IOP – 8089

I/O Processors

- I/O Processors handles all of the interactions between the I/O devices and the CPU.
- I/O Processors communicates with input and output devices through separate address, data, and control lines.
  - This provides an independent pathway for the transfer of information between external devices and internal memory.
- Relieves the CPU of ‘I/O device chores’

CPU Connection to I/O Devices

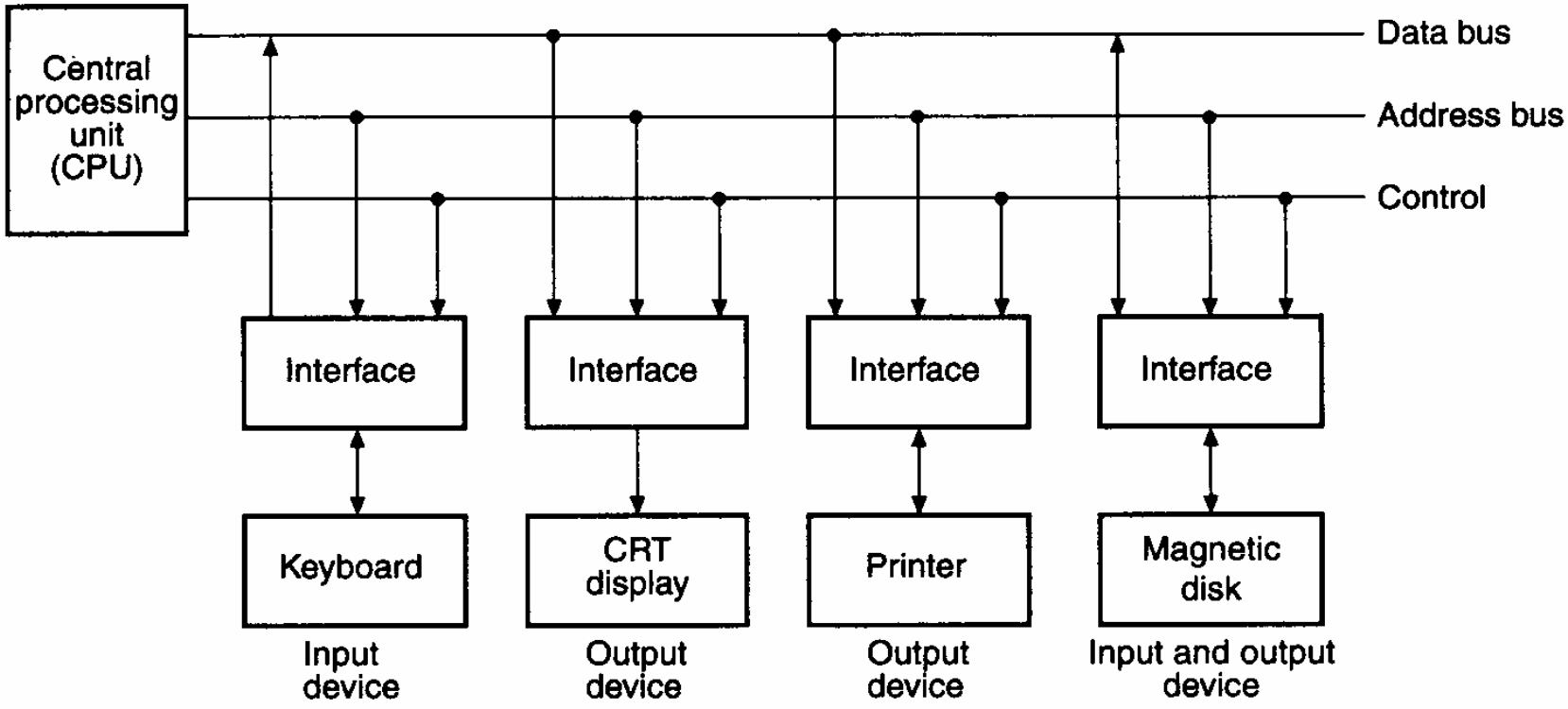
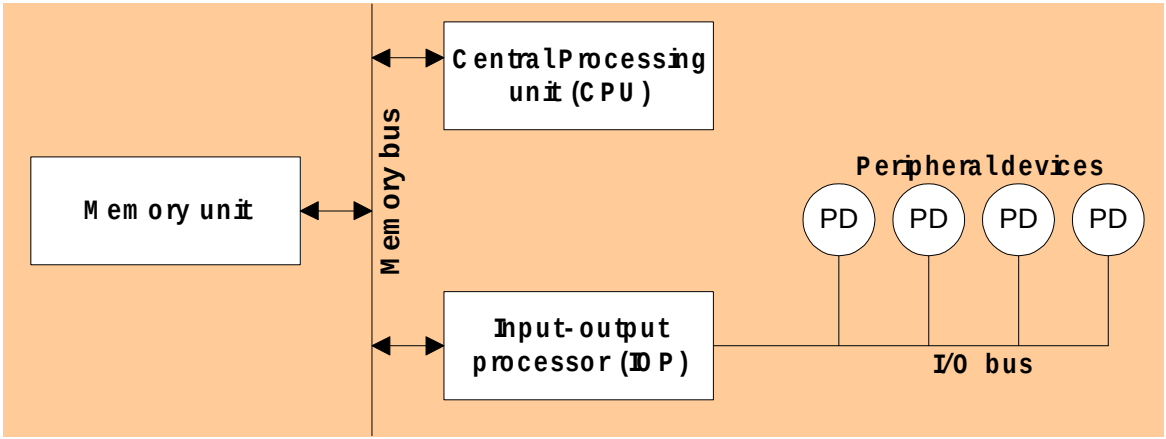


