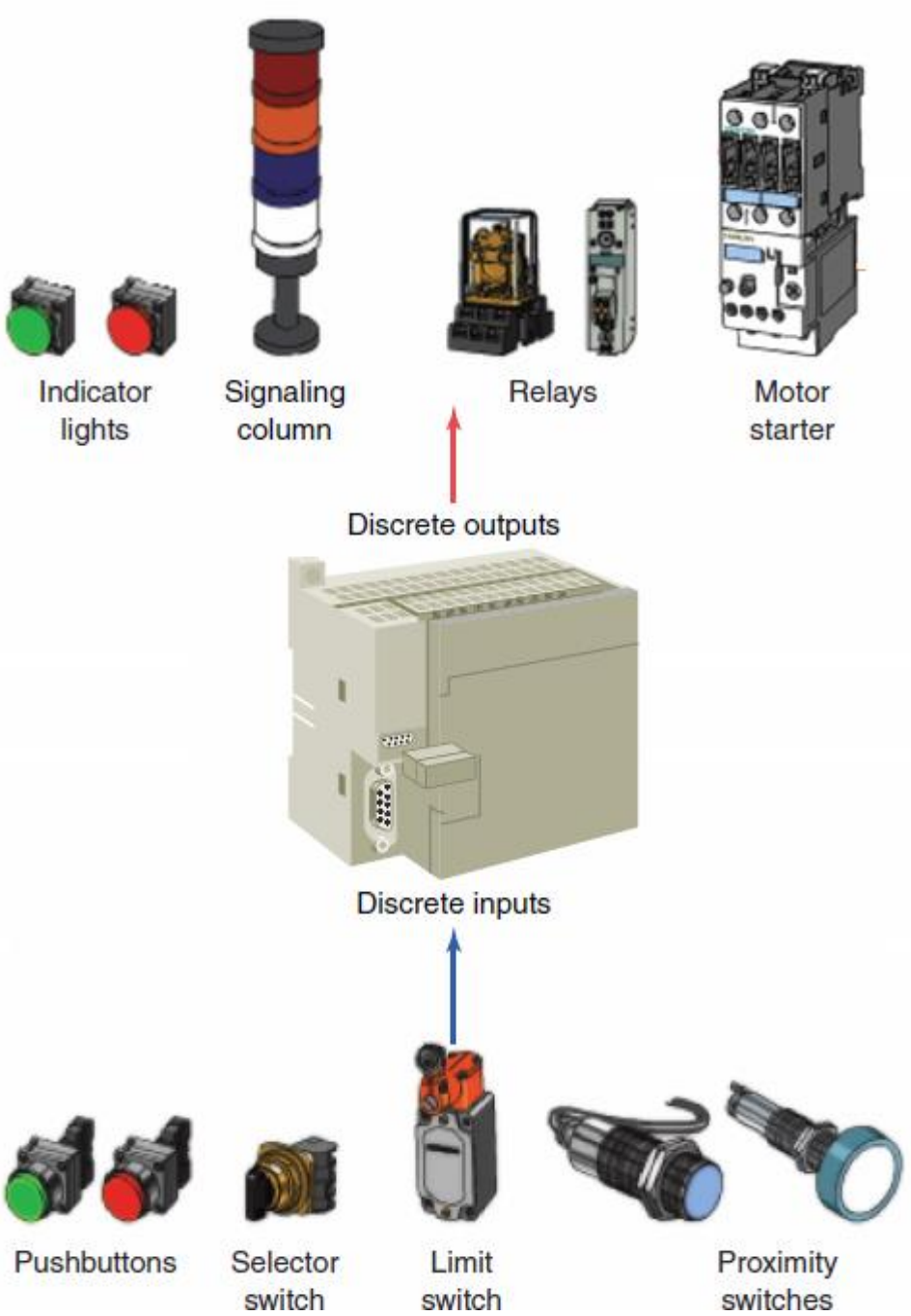
- **Consists of: CPU, I/O section, power supply, and a programming device.**

PLC System


CPU
Input Module
Power Supply
Output Module
Direct205 LOGIC
Koyo
H2-DM1E
F2-08SIM
D2-08TR
D2-03B-1 110/220V~

