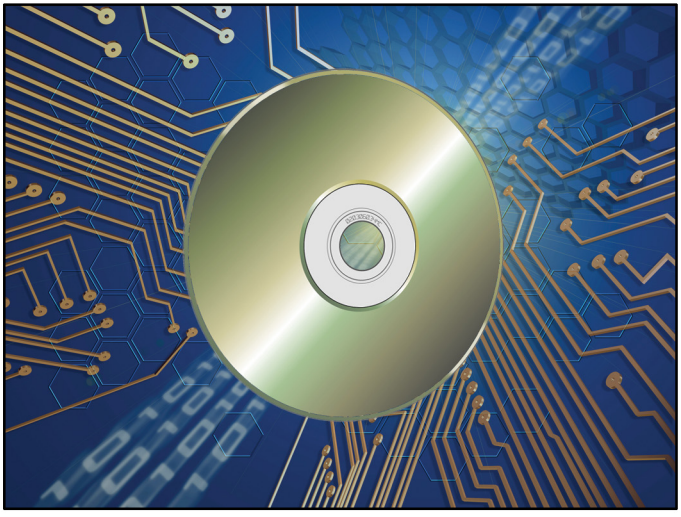
DEMO9S08QB8 User Manual



DEMO9S08QB8UM
Rev. 1.03
September 2009

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Manual version 1.03

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1 INTRODUCTION

1.1 Overview

The DEMO9S08QB8 is a low-cost development system designed for demonstrating, evaluating, and debugging the Freescale MC9S08QB8 microcontroller. P&E's Embedded Multilink circuitry on the DEMO9S08QB8 board allows the processor on the DEMO9S08QB8 to be debugged and programmed via USB from the PC. In addition, the demo board can be powered using the USB bus.

Note: Freescale has an older device called 908QB8. 908QB8 is different from this new 9S08QB8 device. When searching for "QB8" online resources, make sure that the resources pertain to the 9S08QB8 device and NOT the 908QB8 device.

1.2 Package Contents

The DEMO9S08QB8 package includes the following items:

- DEMOQE Base Board with a MC9S08QB8 Daughter Card installed
- 2-cell AAA battery package
- USB Cable
- Quick Start Guide
- Freescale Warranty Card

1.3 Supported Devices

The DEMO9S08QB8 supports the MC9S08QB8CWL device.

1.4 Recommended Materials On DEMO9S08QB8 Resources CD

- DEMO9S08QB8 Embedded Multilink hardware interface driver

- DEMO9S08QB8 User Manual (this document)
- DEMO9S08QB8 Quick Start Guide
- DEMO9S08QB8 Quick Start Application Source Code
- DEMO9S08QB8 Base Board and Daughter Cards Schematics
- DEMO9S08QB8 Component Breakdown List
- DEMOQE Toolkit Applications
- Links to P&E Evaluation Software
- Links to Freescale documentation, P&E Discussion Forums, and DEMO9S08QB8 FAQs.

1.5 Handling Precautions

Take care to handle the package contents, including the DEMOQE base board and MC9S08QB8 daughter card, in a manner such as to prevent electrostatic discharge.

2 HARDWARE FEATURES

The DEMO9S08QB8 is a demonstration and development system for Freescale's MC9S08QB8 microcontroller. Application development is quick and easy using P&E's Embedded Multilink circuitry and the included software tools and examples. An optional BDM port is provided to allow use of an external BDM interface such as P&E's Cyclone PRO automated programmer or USB Multilink. The USB Multilink is functionally comparable to the DEMO9S08QB8's Embedded Multilink circuitry.

Note: The DEMO board's onboard Embedded Multilink circuitry is intended to function with the onboard processor and any daughter cards that may be included. It cannot be used to communicate with other devices.

2.1 DEMOQE Base Board Features

- On-board Logic Analyzer
- On-board Virtual Serial Port
- Asymmetrically positioned 4 8x2 male connectors for interchangeable daughter cards

- P&E's Embedded Multilink circuitry populated on the bottom
- RS-232 Serial Port w/ DB9-F Connector
- SCI signals connected to P&E's Embedded Multilink through jumpers
- ON/OFF Power Switch w/ LED indicator
- A 5VDC to 8VDC power supply input barrel connector

Note: The DEMOQE board power connector is incorrectly labelled as 5-12VDC. The maximum voltage is 8VDC.

- Power Input Selection Jumpers for selecting the input voltage source:
  - Power Input from Embedded Multilink to LDO regulator
  - Power Input from DC Power Jack to LDO regulator
  - Regulated VDD Output at 3.0V
  - Regulated VDD Output at 2.1V
  - Power Input from Battery
  - Power Input from MCU_PORT connector
- RESET Push Button and LED indicator w/ Enable
- Optional External Crystal Circuitry Layout (not populated)
- User Features:
  - 3-axis Accelerometer w/Enable
  - 8 User LED's w/ Enable
  - 4 User Push Buttons w/ Enable
  - 1 Piezzo Buzzer w/ Enable
  - IIC Pullups w/ Enable
  - 10K Ohm POT w/ Enable
- Option Jumpers:
  - COM_EN for 1.8V to 4.25V RS232 Transceiver
  - TXD_EN for SCI_TXD to Embedded Multilink
  - RXD_EN for SCI_RXD to Embedded Multilink
  - INPUT_EN for two input channels to Embedded Multilink

- Specifications:
  - Board Size 3.5 x 4.0
  - Power Input:
    - USB Cable: 5VDC, 500mA max
    - DC Power Jack: 2.5/5.5mm barrel connector, 5VDC to 8VDC Center Positive

Note: The DEMOQE board power connector is incorrectly labelled as 5-12VDC. The maximum voltage is 8VDC.

