MCUs

Microcontrollers (MCUs)

A microcontroller is a microprocessor optimized for performing tasks of control, temporization, supervision of devices, machinery, industrial processes, i.e. for embedded control system applications

Essential components:

- arithmetic logic unit (ALU)
- system memory, both non-volatile (ROM, Flash) and volatile (SRAM, DRAM)
- dedicated peripherals:
  - analog to digital and digital to analog converters (ADCs and DACs)
  - timers and counters for time interval measurements
  - digital modulators (mainly PWMs)

Microcontrollers are designed for providing reduced complexity, low power dissipation, and low cost

Microcontrollers (MCUs)

- Microcontrollers are used in automation, automotive, electrical power drives, and in any measurement system
- Thanks to the great variety of microcontrollers available on the market, designers can always choose the most suitable component for their applications, reducing processing power, memory, and peripherals to what is strictly necessary for the problem at hand.
- There exist microcontrollers with ALU from 4 bits till 32 bits word-length, with different packages, and flexible peripherals

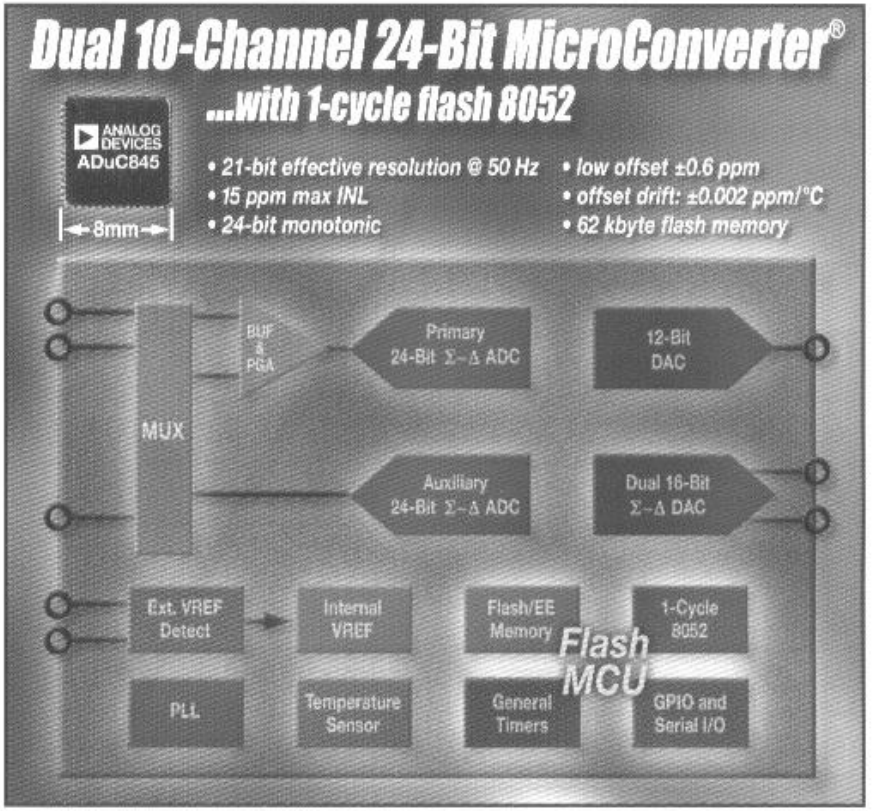
Microcontrollers peripherals

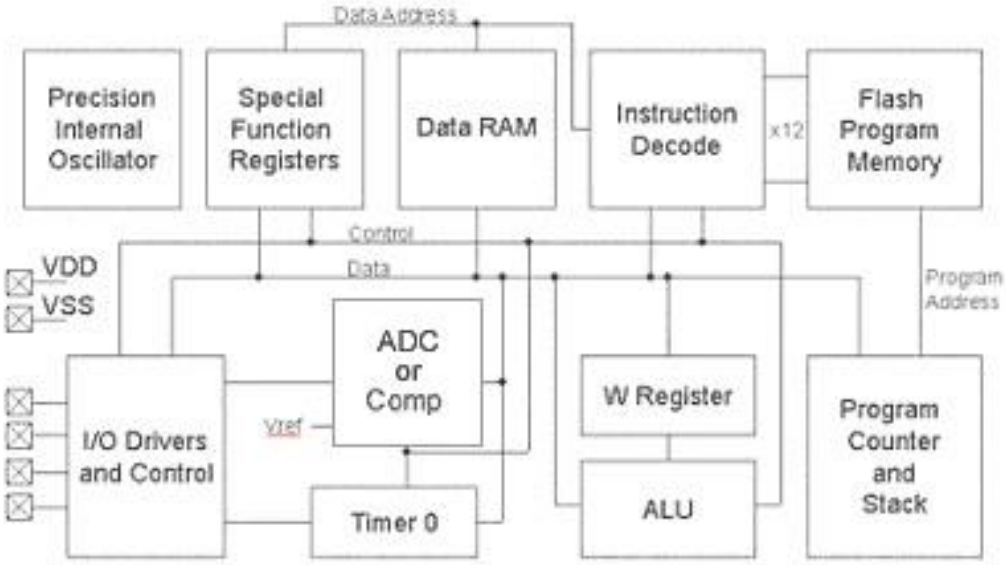
Most common peripherals:

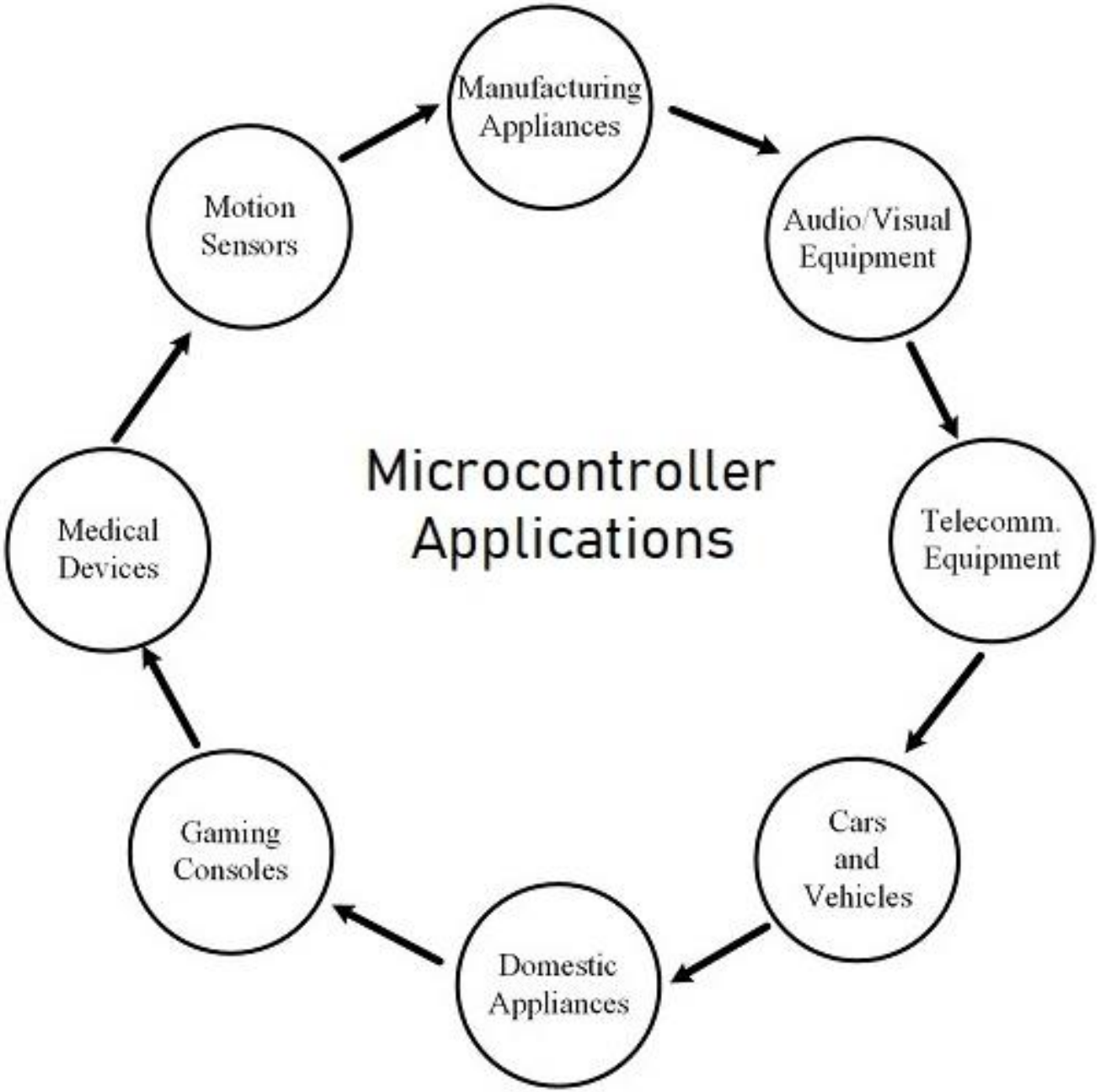
- ADCs and DACs, with different number of bits and sampling frequencies
- timers, counters, PWM modulators
- parallel and serial communication interfaces, with both synchronous and asynchronous serial interfaces
- management modules for bus communications, as I2C, SPI, and controller area network (CAN) bus
- external memory interfaces towards ROM, EEPROM, and flash memories
- power management unit (PMU) for the optimization of the power consumption