Discrete/Analog I/Os

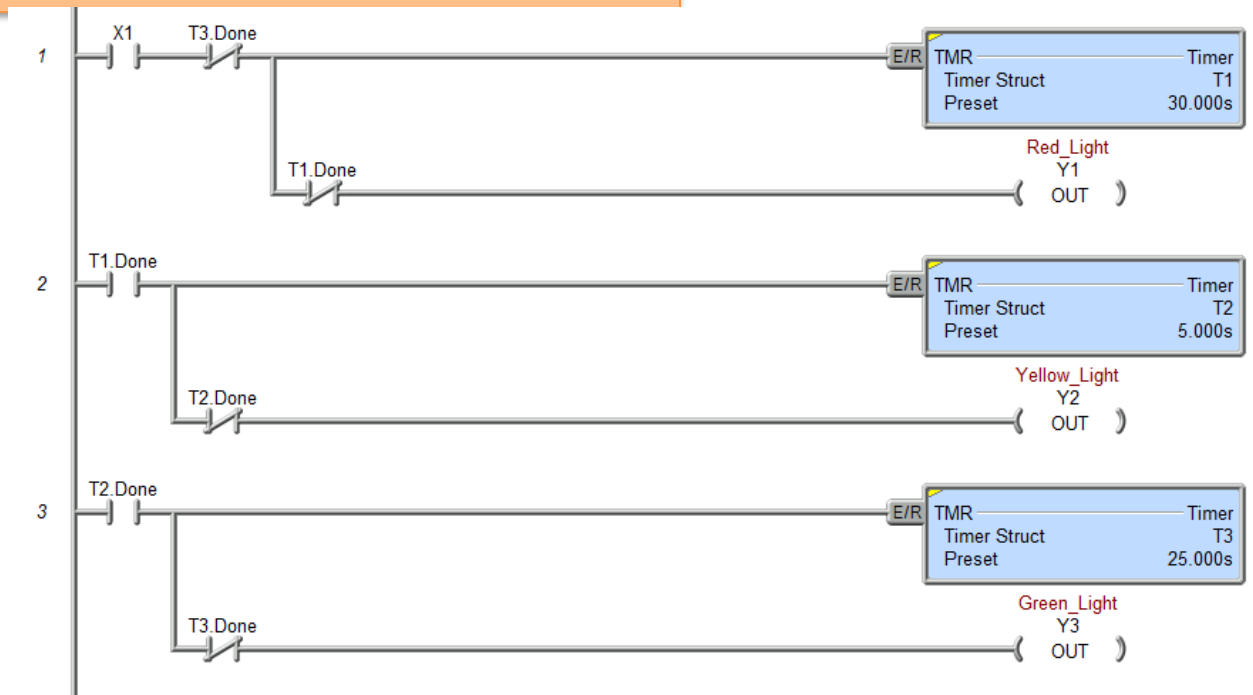
- **Discrete:**
  - **Devices with on/off nature.**
  - **Have only two states: On & Off**
  - **Tied to discrete I/O modules.**
- **Analog:**
  - **Devices with a range of values.**
  - **Tied to analog I/O modules.**



PLC Programming

- Software on a PC
- Languages
  - Ladder Diagram (LD)
  - Function Block Diagram (FBD)
  - Sequential Flow Chart (SFC)
  - Structured Text (ST)

