

Introduction:

This demo uses 2 line by 16 characters LCD to display the RTC data. The IIC Real Time Clock device PCF8583 is interfaced with R8C11/13 micon by two port lines with simulated IIC bus. The port line P45 is used to generate the required clock and P37 is used for reading data and sending command and address to the device.

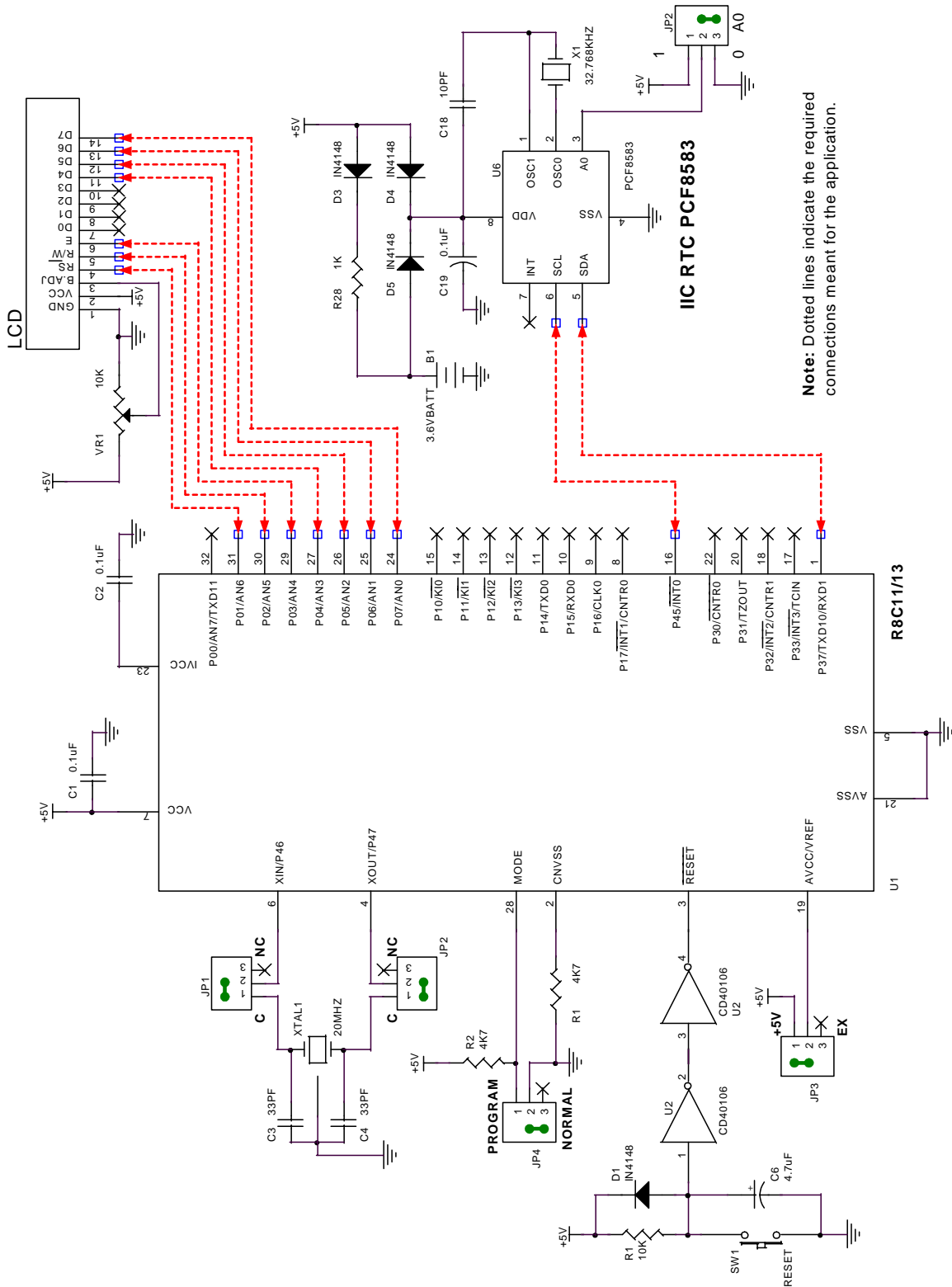
Demo Hardware:

The RTC device is interfaced with the R8C 11/13 micon using two port lines. Port line P45 is used to give clock signal to the RTC and port line P37 is used as data line. Battery backup is provided for the RTC to protect the internal data against power failure.

