Input and Output Devices

Brief overview of typical input and output devices used with PLC’s.

INPUT DEVICES:
Sensors which give digital/discrete, i.e. on/off signal to the input ports of the PLC.
  - Mechanical switches.
  - Proximity switches.
  - Photoelectric switches.
  - Encoders.
  - Etc.

OUTPUT DEVICES:
Devices that are driven by the output ports of the PLC. These devices are switched on/off from the output channel of the PLC which in turn controls some process.
  - Contactors.
  - Motors.
  - Relays.
  - Lights.
  - Etc.
Mechanical switches.

A mechanical switch generates an on/off signal or signals as a result of some mechanical input causing the switch to open or close. The term *limit switch* is used to detect the presence or passage of a moving part.

**Diagram:**
- Lever pushed down by mechanical force
- Force present 1
- Force not present 0
- 24V DC
- (NO)
- PLC
- Input Channel
Input Devices

• Switches are available with *normally open (NO)* or *normally closed (NC)* contacts.

• A (NO) switch has its contacts open in the absence of a mechanical input and the mechanical input is used to close the switch.

• A (NC) switch has its contacts closed in the absence of a mechanical input and the mechanical input is used to open the switch.
Input Devices

• Proximity switches.
  Proximity switches are use to detect the presence of an object without making contact with it. There are a number of forms of such switches, some being only suitable for metallic objects.

  1. Inductive proximity switch.
     Consists of a coil wound round a ferrous metallic core. When one end of this core is placed near to a ferrous metal object there is effectively a change in the mount of metallic core associated with the coil and so its inductance changes. Inductance change can be measured by resonant circuit and can be made to activate a switching circuit.

  2. Reed switch.
     Consists of 2 overlapping, but not touching strips of a springy ferromagnetic material sealed in glass or plastic casing. When the magnet is brought close to the switch, the strips become magnetized and are attracted to each other, causing the contacts to close.
Input Devices

• Photoelectric sensors

Photoelectric switch devices can either operate as *transmissive types* where the object being detected breaks a beam of light, usually infrared and stops it from reaching the detector or *reflective types* where the object being detected reflects a beam of light onto the detector.

![Diagram of transmissive and reflective photoelectric sensors](image-url)
Input Devices

- Encoders
  
  Device that is used to provide a digital output as a result of angular or linear displacement.

  Figure below shows the basic form of an incremental encoder. A beam of light passes through the slots in a disc and is detected by a light sensor. When the disc is rotated the beam is alternately transmitted and stopped thereby producing a pulsed output. The number of pulses is proportional to the angle through which the disc has rotated.
Output Devices

The digital signal from the output channel of a PLC is used to control an actuator which in turn controls some process. The term *actuator* is used for the device which transforms the electrical signal into some more powerful action which then results in the control or action in the process.

- Contactor
  When the output from the PLC is switched *on*, the solenoid closes a switch/switches. The result is that much larger currents can be switched on. E.g. Switch on motor.
Output Devices

Other examples of output devices.

• Motors
• Lights
• Valves
Input and Output Devices

- Processing inputs
  A PLC is continuously running through its program and updating it as a result of the input signals. Each such loop is termed a *cycle*.
Input and Output Devices

- Input and Output addressing
  The PLC has to be able to identify each particular input and output. It does this by allocating addresses to each input and output.

  For this course the *Allen Bradley* addressing will be adopted.

  For example we might have an input with address **I:1/01**

  ![Diagram]

  Example of an output: **O:1/00**

  Note that a module has 16 terminals (0-15).