Microcontroller units (MCUs)

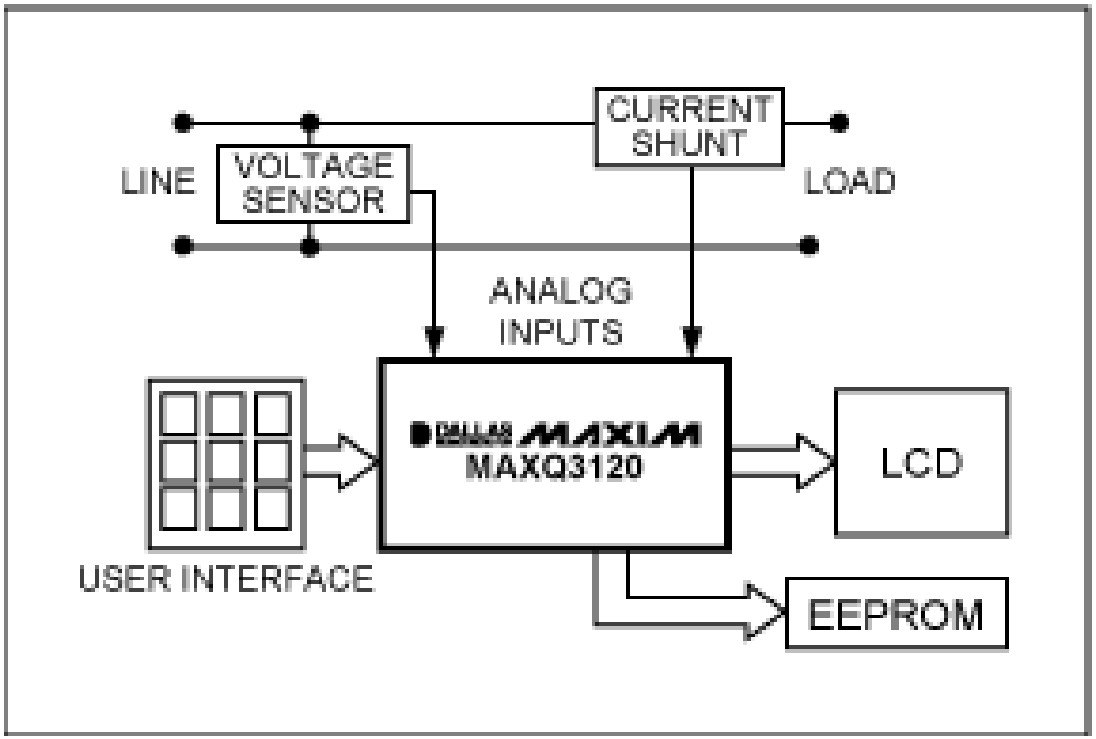
- From very small (3 mm!)
- to rather sophisticated…






Microcontroller Applications
Manufacturing Appliances
Audio/Visual Equipment
Telecomm. Equipment
Cars and Vehicles
Domestic Appliances
Gaming Consoles
Medical Devices
Motion Sensors