The LCD is interfaced with the R8C11/13 micon in 4 bit bus format and port lines P04 to P07 are used as data bus D4 to D7 and port lines P01, P02 and P03 are connected to RS, R/W and E control lines of LCD.

Demo 5 - Read and Display RTC on LCD - Simulated IIC Bus

Circuit Connection Using FE EADS:



Note: Dotted lines indicate the required connections meant for the application.

Connections:

1. Connect port line P45 to SCL line of IIC bus.
2. Connect the port line P37 to SDA line of IIC bus.
3. Connect port lines P04 to P07 to D4 to D7 line of LCD.
4. Connect port lines P01, P02 and P03 to RS, R/W and E lines of LCD.

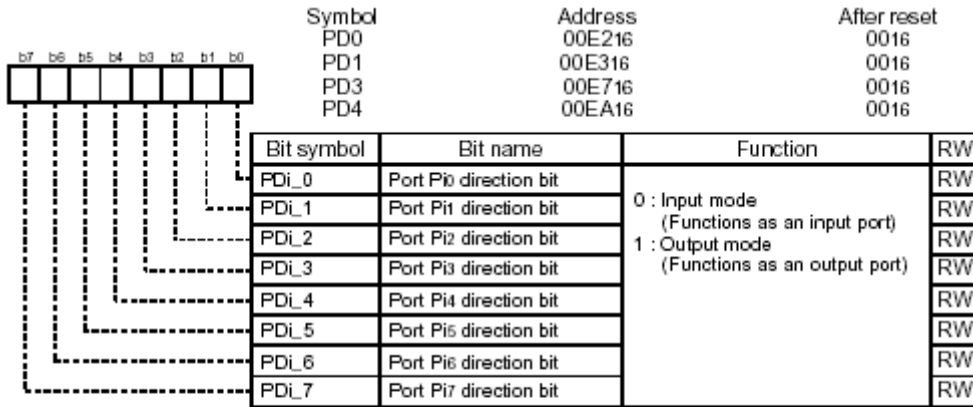
Functional Description:

In this module, the RTC data, hour, minutes and seconds values are read from RTC and displayed on a 2 line by 16 characters LCD.

Registers Used:

PD0 - Port 0 Direction Register
PD3 - Port 3 Direction Register
PD4 - Port 4 Direction Register

Port Direction Registers:



- Notes:
1. The PD0 register must be written to by the next instruction after setting the PRC2 bit in the PRCR register to "1" (write enabled).
 2. Nothing is assigned to the PD3_4 to PD3_6 bits in the PD3 register. When writing to the PD3_4 to PD3_6 bits, write "0" (input mode). When read, its content is indeterminate.
 3. Nothing is assigned to the PD4_0 to PD4_4, PD4_6 and PD4_7 bits in the PD4 register. When writing to the PD4_0 to PD4_4, PD4_6 and PD4_7 bits, write "0" (input mode). When read, its content is indeterminate.

Bit PD4_5 is set 1 to select port line P45 as output line. Bit PD3_7 is set 1 when sending command and address to RTC device and set to 0 when read a data from RTC. Port lines P01 to P07 are selected as output lines by moving H'FE data to PD0 register.

Software Description:

After the reset, the controller will initialize the LCD in 4 bit interface mode and clears the LCD. In a continuous loop, the RTC data, hour, minutes and seconds values are read from the locations H'04, H'03 and H'02 of RTC are displayed on LCD.

