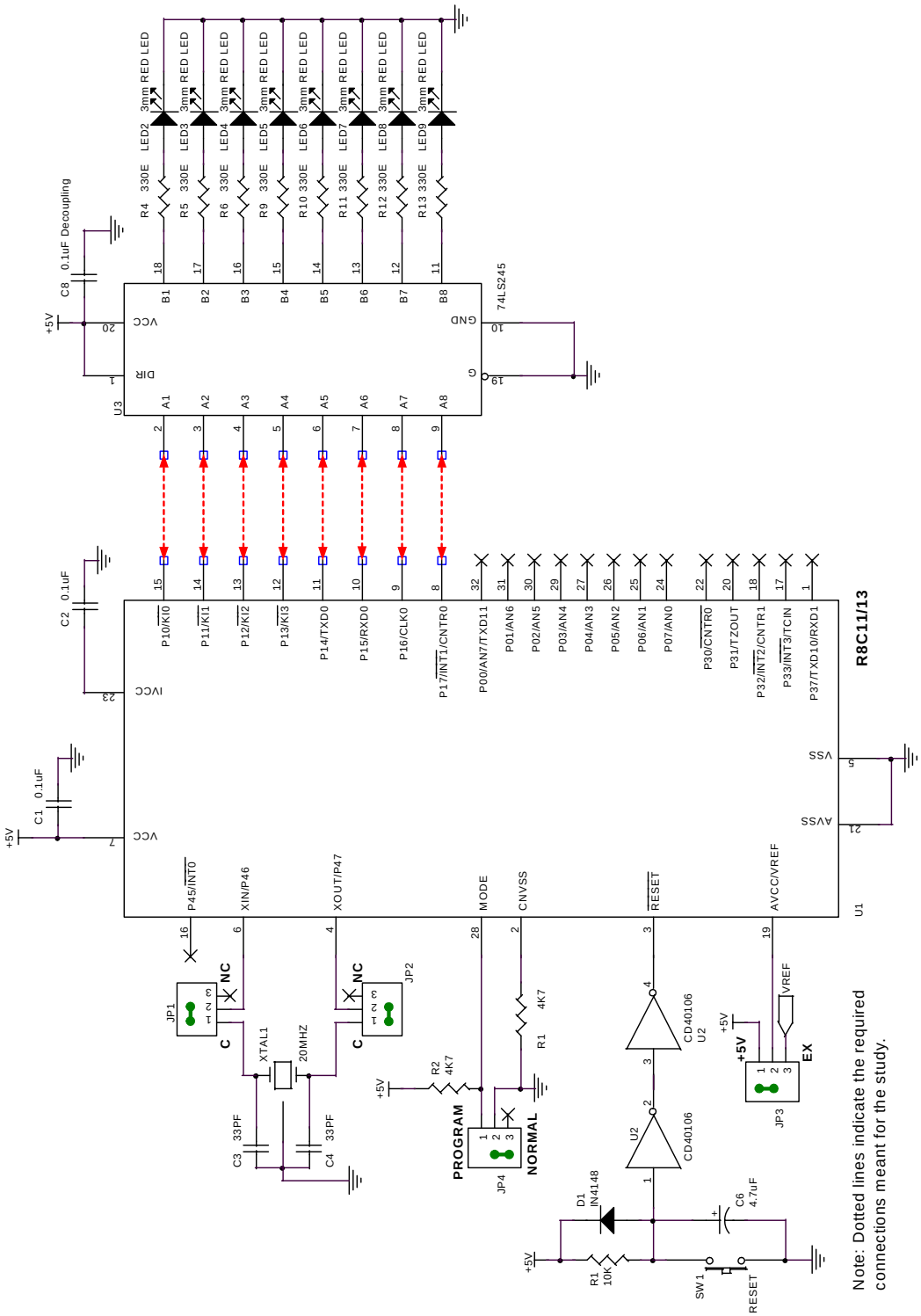
Introduction:

Gives an idea about using the external oscillator as main clock to the CPU and other peripheral functions. After selecting the oscillator, the program will sequentially switch eight LEDs from first LED to 8th LED and from 8th LED to first LED with time interval.

Hardware:

Eight point LEDs are used to study the external oscillator and these LEDs are connected to the port lines P10 to P17.