MCU example: electricity monitoring



MCU example: electric motor control

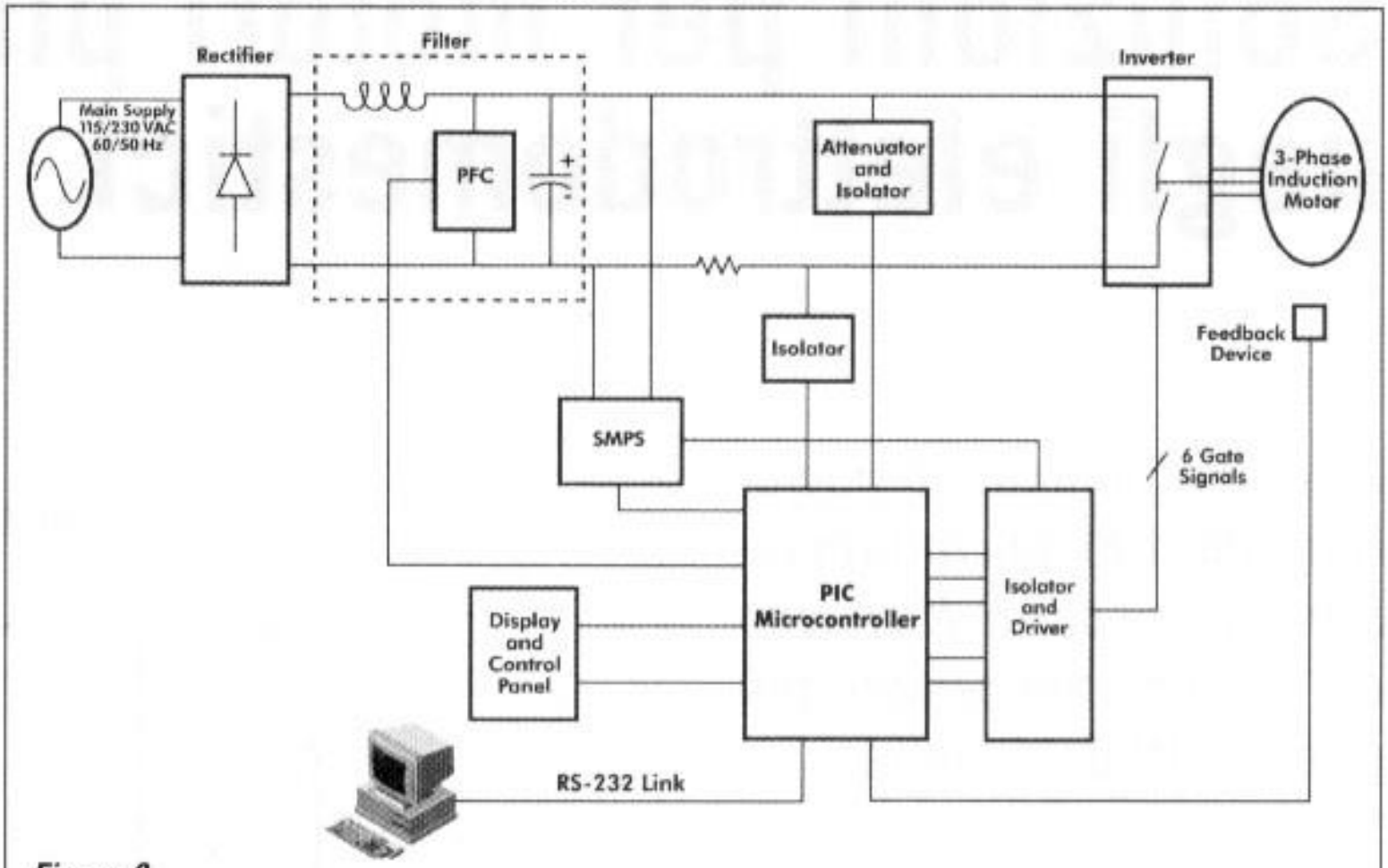
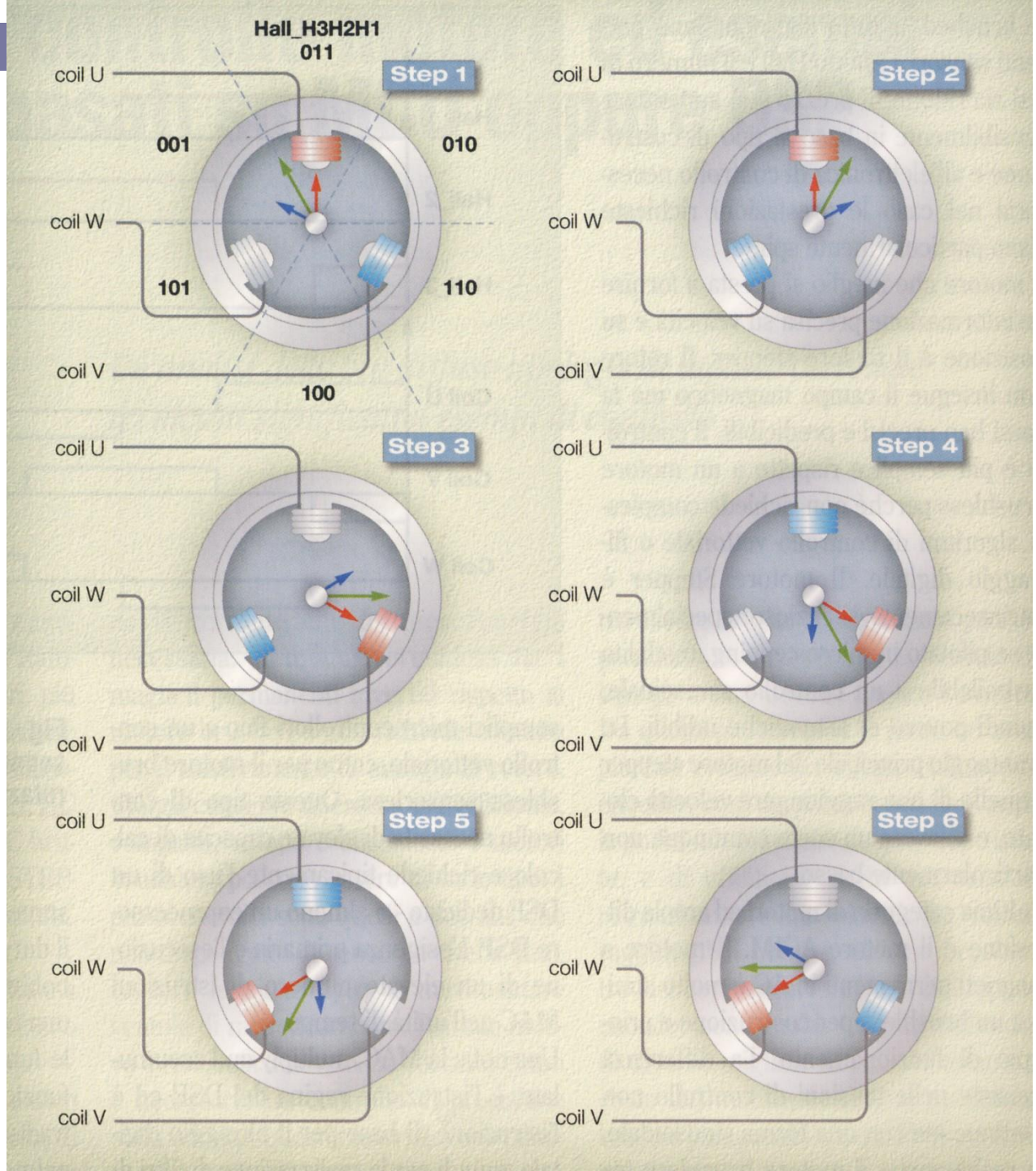