The routine "**ReadDisplayIICRTC**" will read the hour, minutes and seconds data from RTC and display the same on LCD. To read a byte from RTC "**ReadByteRTC**" routine is used.

Demo 5 - Read and Display RTC on LCD - Simulated IIC Bus

The files used in this module are listed below:

<i>Files</i>	<i>Description</i>
Demo5.C	Initializes Clock, IIC and LCD. Reads and displays the RTC on LCD.
R8C1113_FE_A14.C	Main file for this module, will read and display the timing data from RTC.
R8C1113_FE_SimIICRoutines.C	Basic routines to access the IIC bus such as Giving start bit, Stop bit, reading a byte serially, sending a byte serially etc.
R8C1113_FE_SimIICRoutines.H	Declarations of functions in R8C1113_FE_SimIICRoutines.c
R8C1113_FE_LCD_4Bit.C	LCD routines to initialize LCD, cursor on/off, display a message etc.
R8C1113_FE_LCD_4Bit.H	Declarations of functions in R8C1113_FE_LCD_4Bit.C

Demo 5 - Read and Display RTC on LCD - Simulated IIC Bus

The functions in the file **R8C1113_FE_A13.C** and short descriptions are listed below:

<i>Files</i>	<i>Description</i>
ReadDisplayIICRTC	Reads the Hour, Minutes and Seconds from RTC and displays on LCD in the 2nd line. Input: None Output : None.
InitializeReadDisplayIICRTC	Initializes the LCD in 4 bit mode, hides the cursor and displays a message on 1st line on LCD. Input: None Output : None.
ReadByteRTC	Reads a byte from RTC. Input: 8 bit Address Output : Contents of the given location.

Demo 5 - Read and Display RTC on LCD - Simulated IIC Bus

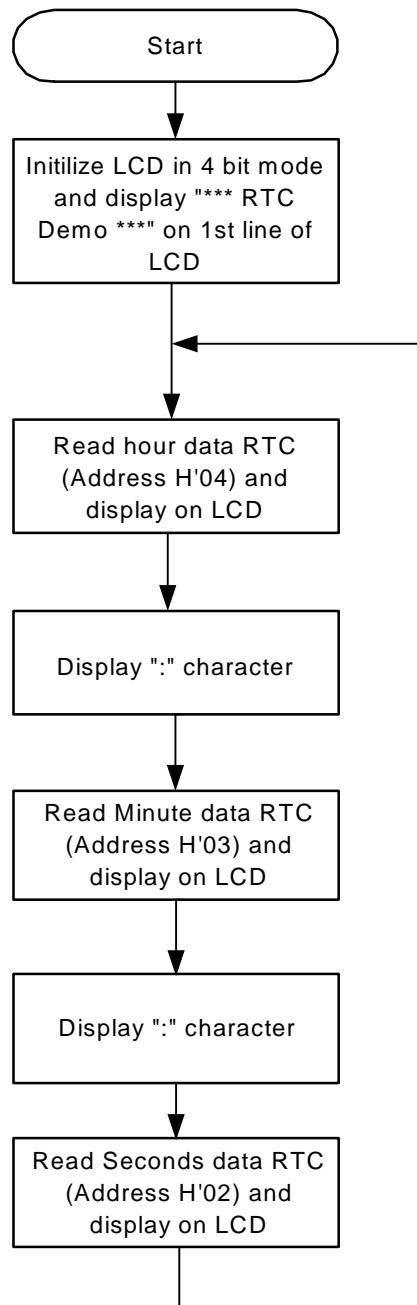
The functions in the file **R8C1113_FE_SimIICRoutines.C** and short descriptions are listed below:

<i>Files</i>	<i>Description</i>
PollAck	Sends the get acknowledge command and wait until slave acknowledges. This routine can be used to sense the completion of a write cycle. Input: None. Output : None.
SendOneByteIIC	Sends a byte (command or address) to the slave IIC device serially. Input: Data to be send. Output : None.
StartBit	Generates a start condition for IIC bus. Input: None. Output : None.
StopBit	Generates a stop condition for IIC bus. Input: None. Output : None.
SlaveAck	Gets acknowledge from the slave. Input: None. Output : None.
ReadOneByteIIC	Rends a byte from the slave IIC device serially. Input: Data to be send. Output : None.