FIGURE 11-4
Connection of I/O Devices to CPU

- Input-Output Processor (IOP)
  - IOP :
  - Communicate directly with all I/O devices
    - Fetch and execute its own instruction
      - IOP instructions are specifically designed to facilitate I/O transfer
    - Designed to handle the details of I/O processing



- Used to address the problem of direct transfer after executing the necessary format conversion or other instructions
- In an IOP-based system, I/O devices can directly access the memory without intervention by the processor

- Three Forms of Commands
- Block transfer commands
  - Moves blocks data to IOP. Usually these instructions swap pages in and out of physical memory, and to load programs from disk memory.
- Arithmetic, logic, and Branch operations
  - IOP uses ALU instructions to manipulate the data so the process time for CPU is shorten.
- Control Command
  - Controls hardware.
    - Ex: rewind the tape on a tape drive or ejecting a CD from a drive.

Microprocessor can transfer data with input/output ports. Here microprocessor is required to set up and perform the actual transfer. For high speed data transfers CPU uses the DMA controller to transfer data. But microprocessor still needs to set up the device controller, initiate the DMA operation, and examine the post transfer status after the completion of each DMA operation. Fig. 8.36 (a) shows input/output handled by microprocessor with DMA controller.

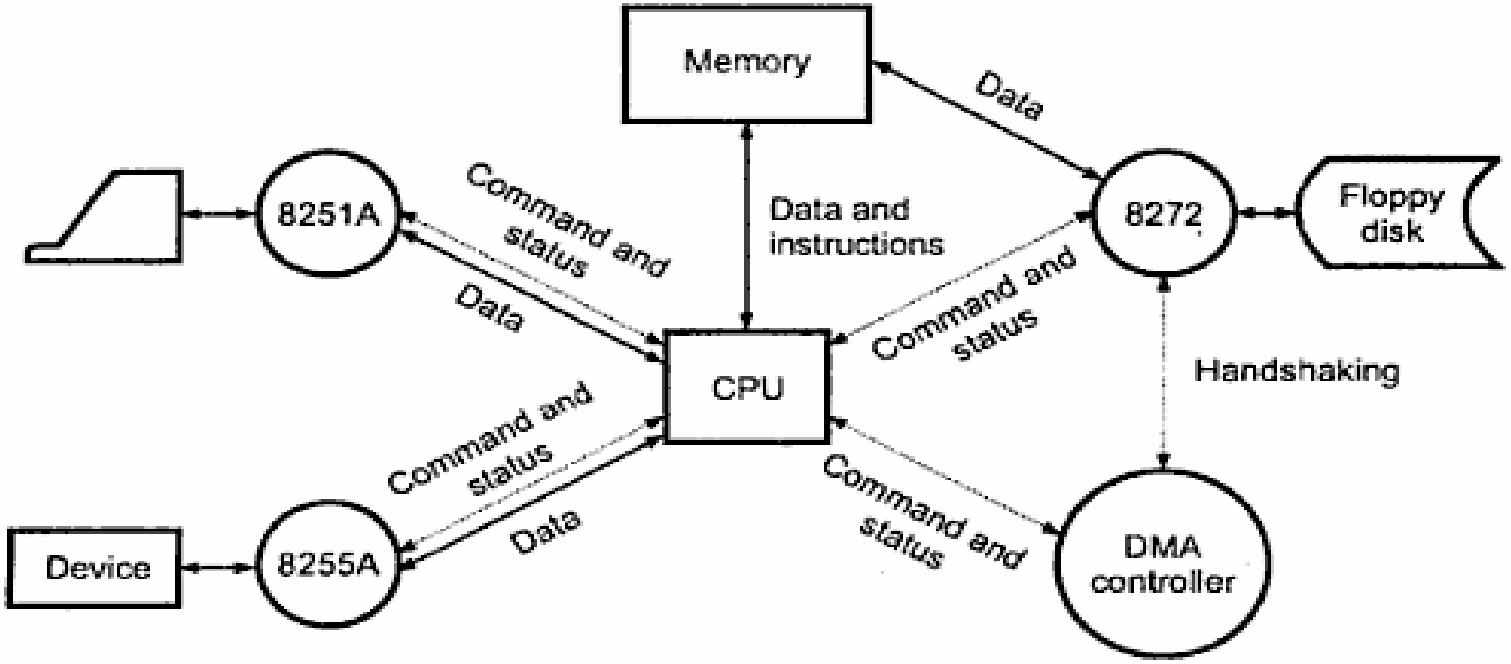


Fig. 8.36 (a) I/O handled by microprocessor

When I/O is handled by IOP, microprocessor can perform some other function at the time of I/O transfer. Refer Fig. 8.36 (b). This increases the system speed. Intel has designed a special device 8089, an I/O processor to look after this I/O transfer.