Figura 2

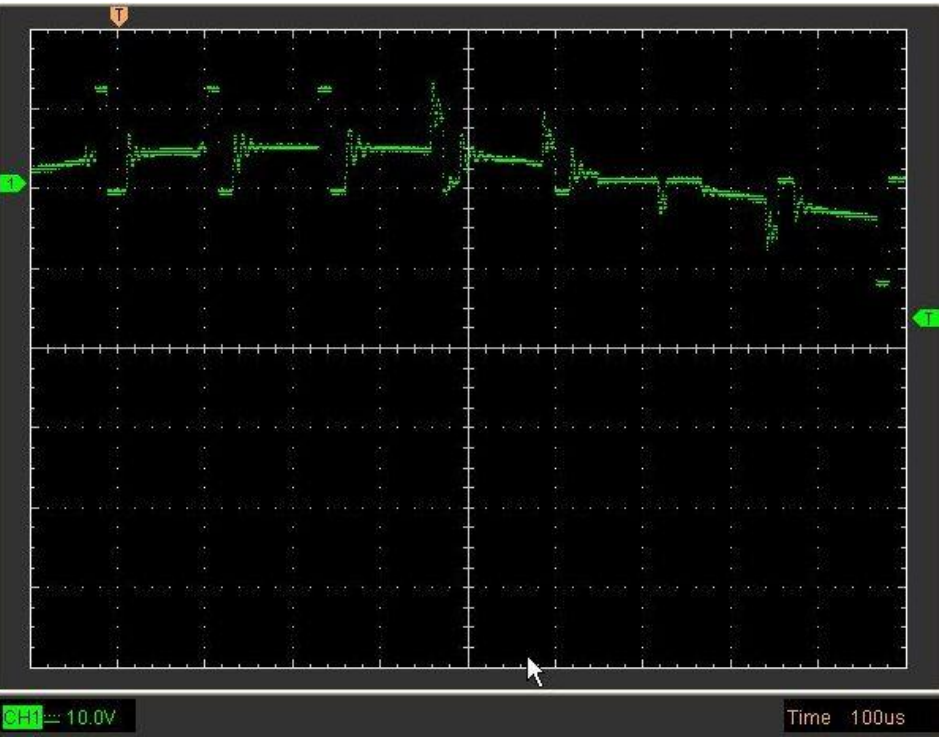
Pilotaggio a frequenza variabile di un ACIM trifase usando MCU PIC18Fxx31

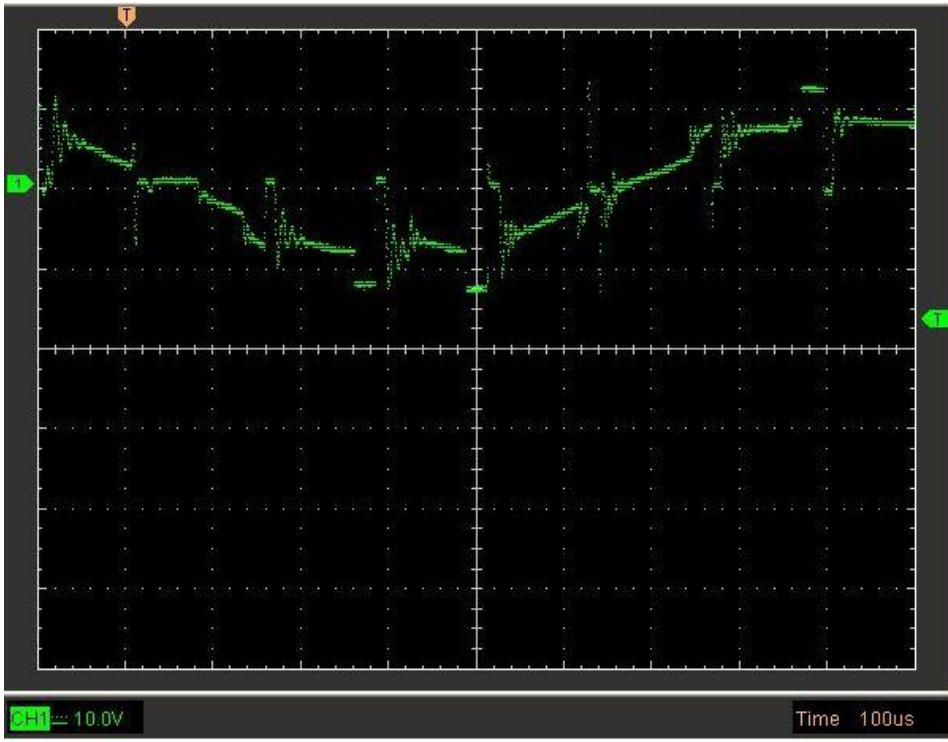
MCU example: electric motor control

- DC brushless motor actuation (possibly with sensorless control)