The functions in the file **R8C1113_FE_LCD_4Bit.C** and short descriptions are listed below:

<i>Files</i>	<i>Description</i>
DisplayLCD	Displays a message (16 characters) on LCD at the given line. Input : Line number, Message. Output : None.
DisplayLCD2Digit	Displays a 2 digit given number at given location on LCD. Input : Line number, Character position and Data to be displayed. Output : None.
CursorON	Makes cursor visible on LCD. Input : None. Output : None.
CursorOFF	Hides the cursor on LCD. Input : None. Output : None.
InitializeLCD	Initializes the I/O lines used by LCD, LCD in 4 bit mode and clears LCD. Input : None. Output : None.

Program Flow:



Execute Application:

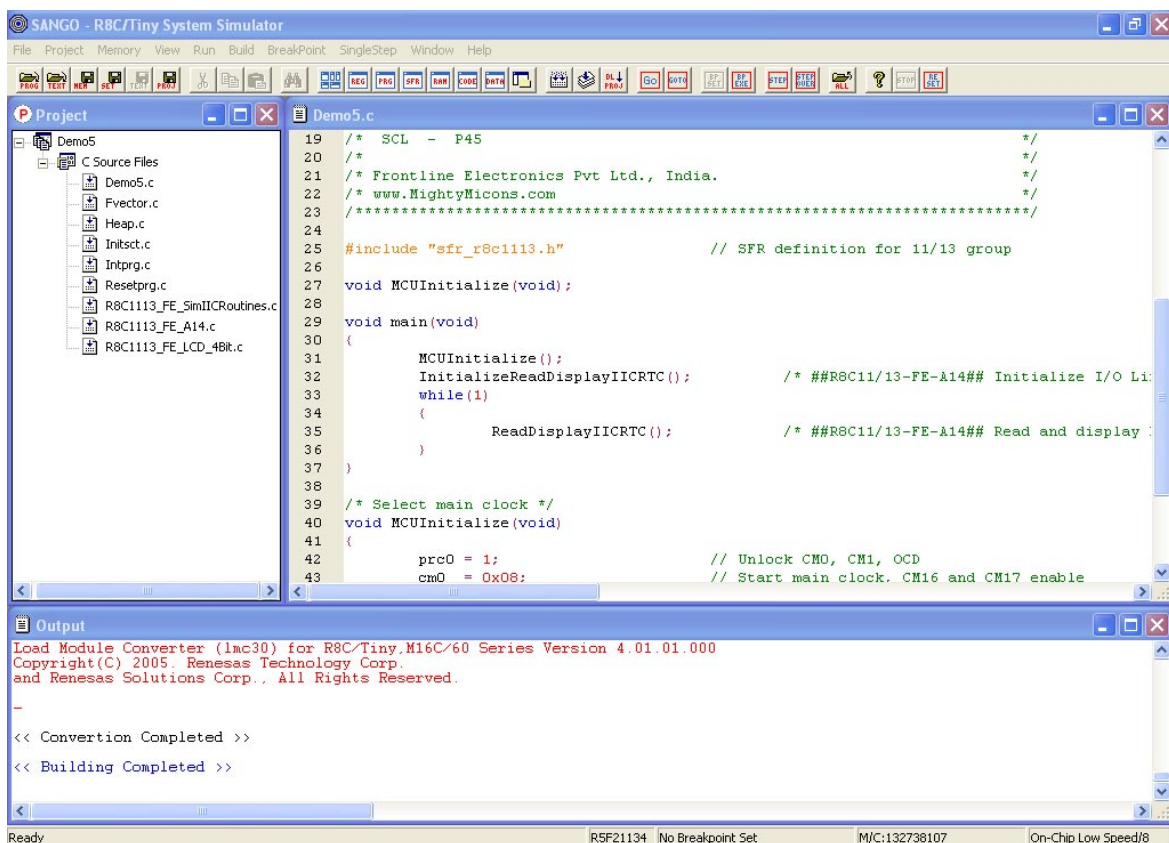
The hour, minutes and seconds data are read from RTC device and displayed on LCD as shown below:

```
*** RTC Demo ***  
12:23:50
```