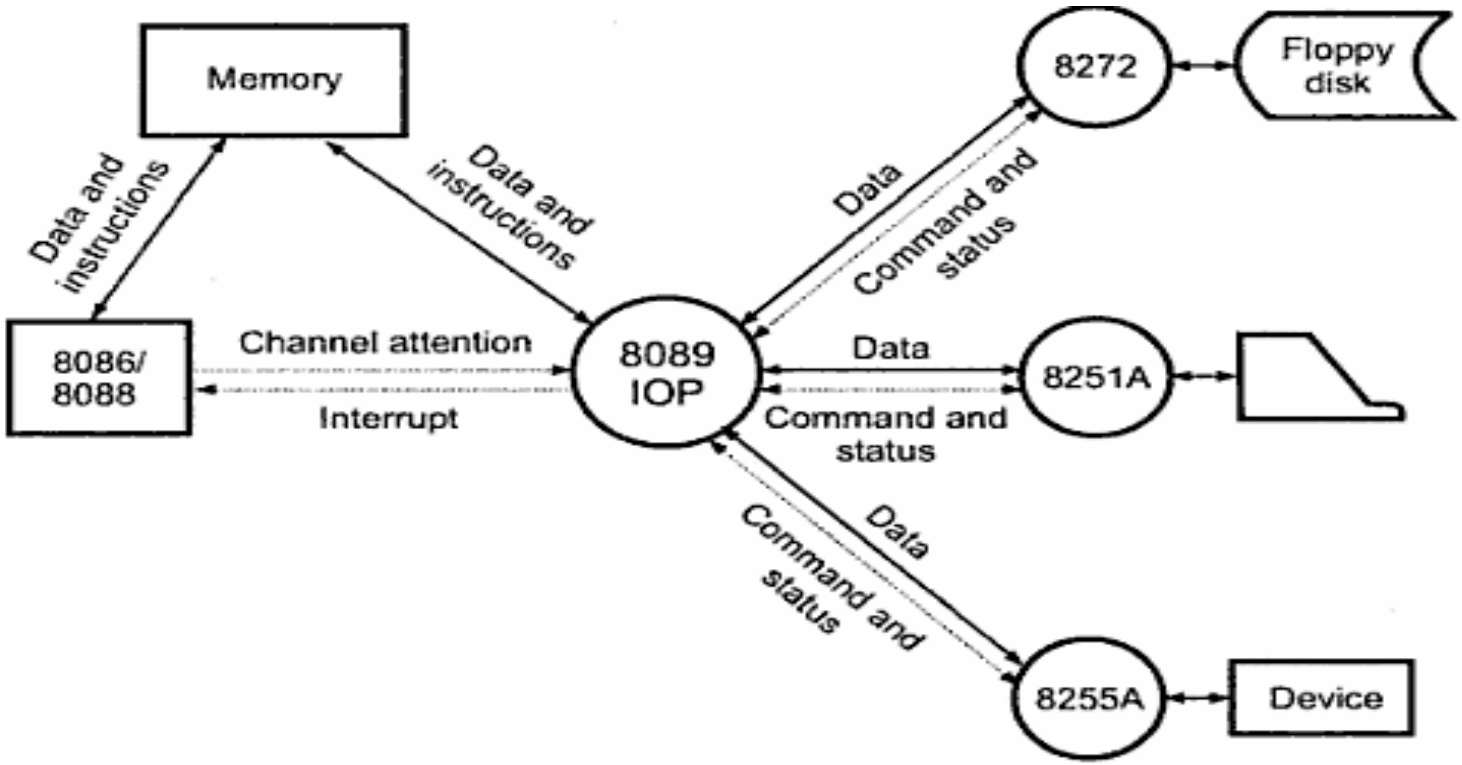


Fig. 8.36 (b) I/O handled by IOP

8.10.1 Features

1. An IOP can fetch and execute its own instructions.
2. Instructions are specially designed for I/O processing.
3. In addition to data transfer, 8089 can perform arithmetic and logic operations, branches, searching and translation.
4. IOP does all work involved in I/O transfer including device setup, programmed I/O, and DMA operation.
5. IOP can transfer data from an 8-bit source to 16-bit destination and vice versa.
6. Communication between IOP and CPU is through memory based control blocks. CPU defines tasks in the control blocks to locate a program sequence, called a channel program.