Ladder Diagram



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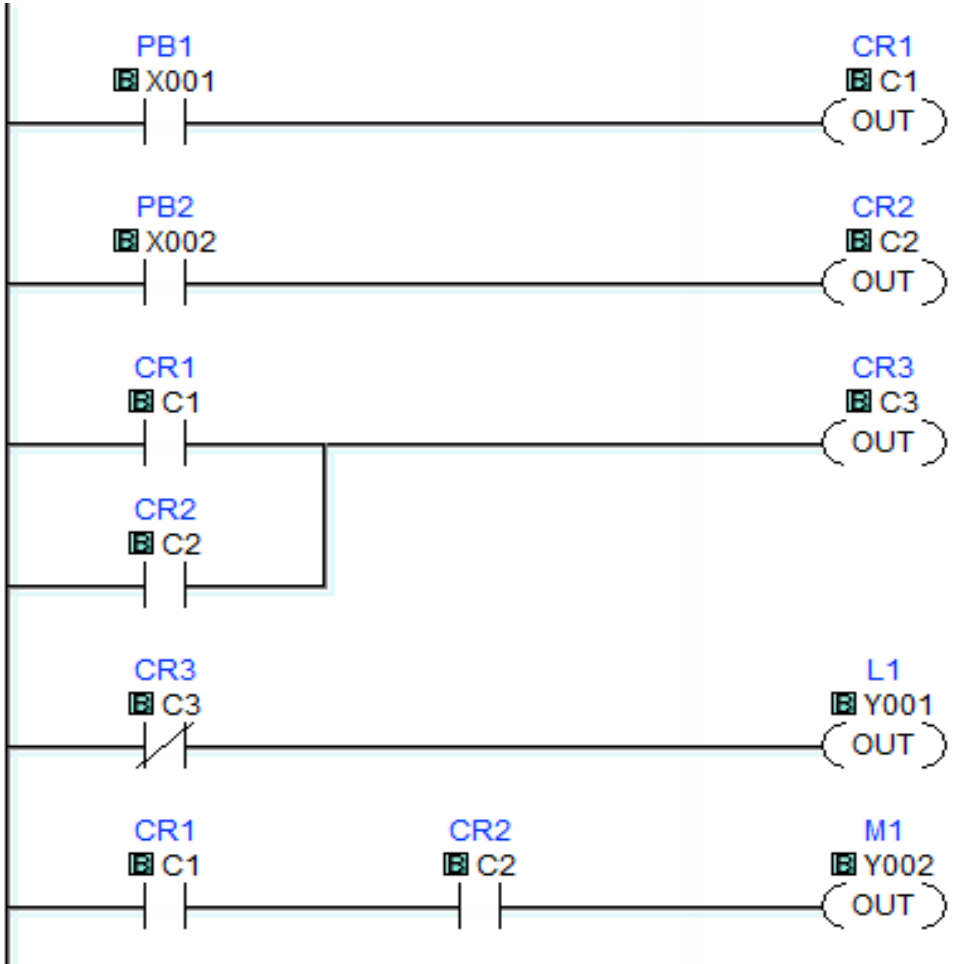
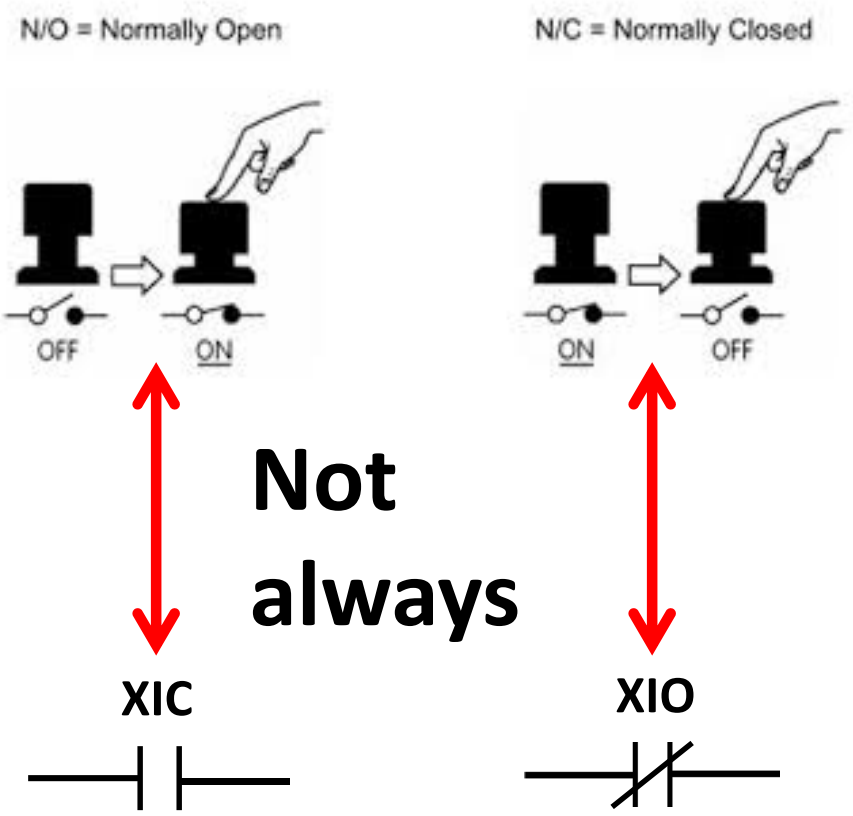


