

## Lego 6 Addressing:

### Motor ports

#### *Direction*

An 8-bit number to port 9000H sets the direction bits as follows

D7	D6	D5	D4	D3	D2	D1	D0
M11	M12	M21	M22	M31	M32	M41	M42

For normal operation Mx1 should be the inverse of Mx2. In previous incarnations of the Lego board this was one bit with the second bit driven by an inverter. If Mx1 and Mx2 are in the same state then motor has two 1's or two 0's on its two inputs. Setting Mx1 and Mx2 to 0 effectively shorts the motor terminals to ground and can be used for dynamic braking.

#### *On/Off/PCM*

The motor driver chip selects are tied directly to the 89C51RD2 PCM ports which are bits 3, 4, 5, and 6 of port 1.

P1.4 → M1 chip select

P1.3 → M2 chip select

P1.6 → M3 chip select

P1.5 → M4 chip select

Set the bit to 0 to turn the motor off and to 1 to turn it on.

### A to D Converter

The chip select for the A to D converter is at port 8000H. Port bit P3.5 can be jumpered (using J1) to read the interrupt (active low) done signal from the converter. To do a conversion write the channel number (0-7) to port 8000H. Wait for P3.5 to go low and read the data from port 8000H.

### LCD

The LCD has two ports. 0F000H is the instruction port for commands. 0F100H is the data port to write data to the LCD

### 8255 Programmable I/O port

The 8255 has four ports as follows:

0A000 → port A

0A100 → port B

0A200 → port C

0A300 → command port

On reset all ports are set to input. If all ports are to be input, no command word is necessary and the user can do input from port A, B, or C. The 8255 has three modes and multiple commands in each mode. Mode 0 is basic I/O. Modes 1 and 2 allow the user to program port C as a handshaking port for ports A and B. For the Lego board we will use only Mode 0. The figures below are taken from the 8255 data sheet and explain the bit

patterns needed to change the ports to input or out put individually. The control word is sent to address 0A300H. Bit 7 must be a 1 to change the mode or the configuration. Bits 2, 5 and 6 control the various modes. If bit 7 = 1 and bits 2, 5, and 6 = 0 you get mode 0. bits 0, 1, 3, and 4 set the port direction in this mode.

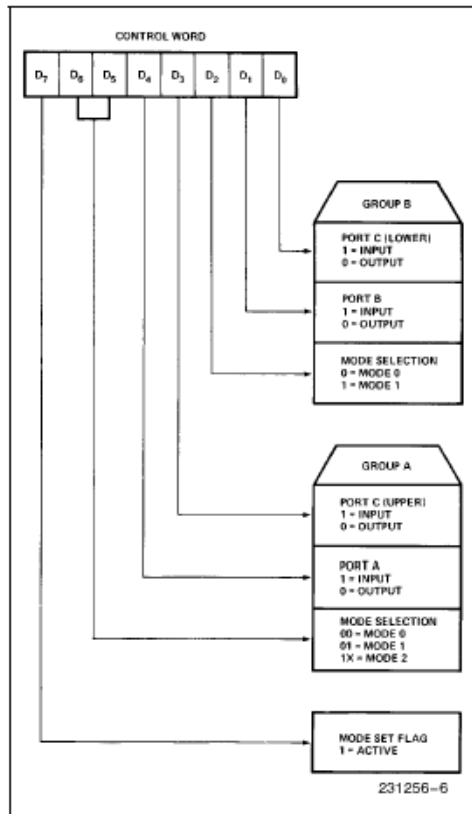


Figure 6. Mode Definition Format

**MODE 0 Port Definition**

A		B		GROUP A			GROUP B	
D <sub>4</sub>	D <sub>3</sub>	D <sub>1</sub>	D <sub>0</sub>	PORT A	PORT C (UPPER)	#	PORT B	PORT C (LOWER)
0	0	0	0	OUTPUT	OUTPUT	0	OUTPUT	OUTPUT
0	0	0	1	OUTPUT	OUTPUT	1	OUTPUT	INPUT
0	0	1	0	OUTPUT	OUTPUT	2	INPUT	OUTPUT
0	0	1	1	OUTPUT	OUTPUT	3	INPUT	INPUT
0	1	0	0	OUTPUT	INPUT	4	OUTPUT	OUTPUT
0	1	0	1	OUTPUT	INPUT	5	OUTPUT	INPUT
0	1	1	0	OUTPUT	INPUT	6	INPUT	OUTPUT
0	1	1	1	OUTPUT	INPUT	7	INPUT	INPUT
1	0	0	0	INPUT	OUTPUT	8	OUTPUT	OUTPUT
1	0	0	1	INPUT	OUTPUT	9	OUTPUT	INPUT
1	0	1	0	INPUT	OUTPUT	10	INPUT	OUTPUT
1	0	1	1	INPUT	OUTPUT	11	INPUT	INPUT
1	1	0	0	INPUT	INPUT	12	OUTPUT	OUTPUT
1	1	0	1	INPUT	INPUT	13	OUTPUT	INPUT
1	1	1	0	INPUT	INPUT	14	INPUT	OUTPUT
1	1	1	1	INPUT	INPUT	15	INPUT	INPUT

**Buzzer**

The buzzer had been changed from a piezo transducer to a true buzzer. The jumper J2 must be in place to operate the buzzer. Send a 0 to P1.0 to turn the buzzer on. Send a 1 (reset condition) to P1.0 to turn the buzzer off.