Circuit Connection :



Connections:

Port lines		LEDs
P00	->	LED 1
P01	->	LED 2
P02	->	LED 3
P03	->	LED 4
P04	->	LED 5
P05	->	LED 6
P06	->	LED 7
P07	->	LED 8

Functional Description:

This clock is supplied by a main clock oscillation circuit. This clock is used as the clock source for the CPU and peripheral function clocks. The main clock oscillator circuit is configured by connecting a resonator between the XIN and XOUT pins. The main clock oscillator circuit contains a feedback resistor, which is disconnected from the oscillator circuit during stop mode in order to reduce the amount of power consumed in the chip. The main clock oscillator circuit may also be configured by feeding an externally generated clock to the XIN pin. Following Figure shows choices available for the main clock connection circuit.

Note: Insert a damping resistor if required. The resistance will vary depending on the oscillator and the oscillation drive capacity setting. Use the value recommended by the maker of the oscillator.
When the oscillation drive capacity is set to low, check that oscillation is stable. Also, if the oscillator manufacturer's data sheet specifies that a feedback resistor be added external to the chip, insert a feedback resistor between XIN and XOUT following the instruction.

During reset and after reset, the main clock is turned off automatically.

The main clock starts oscillating when the CM05 bit in the CM0 register is set to “0” (main clock on) after setting the CM13 bit in the CM1 register to “1” (XIN- XOUT pin).

To use the main clock as the CPU clock, set the OCD2 bit in the OCD register to “0” (selecting main clock) after the main clock becomes stable.

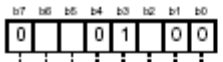
The power consumption can be reduced by setting the CM05 bit in the CM0 register to “1” (main clock off) if the OCD2 bit is set to “1” (selecting on-chip oscillator clock).

Note that if an externally generated clock is fed into the XIN pin, the main clock cannot be turned off by setting the CM05 bit to “1”. If necessary, use an external circuit to turn off the clock.

Registers Used:

CM0 - System clock control register 0
CM1 - System clock control register 1
OCD - Oscillation stop detection register 1

CM0 - System Clock Control Register 0:



Symbol CM0 | Address 000616 | After reset 6816

Bit symbol	Bit name	Function	RW
(b1-b0)	Reserved bit	Set to “0”	RW
CM02	WAIT peripheral function clock stop bit	0 : Do not stop peripheral function clock in wait mode 1 : Stop peripheral function clock in wait mode	RW
(b3)	Reserved bit	Set to “1”	RW
(b4)	Reserved bit	Set to “0”	RW
CM05	Main clock (XIN-XOUT) stop bit[2, 4]	0 : On 1 : Off[3]	RW
CM06	CPU clock division select bit 0[5]	0 : CM16 and CM17 valid 1 : Divide-by-8 mode	RW
(b7)	Reserved bit	Set to “0”	RW

Notes

Bit CM05 is set to 1 to switch off main clock and CM06 bit cleared to enable CM16 & CM17 bits in CM1 register.

CM1 - System Clock Control Register 1:

Symbol CM1 | Address 000716 | After reset 2016

Bit symbol	Bit name	Function	RW
CM10	All clock stop control bit[4,7]	0 : Clock on 1 : All clocks off (stop mode)	RW
(b1)	Reserved bit	Set to "0"	RW
(b2)	Reserved bit	Set to "0"	RW
CM13	Port XIN-XOUT switch bit[7]	0 : Input port P46, P47 1 : XIN-XOUT pin	RW
CM14	Low-speed on-chip oscillation stop bit[5,6]	0 : Low-speed on-chip oscillator on 1 : Low-speed on-chip oscillator off	RW
CM15	XIN-XOUT drive capacity select bit[2]	0 : LOW 1 : HIGH	RW
CM16	CPU clock division select bit 1[3]	b7 b6 0 0 : No division mode 0 1 : Division by 2 mode 1 0 : Division by 4 mode 1 1 : Division by 16 mode	RW
CM17			RW

The bit CM14 is set to 1 to switch off on-chip low speed oscillator.

OCD - Oscillation Stop Detection Register 1:

Symbol OCD | Address 000C16 | After reset 0416

Bit symbol	Bit name	Function	RW
OCD0	Oscillation stop detection enable bit	b1 b0 0 0: The function is disabled[4] 0 1: Avoid this setting 1 0: Avoid this setting 1 1: The function is enabled[7]	RW
OCD1			
OCD2	System clock select bit[6]	0: Select main clock[7] 1: Select on-chip oscillator clock[2]	RW
OCD3	Clock monitor bit[3, 5]	0: Main clock on 1: Main clock off	RO
(b7-b4)	Reserved bit	Set to "0"	RW

Main clock is switched on by setting the bit OCD3 to zero and disables the on-chip oscillator by setting OCD2 bit to zero.