Contacts/Instructions

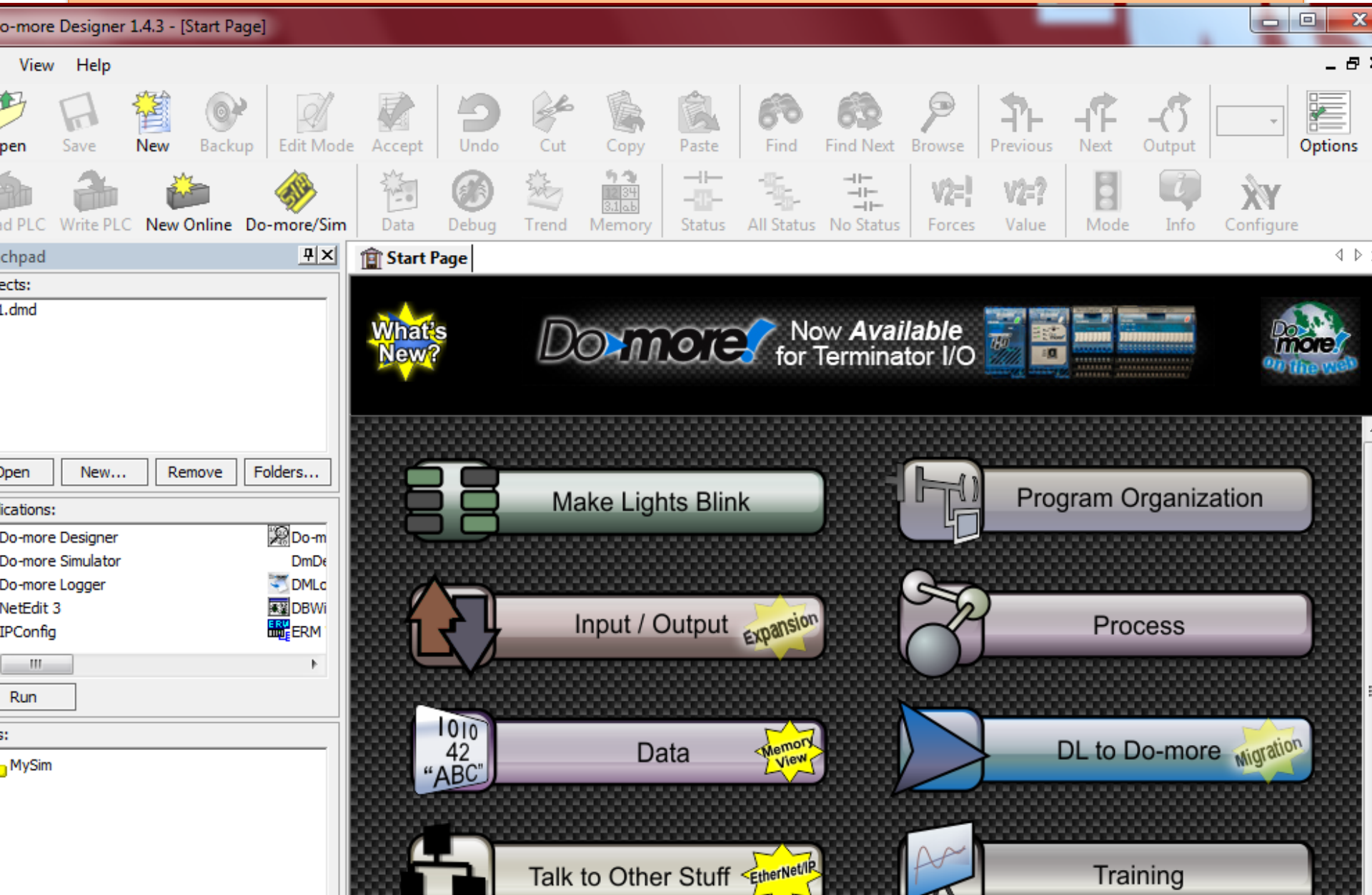
- **Contacts**
  - **Normally Open (NO)**
  - **Normally Closed (NC)**
- **Instructions**
  - **Examine ON or Examine if Closed (XIC)**
  - **Examine OFF or Examine if Open (XIO)**
- **Not fully interchangeable**



PLC Companies

- Rockwell (Allen Bradley) – most in US
- Siemens – most in Europe
- Omron
- ABB
- Schneider (Modicon)
- Mitsubishi - UK
- GE
- Bosch Rexroth
- Beckhoff
- Fuji
- Toshiba
- (Koyo) Automation Direct - Cheapest

