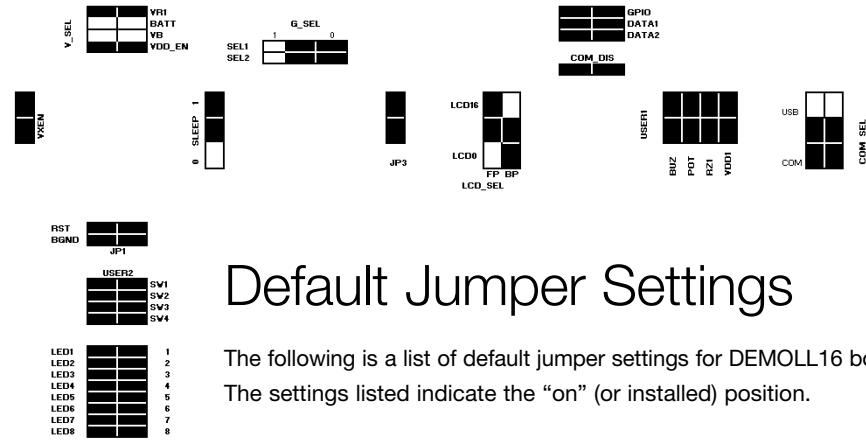




Ultra-Low-Power LCD Microcontrollers

DEMO9S08LL16

Lab tutorial



Default Jumper Settings

The following is a list of default jumper settings for DEMOLL16 board. The settings listed indicate the “on” (or installed) position.

Jumper	Installed Settings
V_SEL	VR1, VDD_EN
G_SEL	SEL1 (0)
G_SEL	SEL2 (0)
SLEEP	1
LCD_SEL	FP(LCD16)
LCD_SEL	BP(LCD0)
COM_SEL	COM
COM_SEL	COM
JP1	RST, BGND
JP2	Placed
JP3	GPIO, DATA1, DATA2
MCU_EN	Placed
USER1	BUZ, POT, RZ1, VDD1
USER2	SW1, SW2, SW3, SW4
USER3	LED1-LED8
COM_DIS	Placed
VX_EN	Placed

Learn More: For more information about Freescale products, please visit www.freescale.com/lcd

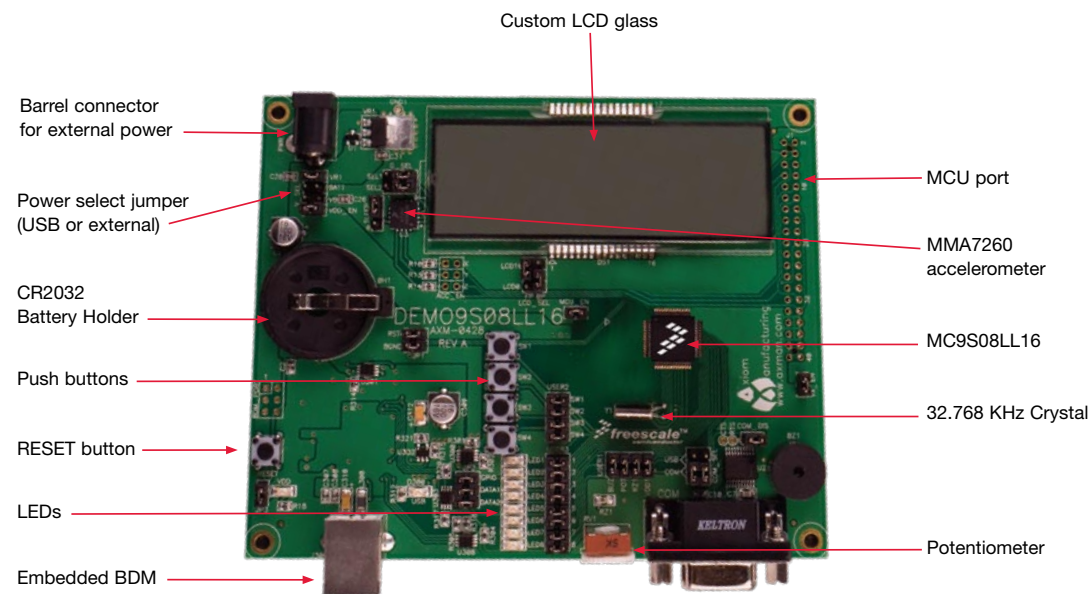


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Figure 1.
DEMO9S08LL16



MCU Port Connector Pin Out

The following is the pin out for the MCU port connector on the DEMOLL16 board.

