1.3.5 Sourcing and sinking

The terms *sourcing* and *sinking* are used to describe the way in which d.c. devices are connected to a PLC. With sourcing, using the conventional current flow direction as from positive to negative, an input device receives current from the input module, i.e. the input module is the source of the current (Figure 1.11(a)). If the current flows from the output module to an output load then the output module is referred to as sourcing (Figure 1.11(b)). With sinking, using the conventional current flow direction as from positive to negative, an input device supplies current to the input module, i.e. the input module is the sink for the current (Figure 1.12(a)). If the current flows to the output module from an output load then the output module is referred to as sinking (Figure 1.12(b)).

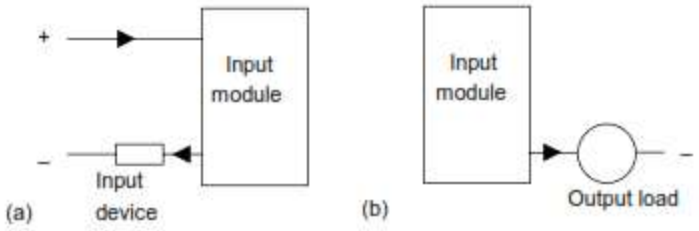

Figure 1.11 *Sourcing*

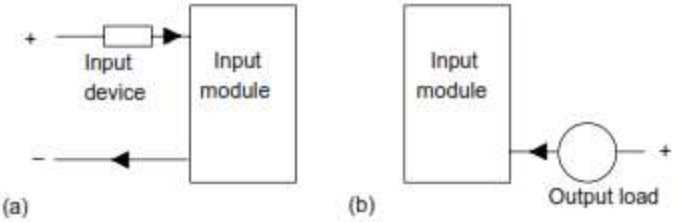

Figure 1.12 *Sinking*

There are two common types of mechanical design for PLC systems; a *single box*, and the *modular/rack types*. The single box type (or, as sometimes termed, brick) is commonly used for small programmable controllers and is supplied as an integral compact package complete with power supply, processor, memory, and input/output units. Typically such a PLC might have 6, 8, 12 or 24 inputs and 4, 8 or 16 outputs and a memory which can store some 300 to 1000 instructions. Figure 1.13 shows the Mitsubishi MELSEC FX3U compact, i.e. brick, PLC and Table 1.1 gives details of models in that Mitsubishi range.

Figure 1.13 *Mitsubishi Compact PLC – MELSEC FX3U (By permission of Mitsubishi Electric Europe)*

Table 1.1 *Mitsubishi Compact PLC – MELSEC FX3U Product range (By permission of Mitsubishi Electric Europe)*

Type	FX3U-16 MR	FX3U-32 MR	FX3U-48 MR	FX3U-64 MR	FX3U-80 MR
Power supply	100-240 V AC				
Inputs	8	16	24	32	40
Outputs	8	16	24	32	40
Digital outputs	Relay				
Program cycle period per logical instruction	0.065 μs				
User memory	64k steps (standard), FLROM cassettes (optional)				
Dimensions in mm (W × H × D)	130 × 90 × 86	150 × 140 × 86	182 × 90 × 86	220 × 90 × 86	285 × 90 × 86

Some brick systems have the capacity to be extended to cope with more inputs and outputs by linking input/output boxes to them. Figure 1.14 shows such an arrangement with the OMRON CPM1A PLC. The base input/output brick, depending on the model concerned, has 10, 20, 30 or 40 inputs/outputs (I/O). The 10 I/O brick has 6 d.c. input points and four outputs, the 20 I/O brick has 12 d.c. input points and 8 outputs, the 30 I/O brick has 18 d.c. input points and 12 outputs and the 40 I/O brick has 24 d.c. input points and 16 outputs. However, the 30 and 40 I/O models can be extended to a maximum of 100 inputs/outputs by linking expansion units to the original brick. For example a 20 I/O expansion module might be added, it having 12 inputs and 8 outputs, the outputs being relays, sinking transistors or sourcing transistors. Up to three expansion modules can be added. The outputs can be relay or transistor outputs.

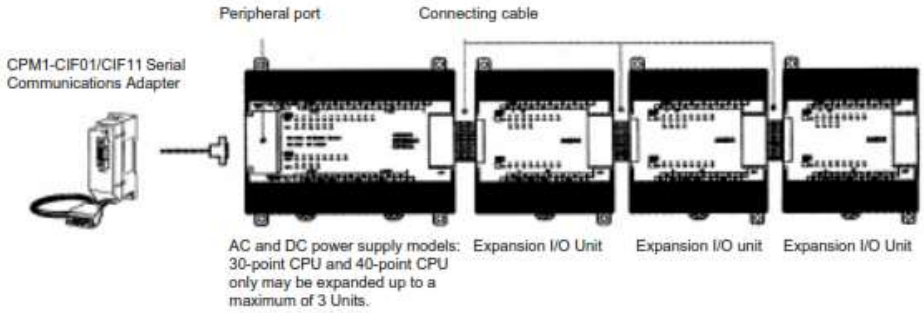

Figure 1.14 *Basic configuration of the OMRON CPM1A PLC (By permission of Omron Electronics LLC)*

Systems with larger numbers of inputs and outputs are likely to be modular and designed to fit in racks. The modular type consists of separate modules for power supply, processor, etc., which are often mounted on rails within a metal cabinet. The rack type can be used for all sizes of programmable controllers and has the various functional units packaged in individual modules which can be plugged into sockets in a base rack. The mix of modules required for a particular purpose is decided by the user and the appropriate ones then plugged into the rack. Thus it is comparatively easy to expand the number of input/output (I/O) connections by just adding more input/output modules or to expand the memory by adding more memory units.