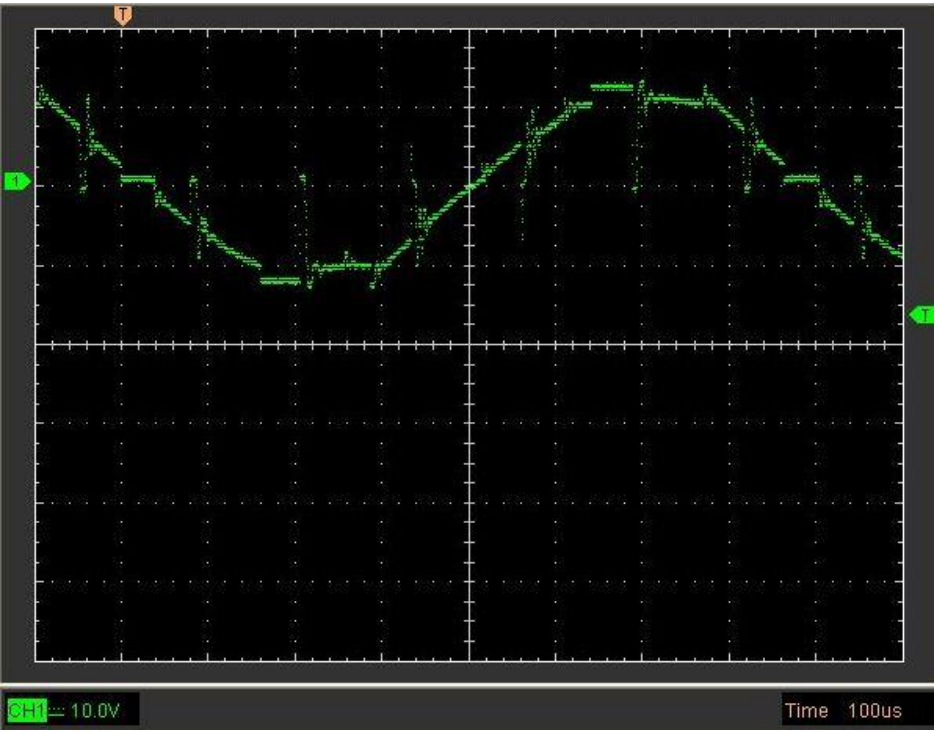


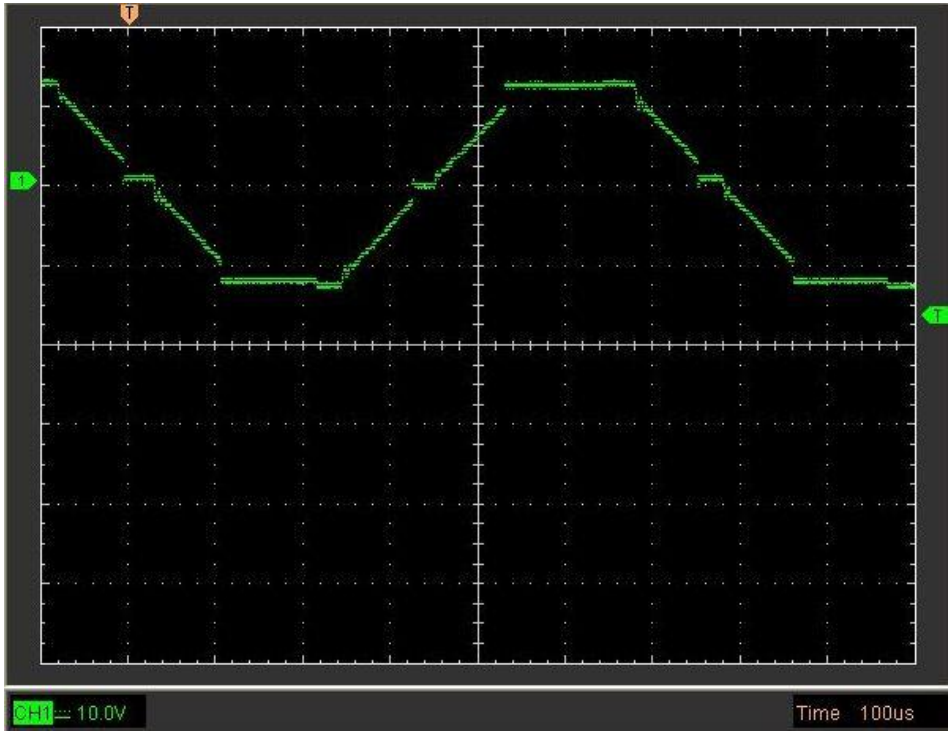
DC brushless motor actuation with sensorless control