Use Topview Simulator to Verify the Design.

Open the project Demo5 in the R8C/Tiny System Simulator using **Open Project** option from **Project** menu. The project window opens up along with the Demo5.c file. Use **Build** option from **Build** menu to compile the project. An output window captures the compiler output.

Use **Project -> Download Project** from main menu to download the Demo5.mot file into the simulator's memory for simulation.



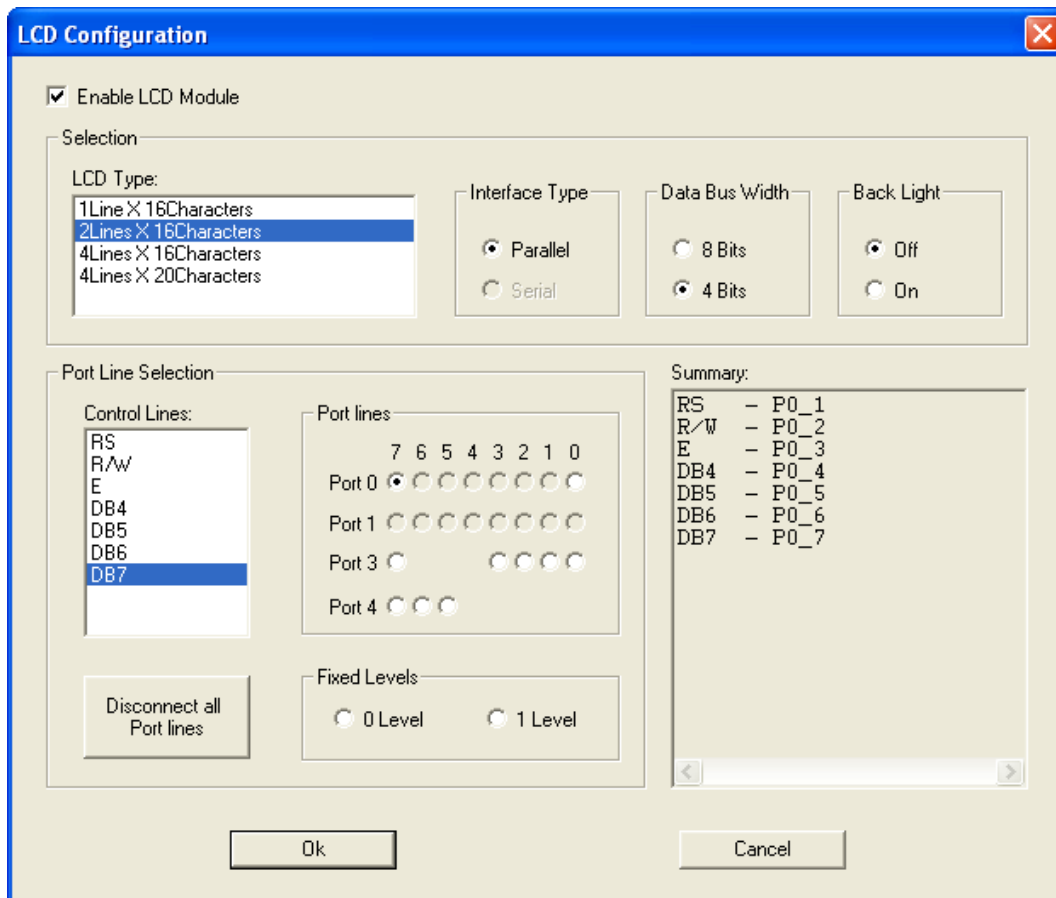
```
19 /* SCL - P45 */
20 /* */
21 /* Frontline Electronics Pvt Ltd., India. */
22 /* www.MightyMicons.com */
23 /*****/
24
25 #include "sfr_r8c1113.h" // SFR definition for 11/13 group
26
27 void MCUInitialize(void);
28
29 void main(void)
30 {
31     MCUInitialize();
32     InitializeReadDisplayIICRTC(); /* ##R8C11/13-FE-A14## Initialize I/O Li
33     while(1)
34     {
35         ReadDisplayIICRTC(); /* ##R8C11/13-FE-A14## Read and display
36     }
37 }
38
39 /* Select main clock */
40 void MCUInitialize(void)
41 {
42     prc0 = 1; // Unlock CMO, CM1, OCD
43     cm0 = 0x08; // Start main clock. CM16 and CM17 enable
```