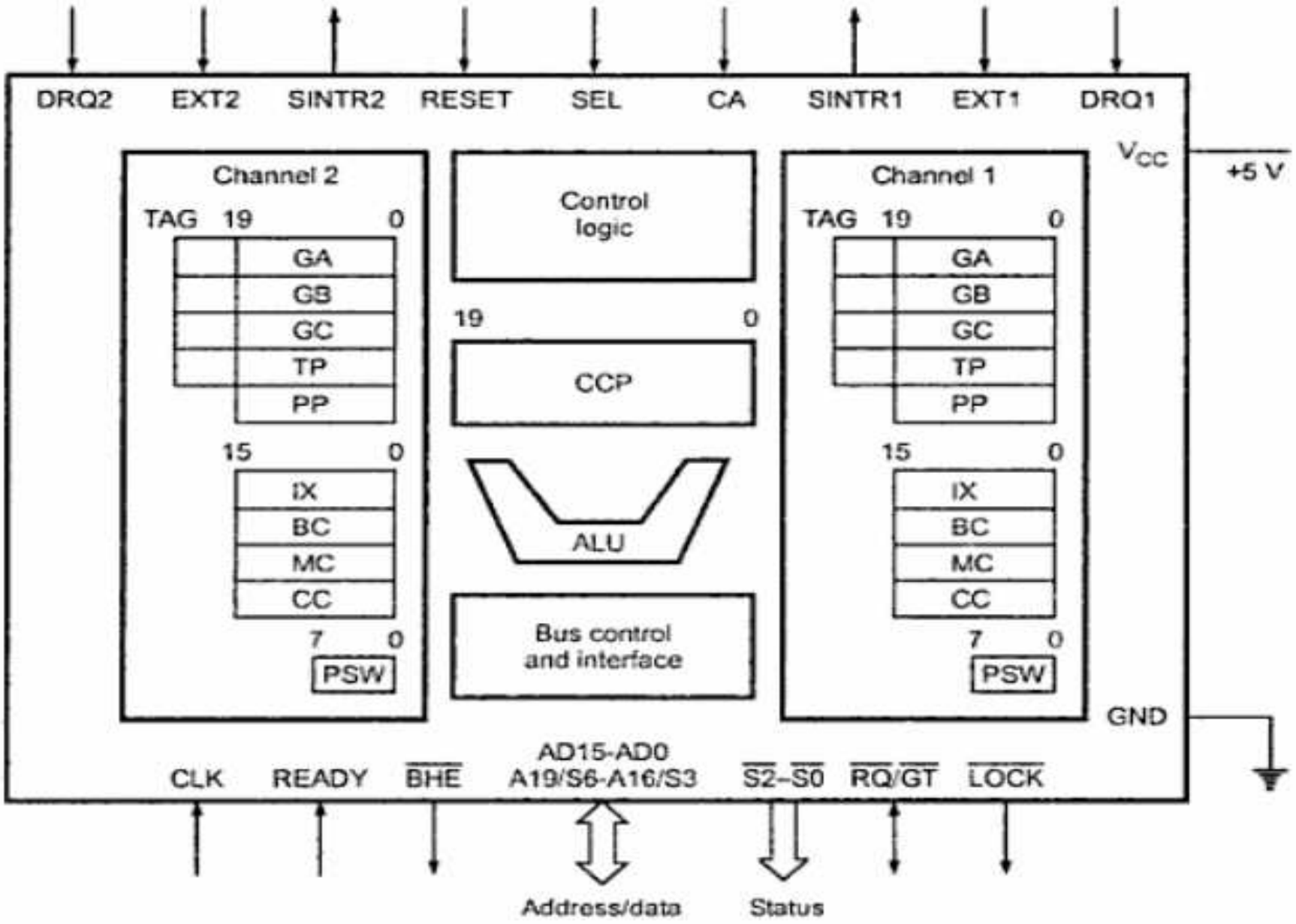