Symbol	Number	Number	Symbol
VX	1	2	PTC7/IRQ/TCLK
VSS	3	4	PTB2/RESET
PTC1/TxD	5	6	PTC6/ACMP0/BKGD/MS
PTC0/RxD	7	8	PTA0/KBIP0/SS/ADP0
PTC4/TPM2CH0	9	10	PTA1/KBIP1/SPSCK/ADP1
PTC5/TPM2CH1	11	12	PTA2/KBIP2/MISO/SDA/ADP2
PTC2/TPM1CH0	13	14	PTA3/KBIP3/MOSI/SCL/ADP3
PTC3/TPM1CH1	15	16	NC
PTB5/MOSI/SCL	17	18	NC
PTB4/MISO/SDA	19	20	PTA6/KBIP6/ADP6/ACMP+
PTB6/SPSCK	21	22	PTA7/KBIP7/ADP7/ACMP-
PTB7/SS	23	24	NC
NC	25	26	NC
NC	27	28	NC
NC	29	30	PTA2/KBIP2/MISO/SDA/ADP2
NC	31	32	PTA3/KBIP3/MOSI/SCL/ADP3
NC	33	34	VSS
VDD	35	36	VSS
VSS	37	38	VDD
VLCD	39	40	VDD



DEMO9S08LL16 Lab

This lab document applies to DEMO9S08LL16.

Start each lab with the board powered ON. Make sure to use only one utility at a time, as they share the same USB source. Familiarize yourself with these buttons:



Start/Continue (F5) button



MCU Change Wizard button



Debug button

DEMO9S08LL16

LAB
1

Learn How to Use the DEMOLL16 Toolkit Utilities

This lab will show you how to use one of several graphical utilities in the DEMOLL16 Toolkit included with your board. Instructions to download these utilities to your computer are provided in Step 2 of the Quick Start Guide (DEMOS08LL16QSG.pdf). In this lab we will use the Logic Analyzer utility that was installed with the P&E embedded multilink toolkit. To perform this lab the Quick start application must be downloaded to the demo board as described in the Quick start guide. This PC-based utility graphs the DATA1 and DATA2 signals on the board. For convenience, if both DATAx jumpers are installed, DATA1 graphs PTC4 activity and DATA2 graphs PTC5 activity. To graph other microcontroller signals, use wire jumpers from DATA1 and DATA2 to the respective signals on the board's MCU PORT.

1. Press RESET and Make sure that the Quick Start Application is running. Refer To the quick start guide for information on running the quick start application.
2. Launch DEMOLL16 Logic Analyzer utility from the start menu (Programs > P&E Embedded Multilink Toolkit > Utilities > Logic Analyzer Utility).
3. In the utility, click on the "Connect to embedded Multilink analyzer and Graph Pins" button to begin graphing IN0 and IN1. These signals will be continually graphed at a sampling rate of 10 kHz.
4. Rotate the DEMOLL16 potentiometer RV1. This will change the duty cycle of the variable pulse width modulation signal output on the PTC4 and PTC5 pins.
5. Click on "Close Port" button when finished.

LAB
2

Features of the LCD Driver

This lab will demonstrate two main features of the embedded LCD driver for the MC9S08LL16, low-power operation and contrast control. This lab requires that a Digital multi-meter be used to measure the current at the MCU_EN header of the DEMOLL16. Connect a digital multimeter so that it is in series with the MCU_EN header.

1. Make sure that the Quick Start Application is running. Refer To the quick start guide for information on running the quick start application.