Software Description:

After reset, the program will initialize the system control registers CM0, CM1, OCD and HR0 to select the external oscillator as clock source for the CPU and other peripherals. The port lines P10 to P17 are selected as output lines by setting all the bits of PD3 register.

In a loop, the eight LEDs are sequentially switched from 1st LED to 8th LED and from 8th LED to 1st LED with a time interval.

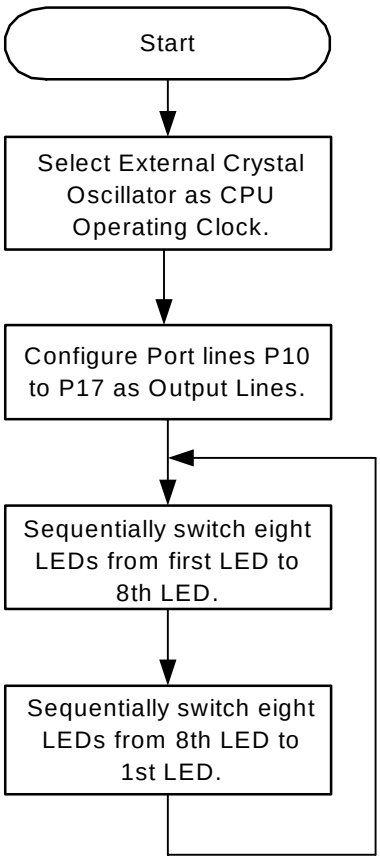
The files used in this module are listed below:

Files	*Description*
Demo1.C	Main file for this module, will select the external oscillator as the clock source for CPU and other peripherals. Eight LEDs are sequentially switches from 1st LED to 8th LED and from 8th LED to 1st LED with a periodic delay. .

The functions in the file **Demo1.C** and short descriptions are listed below:

Files	*Description*
Main	This is the main function of this module and will selects the external oscillator as clock source of CPU and other peripherals. After selecting the oscillator, eight LEDs are sequentially swicthed from 1st LED to 8th LED and from 8th LED to 1st LED with time delay. **Input**: None. **Output** : None.
ClockInitialization	Selects the external oscillator as clock source for the CPU and other peripherals. **Input**: None. **Output** : None.
InitializeIOPorts	Initializes the port lines P10 to P17 as output lines to drive LEDs. **Input**: None. **Output** : None.

Program Flow:



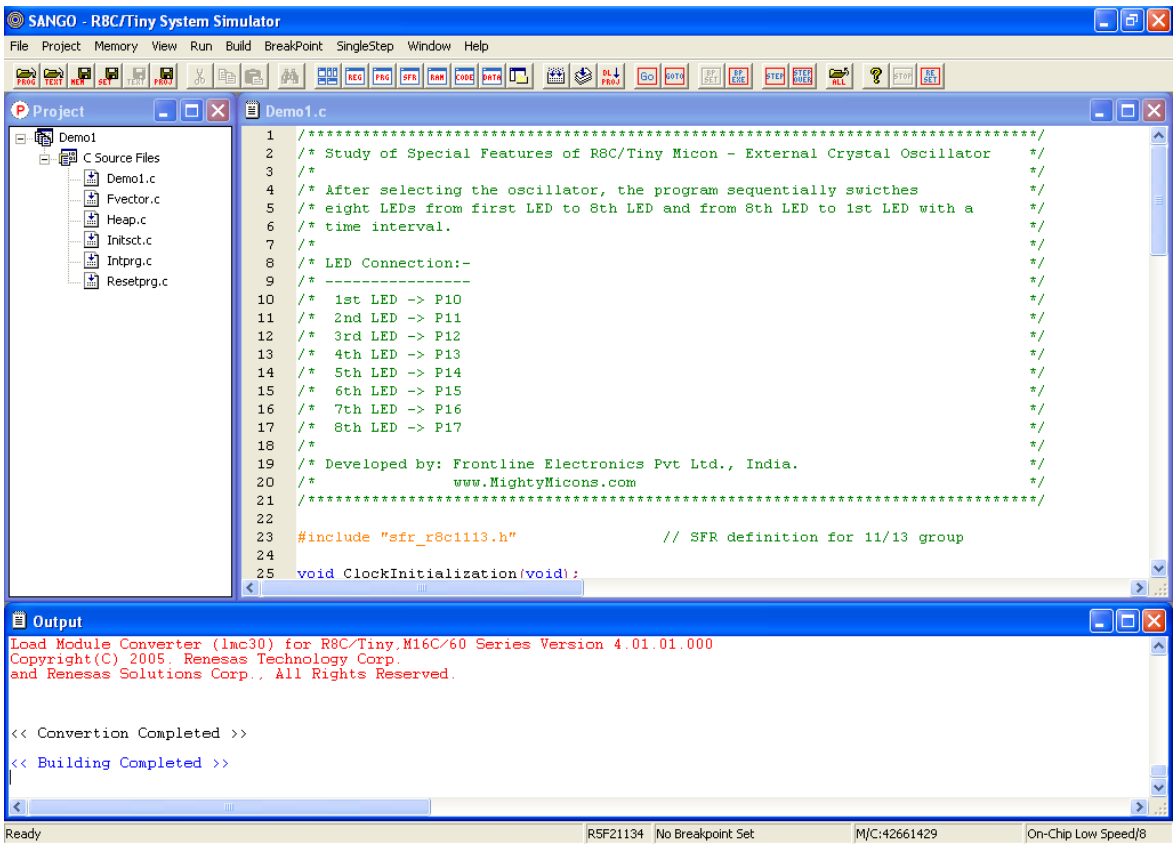
Execute Demo:

After selecting the external oscillator, the program will sequentially switch eight LEDs from first LED to 8th LED and from 8th LED to 1st LED with the time delay.

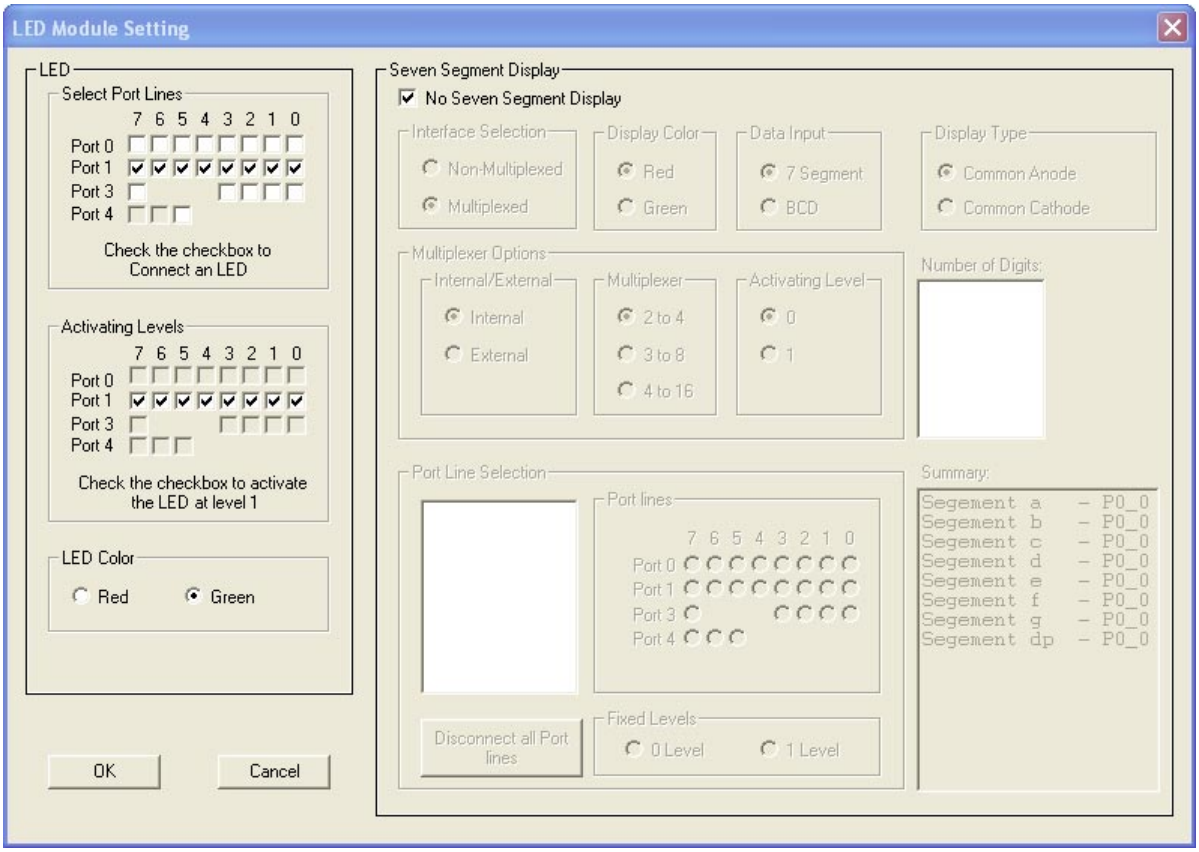
Use Topview Simulator to Verify the Design.