An example of such a modular system is provided by the Allen-Bradley PLC-5 PLC of Rockwell automation (Figure 1.15). PLC-5 processors are available in a range of I/O capacity and memory size, and can be configured for a variety of communication networks. They are single-slot modules that are placed in the left-most slot of a 1771 I/O chassis. Some 1771 I/O chassis are built for back-panel mounting and some are built for rack mounting and are available in sizes of 4, 8, 12, or 16 I/O module slots. The 1771 I/O modules are available in densities of 8, 16, or 32 I/O per module. A PLC-5 processor can communicate with I/O across a DeviceNet or Universal Remote I/O link.

A large selection of 1771 input/output modules, both digital and analogue, are available for use in the local chassis, and an even larger selection available for use at locations remote from the processor. Digital I/O modules have digital I/O circuits that interface to on/off sensors such as pushbutton and limit switches; and on/off actuators such as motor starters, pilot lights, and annunciators. Analogue I/O modules perform the required A/D and D/A conversions using up to 16-bit resolution. Analogue I/O can be user-configured for the desired fault-response state in the event that I/O communication is disrupted. This feature provides a safe reaction/response in case of a fault, limits the extent of faults, and provides a predictable fault response. 1771 I/O modules include optical coupling and filter circuitry for signal noise reduction.

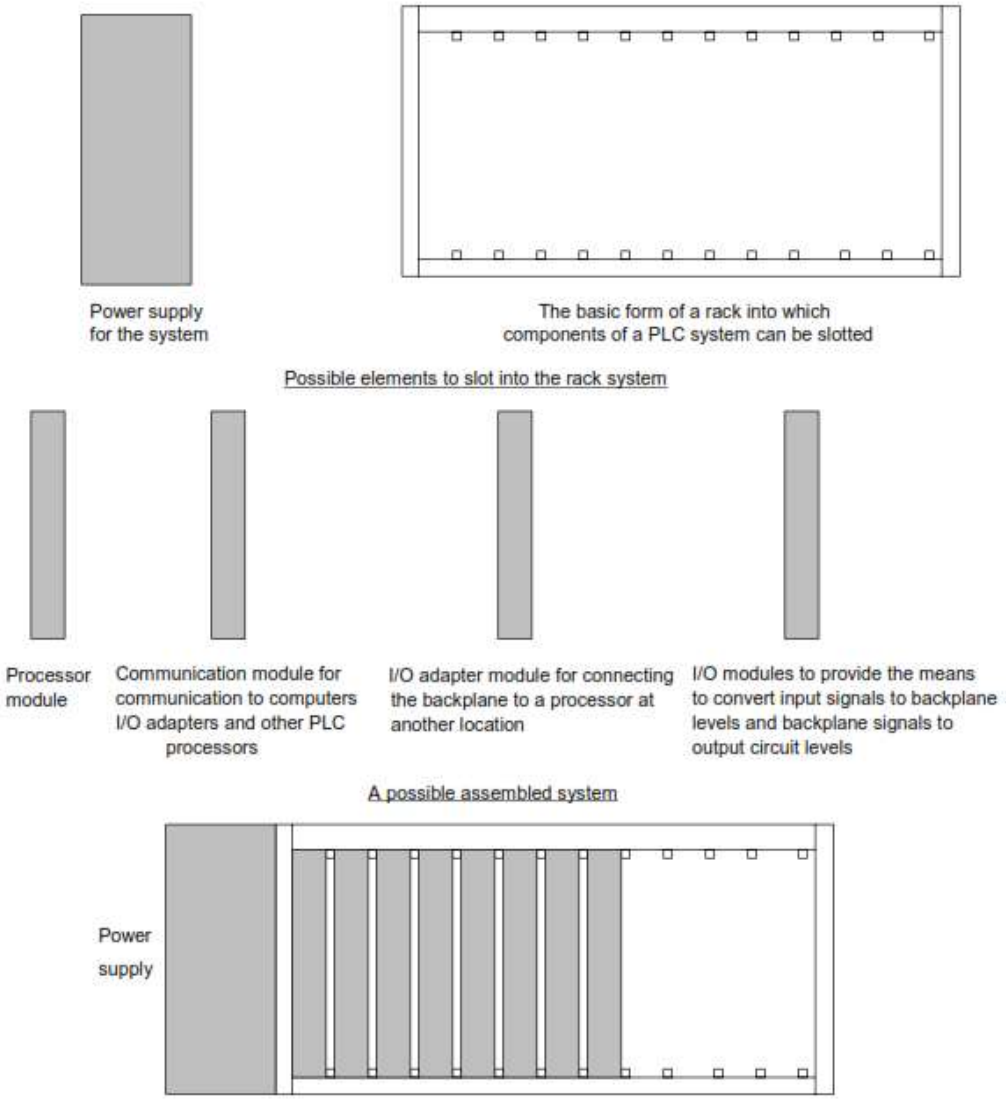

Figure 1.15 *A possible arrangement of a rack system, e.g. the Rockwell Automation , Allen-Bradley PLC-5*

Digital I/O modules cover electrical ranges from 5…276V a.c. or d.c. and relay contact output modules are available for ranges from 0…276 V ac or 0…175 V dc. A range of analogue signal levels can be accomodated, including standard analogue inputs and outputs and direct thermocouple and RTD temperature inputs.