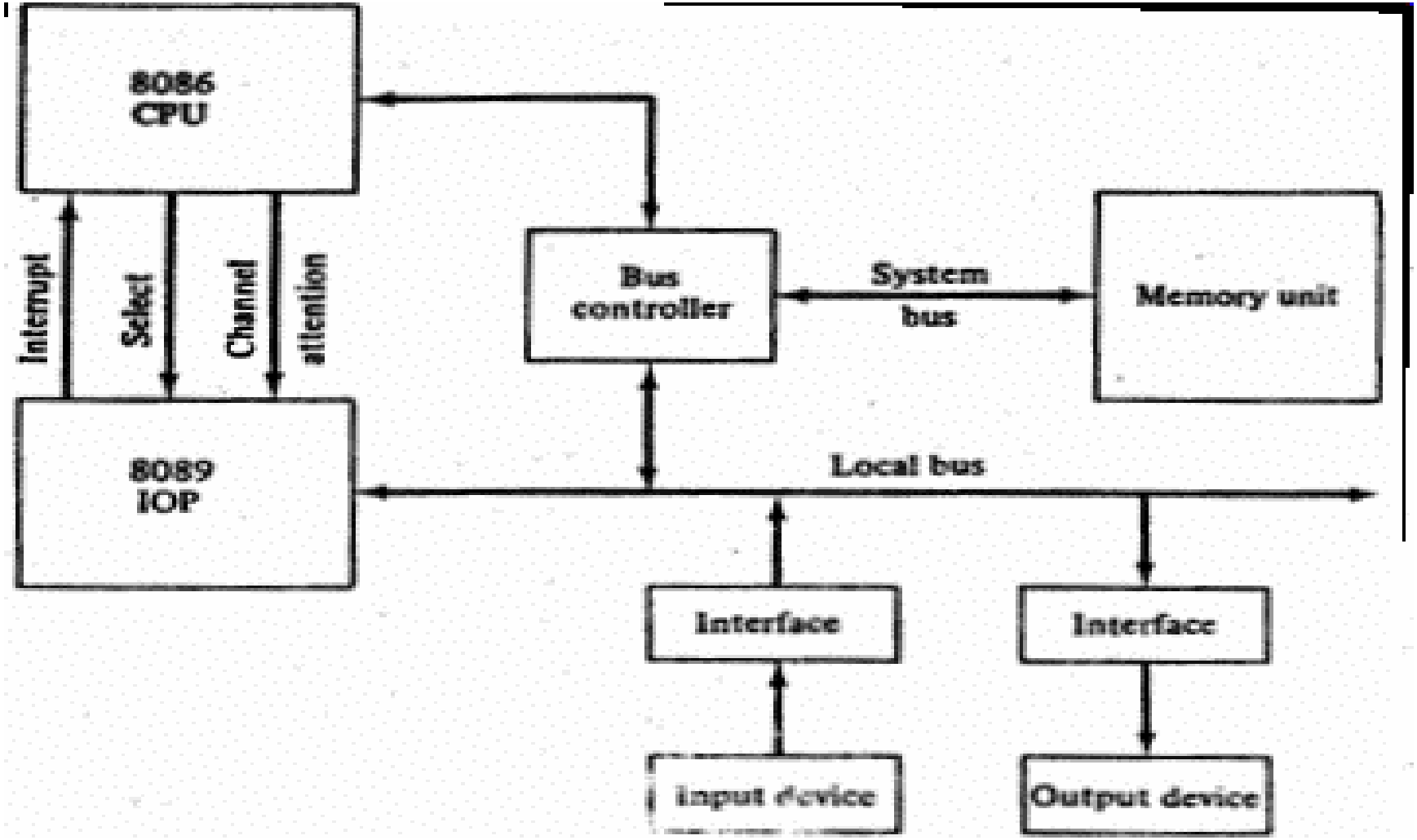
