Chapter 3

Control equipment

3.1 Programmable logical controller (PLC)

*PLC*s are common in industrial automation. Figure 3.1 shows a PLC system (Mitsubishi FX2N). PLC is short for Programmable Logical

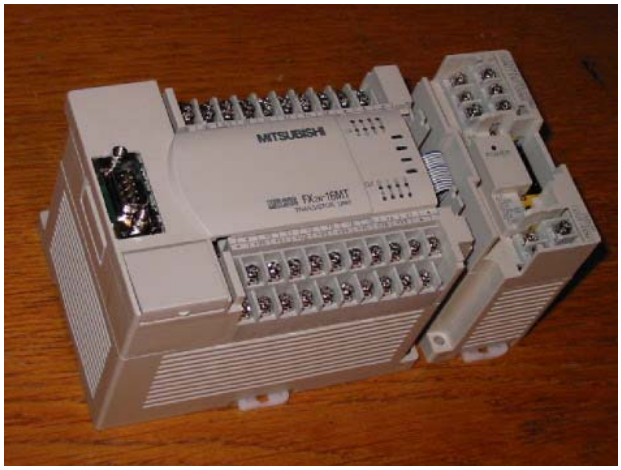

Figure 3.1: A PLC (Programmable Locical Controller). (Mitsubishi FX2N)

Controller. PLC-systems are modular systems for logical (binary) and sequential control of valves, motors, lamps etc. Modern PLCs includes function modules for PID control. The programming is usually executed on a PC, and the PLC-program is then downloaded (transfered) to the CPU in the PLC-system which then can be disconnected from the PC. The program languages are standardized (the IEC 61131-3 standard), but the

actual languages which are implemented on commercial PLCs may differ somewhat from the standard. PLC programming is described in more detail in Section 6.

Figure 3.2 shows the main parts of a PLC.

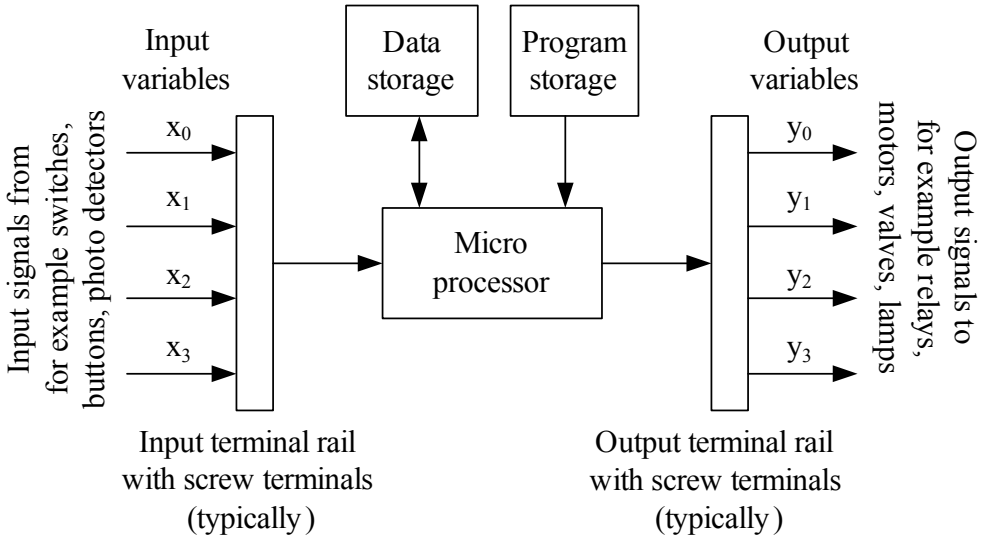

Figure 3.2: The main parts of a PLC

The PLC operates as follows: The control program executes the program code which is stored in the program storage (memory). The executable program is typically developed on a PC and then downloaded from the PC to the PLC. The data storage contains data uses by the program. Typically the program uses data from the physical inputs, together with data in the data storage, to calculate output values. The program may execute periodically. The cycle time or period is typically in the range of 10ms. The program may also execute if a certain event occurs, e.g. if a program interrupt signal is generated by a digital (boolean) input or by some other external or internal signal source.

3.2 Alternatives to PLCs

There are alternatives to PLCs as control hardware. One example is National Instruments' (Compact) FieldPoint, see Figure 3.3. It is here assumed that the FieldPoint rack contains a RT unit (Real-time) which contains a microprocessor running a real-time operating system which can

run LabVIEW programs downloaded from a PC where the program was developed. To download LabVIEW code, the LabVIEW Real-Time Module must be installed on the PC. Once downloaded, the PAC can be run independently of the PC. National Instruments denotes this equipent a *PAC* – Programmable Automation Controller. The PAC is a modular system similar to PLCs in several aspects. Logical and sequential control and PID control can be realized in the PAC. In fact, all kinds of applications can be developed with LabVIEW and downloaded to the PAC.

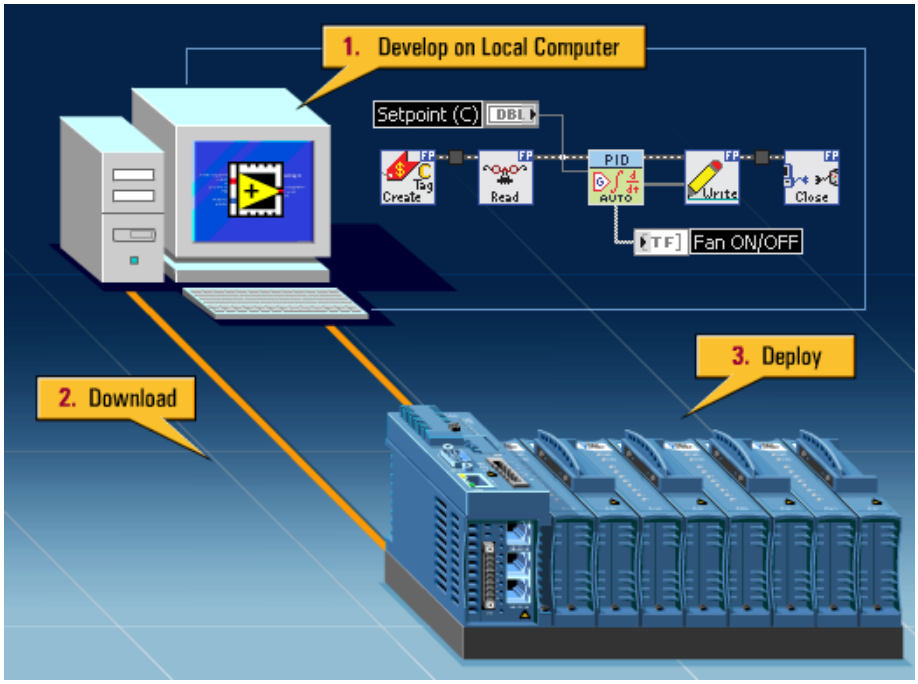

Figure 3.3: Modular control equipment: Compact Fieldpoint, denoted *PAC* - Programmable Automation Controller. (National Instruments)

3.3 PID controllers

3.4 Taylor-made modular computers