Load Module Converter (lmc30) for R8C/Tiny.M16C/60 Series Version 4.01.01.000
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<< Conversion Completed >>
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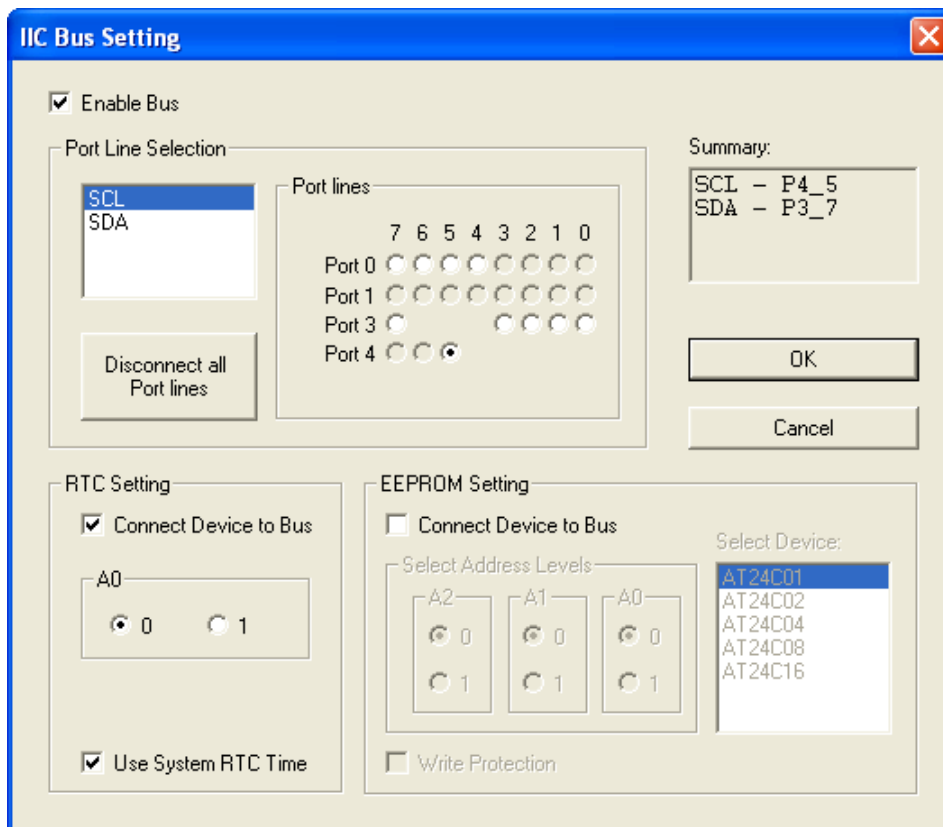
Demo 5 - Read and Display RTC on LCD - Simulated IIC Bus

Open the LCD Module settings window and do the settings to the LCD module as shown. Connect Data lines D4 to D7 of the display to the port lines P04 to P07. Connect the control lines RS, R/W and E to P01, P02 and P03 respectively.