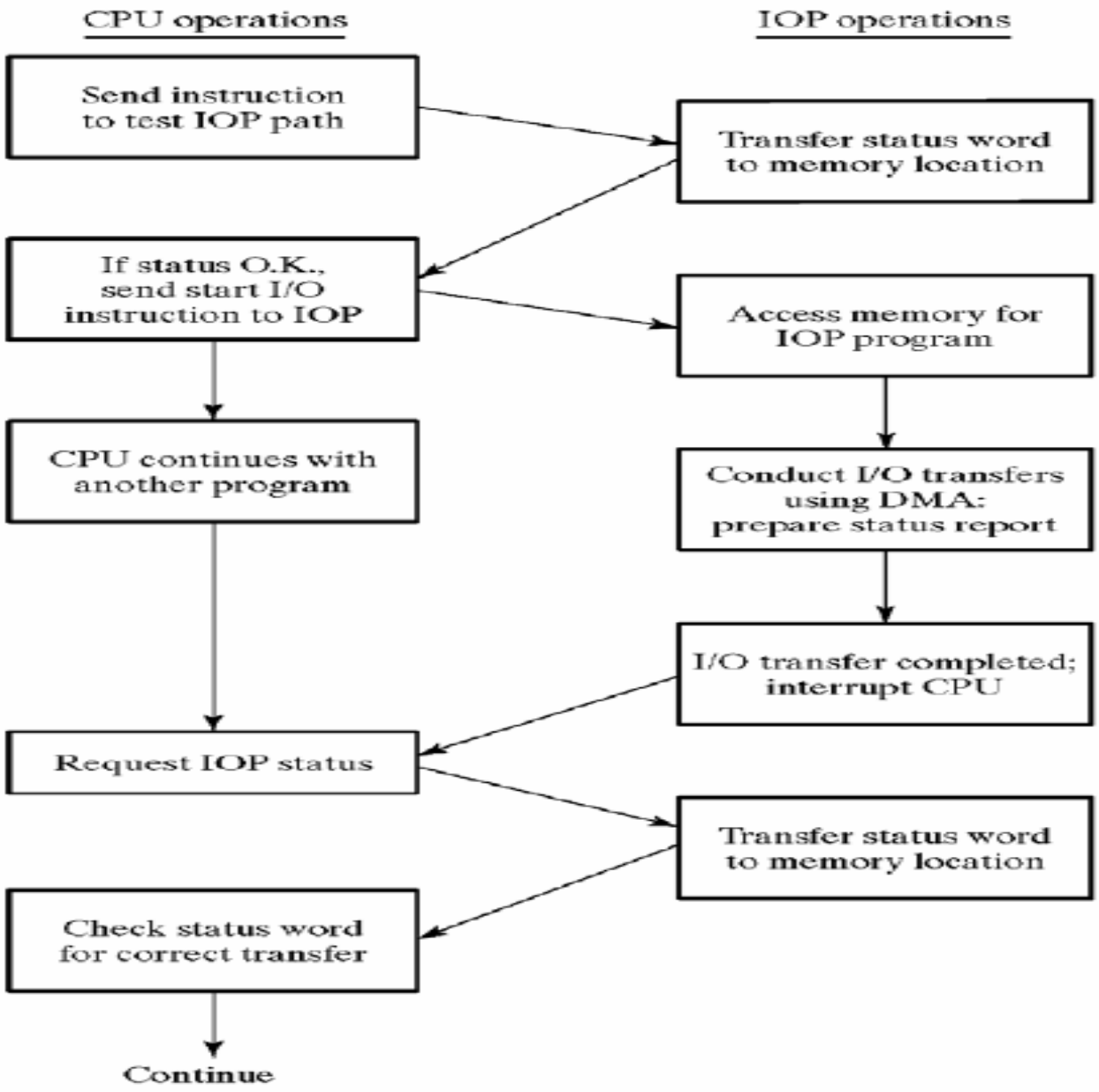


