

Lab Notes

Take robot to tech support and ask them to:

- Flux remover
- Contact restore

When we get the board back, it may be a little sticky, but don't worry about it.

ROM

During fabrication, the manufacturer can write your program into memory. It's no longer a standard way of doing behavioral ROMs in industry. Instead, the EEPROM, for example, is used.

MC68HC11 Family

The clock frequency can be 2, 3, 4, or 5 MHz. The typical clock frequency used on the HC11 is 2MHz. The K series chips run at higher frequencies. Crystals and ceramic resonators are used to generate the clock signal.

Crystals – require resistances and capacitances to create the clock signal

Ceramic Resonators – don't need to add external resistors and capacitors, as they are built in as part of the resonator.

Our robot uses a crystal.

The crystal frequency is always 4 times larger than the E (system) clock.

What makes the MC68HC11 a Microcontroller?

- On-chip memory
- CPU (arithmetic, controller)
 - Registers: A, B, X, Y, PC, SP, CCR

EPROMs are erased by shining UV light through a little window on the chip

MC68HC11 Pins (Input/Output)

The byte has become the de facto width for most things in the computer industry. Ports tend to be a byte wide.

Port Name	Pins	Alternate Function
Port A	3 in, 4 out, 1 bi-directional	Timer Subsystem
Port B	8 out	ABUS - A15:A8
Port C	8 bi-directional	ABUS – A7:A0 or DBUS D7:D0
Port D	6 bi-directional	SCI, SPI
Port E	8 input	A/D Converter

Each port is addressed uniquely. We can attach 36 signals to the processor. Some are inputs, some are outputs.

The HC11 provides some input/output peripheral devices on-chip that share these pins. A microprocessor, such as the Pentium, does not have these devices built onto it.

SCI – Serial Communications Interface - Standard RS232 protocol implemented with 0 and 5V signals. In other words, it is not RS232. Rather, it is a universal serial device. The robot converts these signals to the appropriate voltages that are needed for RS232.

SPI – Synchronous Peripheral Interface – Created by Motorola, the SPI is effectively a 3-wire serial loop. It is often used to interface with transducers.

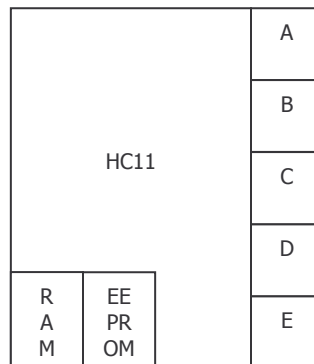
These two communications sub systems allow networking with other systems, thus providing input/output functionality.

Single-Chip Mode

The intent is that the HC11 will have nothing but itself and it will present ports A, B, C, D, and E at its pin interface.

There is no external memory. Single-chip mode was intended for small-memory environments. For example: an airbag monitor or thermostat controller.

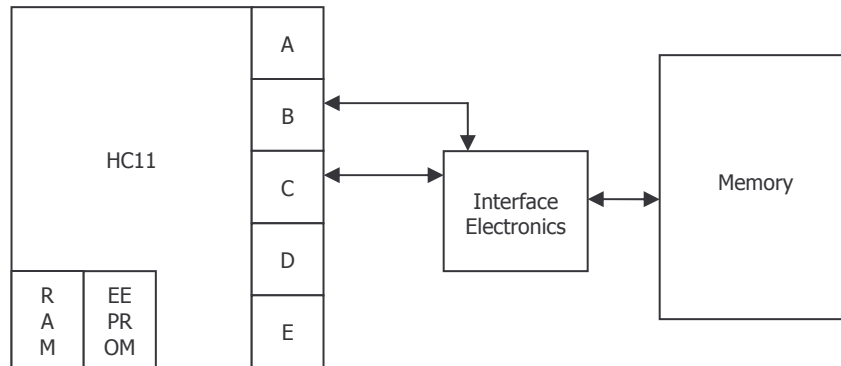
Memory is very expensive and takes lots of silicon to manufacture.



Since the on-chip memory is so small, Motorola expected that you would want to add external memory.

Expanded-Chip Mode

Port B and Port C are used by the chip in expanded-chip mode to communicate with external memory.



The HC11 presents a 16-bit memory address. Therefore, it could be no greater than 2^{16} bytes = 64 KB.

Robot:

62256 memory IC → 32 KB

The interface electronics map the external memory from 8000 – FFFF.

Other HC11 Pins

MODB, MODA, \overline{RESET} -

As long as RESET is held at 0V, the controller does nothing. As reset begins to rise toward 5 volts, it samples MODB and MODA

MODB	MODA		
0	0	Special, Single-chip mode (special bootstrap)	
0	1	Special, expanded mode (special test)	
1	0	Normal single-chip mode	
1	1	Normal expanded mode	
0 = Special 1 = Normal	0 = Single 1 = Expand		

Motorola never intended anyone to build a circuit in special test mode. It was used by Motorola to test the controller. BUT, everyone uses the special test mode.