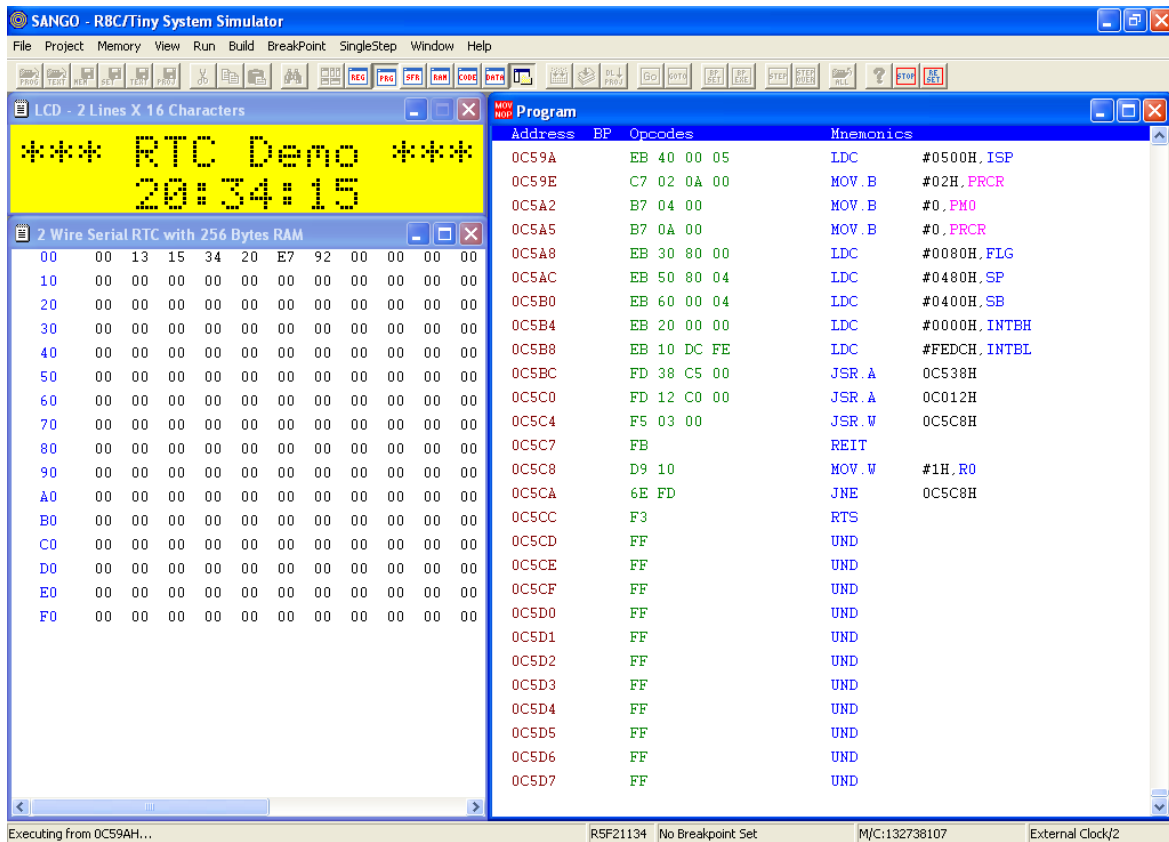
Demo 5 - Read and Display RTC on LCD - Simulated IIC Bus

Open the IIC module setting window and connect the SDA line to P37 and SCL line to P45. Connect the RTC to the bus.



Demo 5 - Read and Display RTC on LCD - Simulated IIC Bus

Then open the **LCD window**, **IIC window** and the **Program window**.



Run the program using **Go** from the **Run** menu. The program will read and display the real time clock in the LCD.