Fig. 8.37 Internal block diagram of 8089

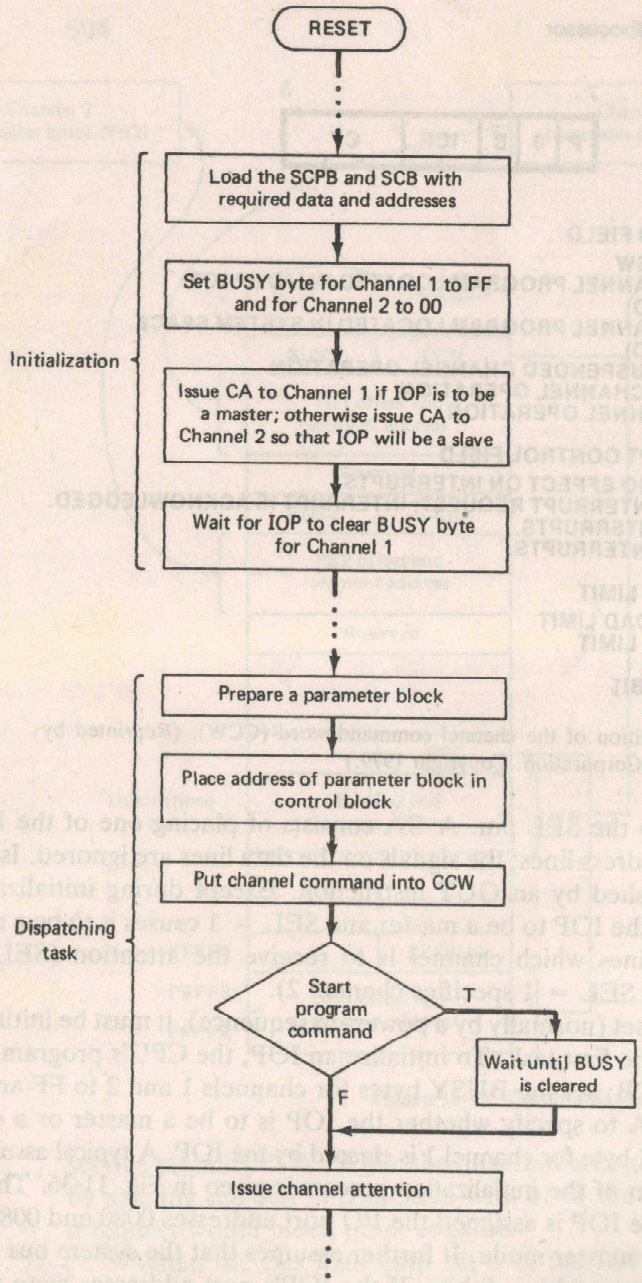
Intel 8086/8089 microcomputer system block diagram