Open the project Demo1 in the R8C/Tiny System Simulator using **Open Project** option from **Project menu**. The project window opens up along with the Demo1.c file. Use **Build** option from **Build** menu to compile the project. An output window captures the compiler ouput.

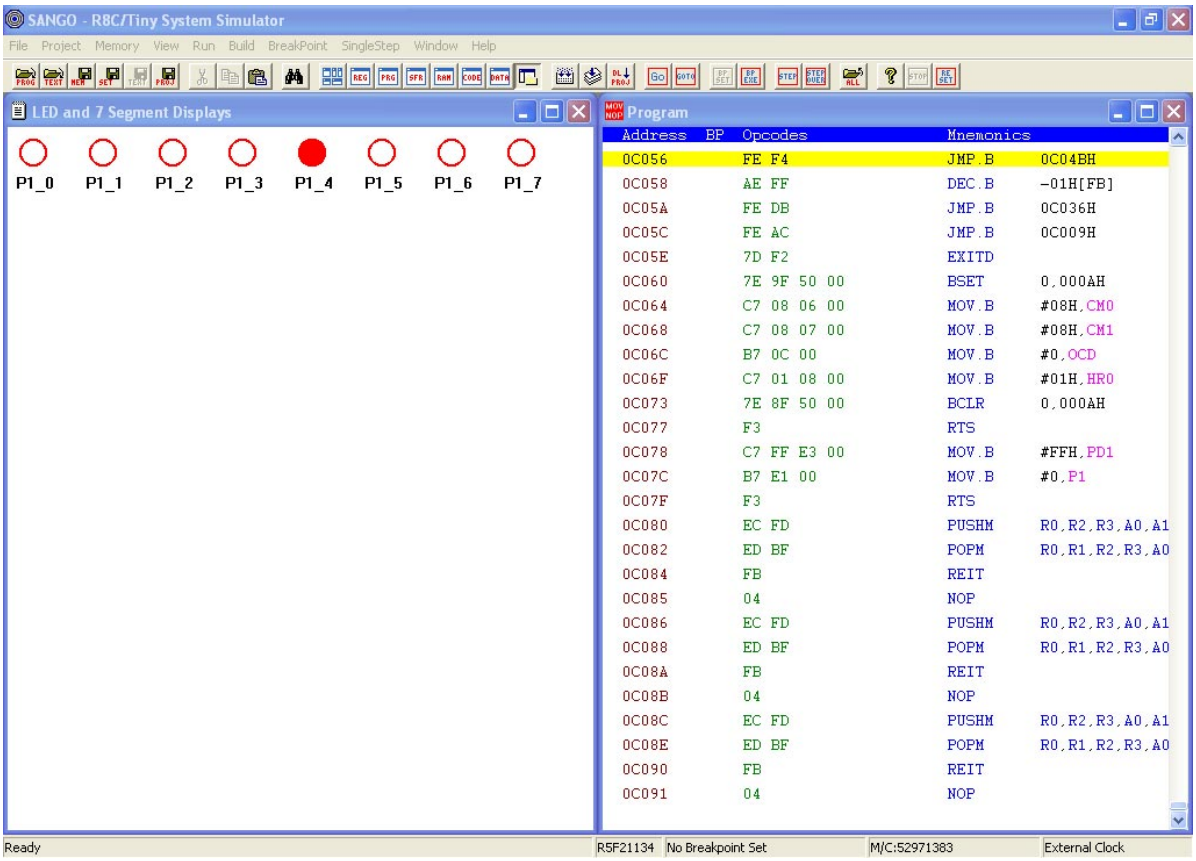
Use **Project** -> **Download Project** from main menu to download the Demo1.mot file into the simulator's memory for simulation.



Do the settings to the LED modules as shown. Connect LEDs to port lines P10 to P17 by checking the respective check boxes.



Then open the LED window as shown below.



Run the program using **Go** from the **Run** menu. The program will sequentially switch eight LEDs from first LED to 8th LED and from 8th LED to 1st LED with a time interval.