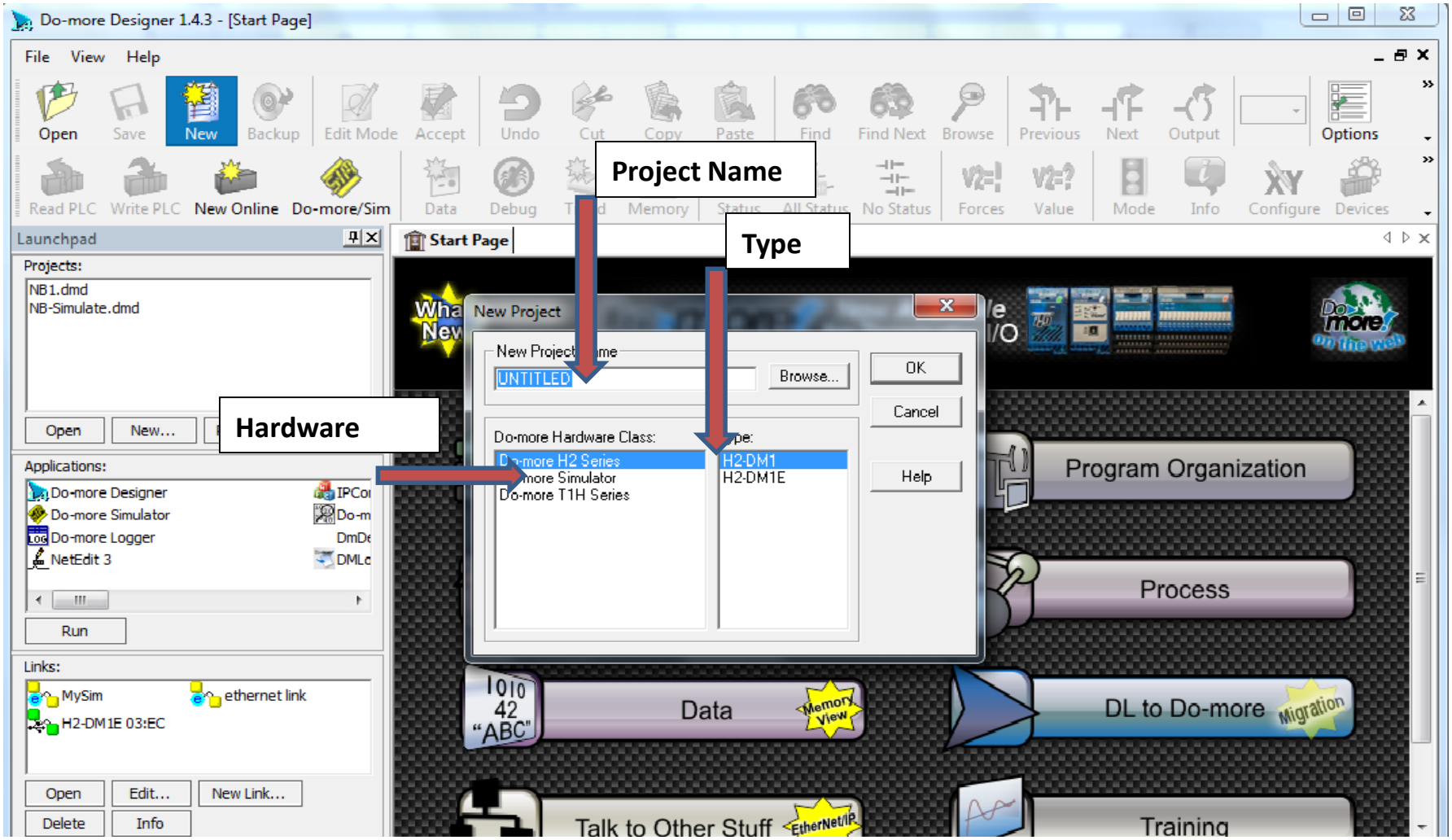
Do-More Designer



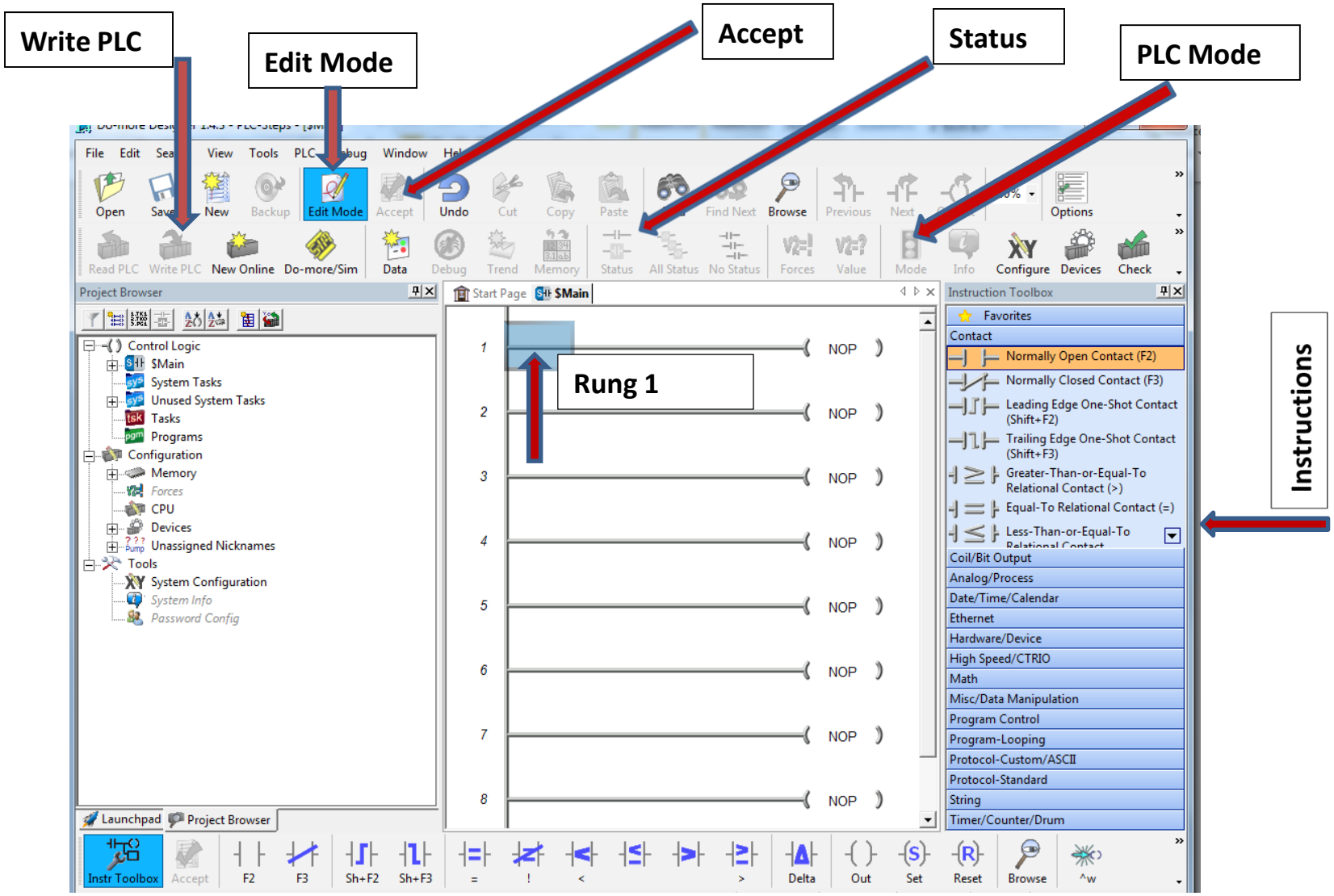
Do-More Designer

- https://www.youtube.com/watch?v=jUugb68K41Q
- Steps
  - Create a new program
  - Make changes
  - Accept changes
  - Connect to PLC
  - Test the program