Block Diagram of a Computer with I/O Processor

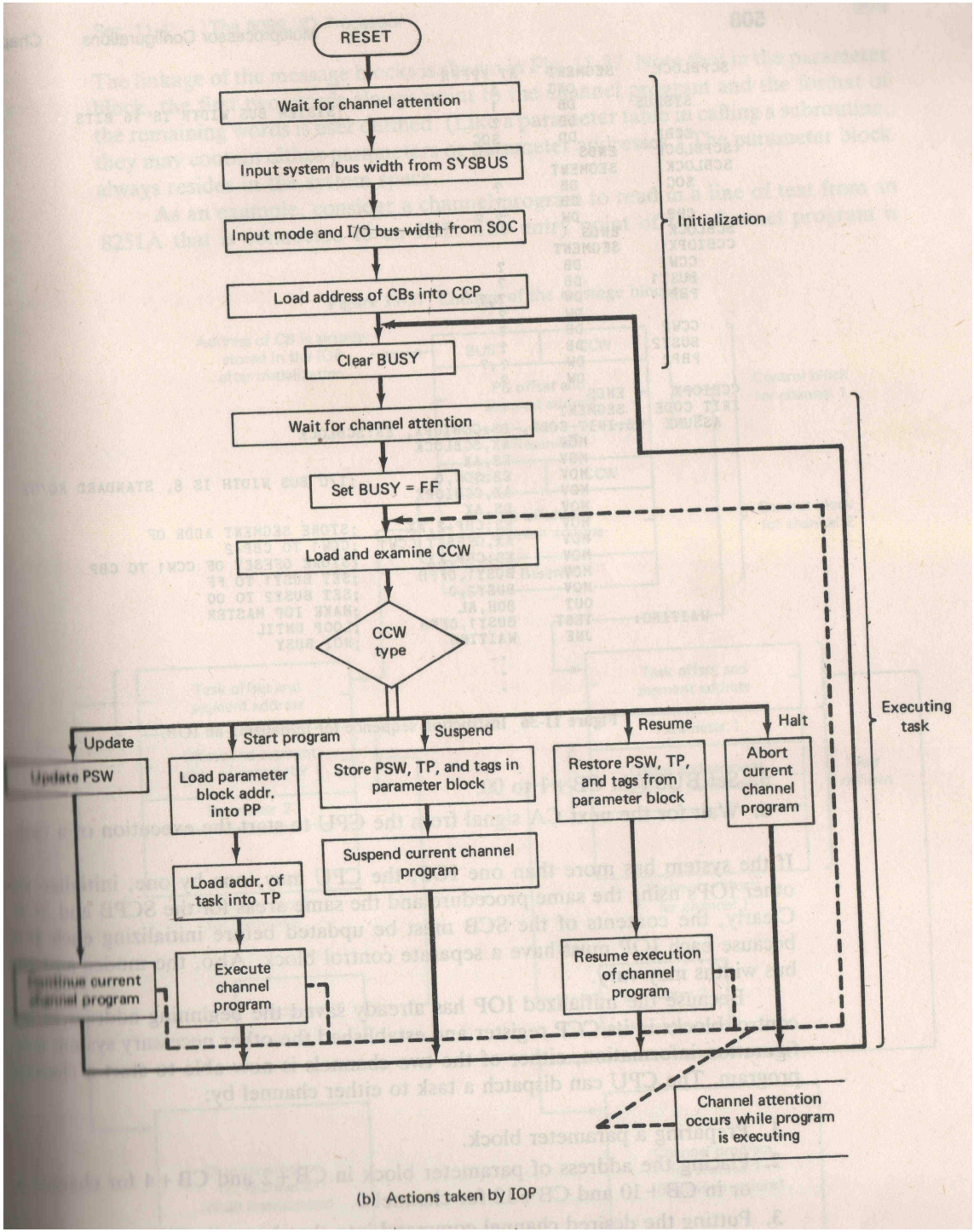


CPU-IOP Communication



(a) Actions taken by CPU program

Figure 11-35 Flowcharts of the initialization and command actions for the 8089.



(b) Actions taken by IOP