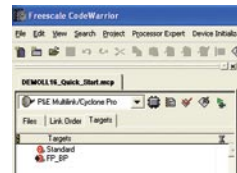
2. Press RESET to initialize the demonstration
3. After the Message has completed scrolling and the "LOGICANLY" is shown press SW2 to enter the Time display demo. (You should see time being updated on the LCD screen)
4. The time display demo operates in Stop3 mode until the TOD (Time of Day) second interrupt occurs. Every second the TOD interrupt causes the MCU to recover from stop mode to update the LCD screen. Note that the current measured when the MCU is in stop mode is around 5uA.
5. Use the POT on RZ1 to control the LCD contrast. The internally regulated voltage source for the LCD is changed based on the Potentiometer reading. Rotate the potentiometer all the way to the left to see the lowest contrast setting. Rotate the potentiometer all the way to the right to see the highest contrast setting. Note that higher contrast setting require slightly higher power consumption.



LAB
3

FP/BP Configurability

LCD glass is driven by Front plane and Back plane signals. The LL16 has the ability to configure any LCD pin to operate as a front plane or a back plane. This lab will demonstrate FP/BP configurability on the DEMOLL16.

1. Make sure that the Quick Start Application is running. Refer to the quick start guide for information on running the quick start application.
2. In the DEMOLL16_Quick_Start project window select the Targets tab and then left mouse click on the target symbol to select the FP_BP target.





3. Change the setting of the LCD_SEL jumpers so that LCD0 is connected to FP and LCD16 is connected to BP.
4.  Compile and program the MC9S08LL16 microcontroller with demo application by clicking on "Debug" button, launching Debugger.
5.  Click on the "Start/Continue (F5)" button in debugger to run application.
6. The demo application is now running with a different configuration for the FP and BP pins. Note the commented changes for the FP/BP software in the main_FP_BP.c file

LAB
4

MC9S08LL16 Accelerometer Demo

This lab will highlight the performance capability of the MC9S08LL16 microcontroller and show how this microcontroller can easily interface with a sensor. This lab will also detail how to use another one of several software utilities included with your board to help you in your development. Instructions to download these utilities to your computer were provided in Step 2 of the Quick Start Guide. The accelerometer application reads the X, Y and Z axes of the 3-axis accelerometer on the DEMOLL16 board using the microcontroller's A/D converter. After any reset, it outputs the raw values of the accelerometer data on the microcontroller's serial communication interface. Pressing the SW1 switch outputs a rolling average of the raw accelerometer data, and pressing the SW2 switch outputs a filtered version of the raw accelerometer data.

1. Open CodeWarrior for Microcontrollers. From Windows start menu, you can locate it using the "Programs > Freescale CodeWarrior > CW for Microcontroller V6.x > CodeWarrior IDE.exe" path.
2. Click on File->Open and open the DEMO9S08LL16_Accelerometer.mcp file that is found in the DEMOLL_Toolkit\DEMOLL_Software_Examples\DEMOLL16_Accelerometer directory.
3.  Compile and program the MC9S08LL16 microcontroller with demo application by clicking on "Debug" button, launching Debugger.
4. From Connection Manager menu, select " DEMOLL16 on USB1" port and click on "Connect (Reset)."
5. From Erase and Program Flash menu, click on "Yes" to allow the debugger to mass erase the microcontroller's on-chip flash memory and program it with the new application.
6.  Click on the "Start/Continue (F5)" button in debugger to run application. Close the true time simulator window.
7. Launch Serial Grapher utility from the start menu (Programs > P&E Embedded Multilink Toolkit > Utilities > Serial Grapher Utility).
8. Set port to USB COM.
9. Set baud rate to 19200.
10. Move the COM_SEL jumpers from COM to USB and remove USER1 RZ1. All other board jumpers should all be set to the default settings.

11. Bring Accelerometer Demo utility to front and click the "Open Serial Port and Start Demo" button.
12. Move board around to demonstrate 3-axis accelerometer. NOTE: If the serial graphing utility does not show the accelerometer data remove and replace the VDD_EN jumper to cycle power on the Accelerometer device.
13. Observe output of raw data in Accelerometer Demo utility. The data is displayed in hexadecimal format in the Terminal Window and in graphical form in the bar graph and Scope windows. The fourth value is the number of bus cycles for the CPU to process the data.
14. Click button labeled "SW1" on board to enable data filtering move board.
15. Click button labeled "SW2" on board to enable data averaging move board.
16. Click on "Close Port" button and close Terminal Utility when finished.