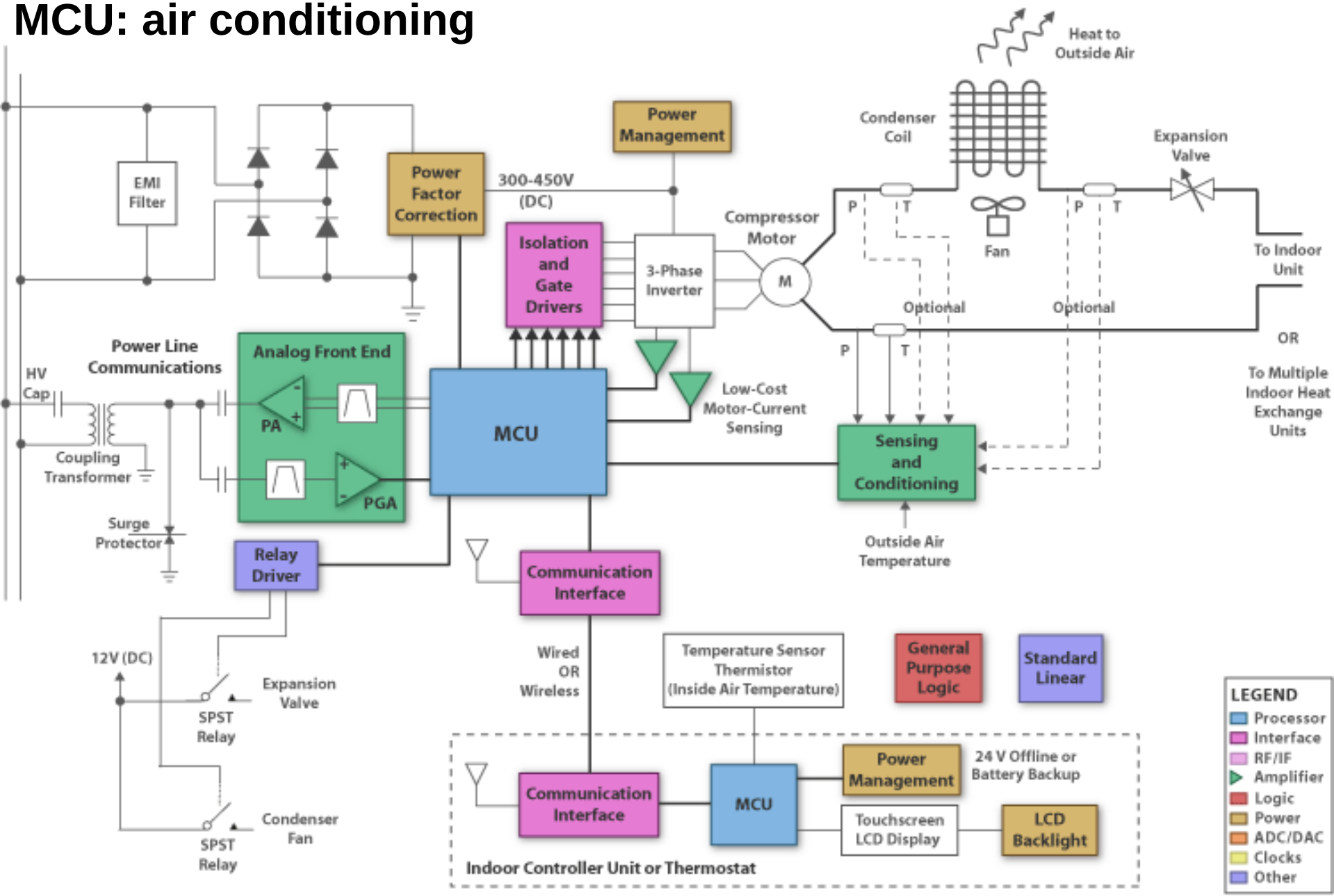


DC brushless motor actuation with sensorless control





MCU: air conditioning



The choice of a microprocessor

Choice of device influenced by many factors:

- cost of the device (depending also on volumes)
- power consumption
- performance
- needed peripherals
- operation conditions: maximum power dissipation, working temperature,…
- design cost: availability of IDE (integrated development environment), previous familiarity with MCU and IDE…
- time to market
- field of application: consumer, automotive, aerospace…
- …