Do-More Designer Cont…

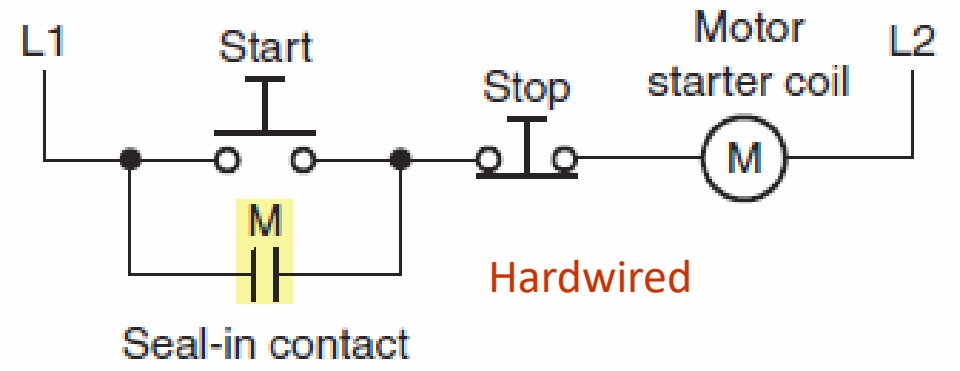


Commands


Write PLC
Edit Mode
Accept
Status
PLC Mode
Rung 1
Instructions
Project Browser
Instruction Toolbox
Start Page
$Main
Control Logic
$Main
System Tasks
Unused System Tasks
Tasks
Programs
Configuration
Memory
Forces
CPU
Devices
Unassigned Nicknames
Tools
System Configuration
System Info
Password Config
Favorites
Contact
Normally Open Contact (F2)
Normally Closed Contact (F3)
Leading Edge One-Shot Contact (Shift+F2)
Trailing Edge One-Shot Contact (Shift+F3)
Greater-Than-or-Equal-To Relational Contact (>)
Equal-To Relational Contact (=)
Less-Than-or-Equal-To
Coil/Bit Output
Analog/Process
Date/Time/Calendar
Ethernet
Hardware/Device
High Speed/CTRIO
Math
Misc/Data Manipulation
Program Control
Program-Looping
Protocol-Custom/ASCII
Protocol-Standard
String
Timer/Counter/Drum
NOP

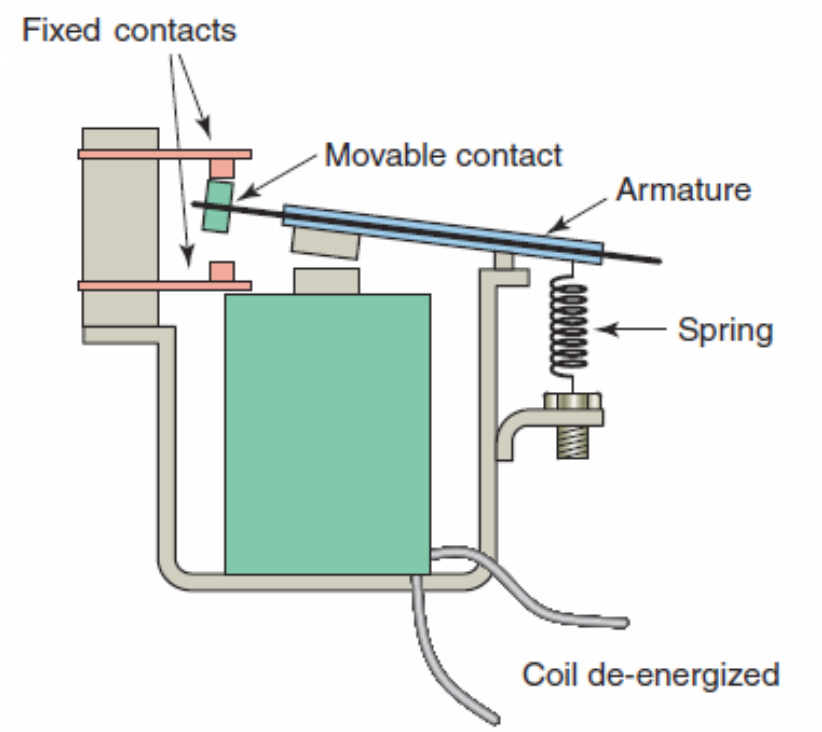
Ex1: Seal-in Circuit

- **A method of maintaining current flow after a momentary switch has been pressed and released.**
  - **Start: Normally Open (NO)**
  - **Stop: Normally Closed (NC)**

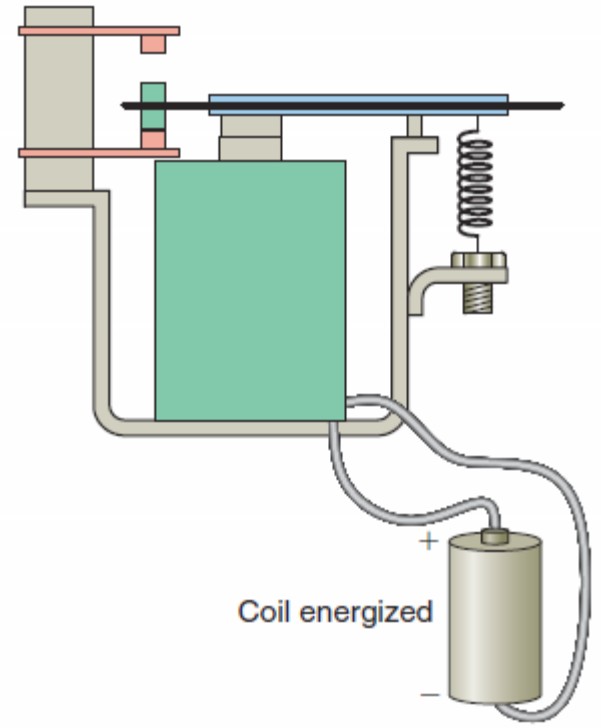


Control Relay

- Consists of coil and contacts (NO and/or NC)
- Other forms: Contactors, Motor starters, Relays



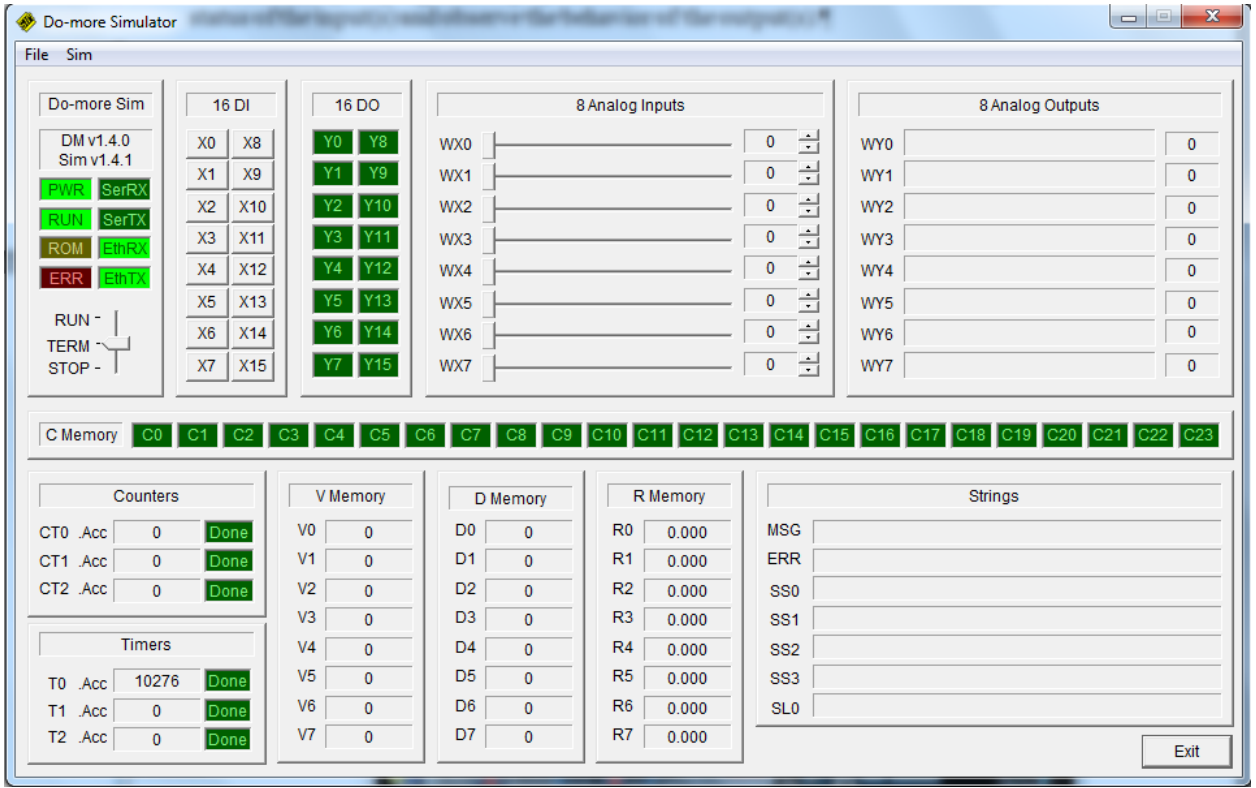
De-energized



Energized

Do-more Simulator

- A PLC in the software
- Behavior: Like an actual hardware
- Suitable for testing and teaching purposes



HMI-Human Machine Interface

- **Other names:**
  - **Man machine Interface (MMI), operator interface, touch screen**
- **Characteristics:**
  - **Control and manage an entire line from a single location (screen)**
  - **No need to walk to devices to activate/de-activate (time and effort saved)**
  - **Replacing hardwired pushbuttons and pilot lights by icons**
  - **Buttons are activated by touching corresponding icons**
  - **Displaying the operation in graphic format for easier viewing and in real time**
  - **Changing the preset values for counters/timers using numeric keypad graphic on the screen**
  - **Complete list of alarms with time and of occurrence and location**
  - **Displaying variables as they change over time**