  - Two AAA Battery Cells

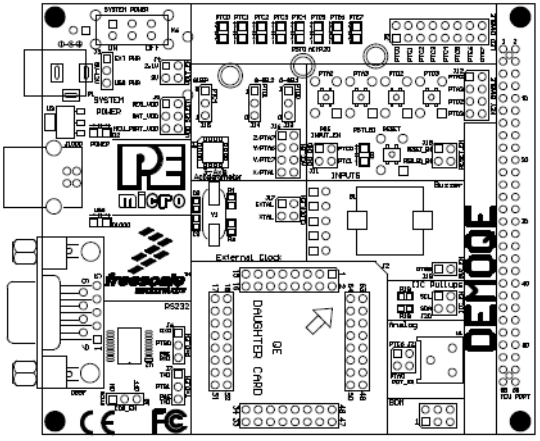


Figure 2-1: DEMOQE Top Component Placement

2.2 On-Board Logic Analyzer

The DEMOQE board has a built-in 2-channel logic analyzer which may be used to display captured data in real-time on a host PC. The logic analyzer channels (IN0/IN1) are connected to the PTC0 and PTC1 signals on the DEMOQE board by default via the J11 jumpers. The channels may be connected to any of the processor pins by wire jumpers (not included).

The DEMOQE Logic Analyzer Utility, included in the DEMOQE Toolkit on the accompanying DVD-ROM, displays the logic analyzer signals on a PC.

2.3 On-Board Virtual Serial Port

The DEMOQE board has a built-in virtual serial port which may be connected to the QE processor's SCI RXD/TXD. This allows certain PC applications to be able to connect in a serial fashion to the microcontroller without the actual use of serial port hardware.

The DEMOQE Terminal Window Utility, included in the DEMOQE Toolkit on the accompanying DVD-ROM, is a generic serial port utility which works with the DEMOQE virtual serial port or actual serial port hardware.

2.4 DEMOQE Daughter Card Features

- Four bottom-mounted asymmetrically positioned 8x2 female connectors to mate with the DEMOQE Base Board
- A top-mounted MC9S08QB8CWL chip

2.5 DC9S08QB8 Specific Connections

The labels on the DEMOQE do not necessarily represent actual pin port function from the MC9S08QB8 microcontroller. In order to take full advantage of the DEMOQE Base Board resources, MC9S08QB8 signals are mapped to the DEMOQE Base Board 64-Pin Header as following:

SIGNALS OF QB8	SIGNALS OF DEMOQE BOARD
PTA0-3	PTA0-3
PTA4/BKGD	PTA4/BKGD
PTA5/RESET	PTA5/RESET
PTA6	PTD2/KEY
PTA7	PTD3/KEY
PTB0-1	PTB0-1
PTB2/ADP	PTA6/ADP
PTB3/ADP	PTA7/ADP

SIGNALS OF QB8	SIGNALS OF DEMOQE BOARD
PTB4-5	PTB4-5
PTB6/XTAL	PTB6/XTAL
PTB7/EXTAL	PTB7/EXTAL
PTC0-5	PTC0-5
PTC6	PTE6/LED
PTC7	PTE7/LED

2.6 Signal Mapping of DC9S08QB8 to MCU_PORT

Signal Mapping

MCU PORT NUMBER	MC9S08QB8 PIN SIGNAL	MCU PORT NUMBER	MC9S08QB8 PIN SIGNAL
1	VDD	2	PTA5/IRQ/TCLK/ ~RESET
3	VSS	4	PTA5/IRQ/TCLK/ ~RESET
5	PTB1/KBIP5/TxD/ ADP5	6	PTA4/ACMPO/BKGD/ MS
7	PTB0/KBIP4/RxD/ ADP4	8	PTC7
9	PTA2/KBIP2/ADP2	10	VREFH
11	PTA3/KBIP3/ADP3	12	VREFL
13	PTC0	14	PTA0/KBIP0/ TPMCH0/ADP0/ ACMP+

Signal Mapping

MCU PORT NUMBER	MC9S08QB8 PIN SIGNAL	MCU PORT NUMBER	MC9S08QB8 PIN SIGNAL
15	PTC1	16	PTA1/KBIP1/ADP1/ ACMP-
17	NC	18	NC
19	PTB4	20	NC
21	NC	22	PTB2/KBIP6/ADP6
23	PTB5/TPMCH0	24	PTB3/KBIP7/ADP7
25	NC	26	NC
27	PTA6	28	NC
29	NC	30	NC
31	PTA7	32	NC
33	PTC2	34	NC
35	PTC3	36	NC
37	PTC4	38	NC
39	PTC5	40	NC
41	NC	42	PTB7/EXTAL
43	NC	44	PTB6/EXTAL
45	NC	46	NC
47	NC	48	NC
49	NC	50	NC
51	NC	52	NC

Signal Mapping

MCU PORT NUMBER	MC9S08QB8 PIN SIGNAL	MCU PORT NUMBER	MC9S08QB8 PIN SIGNAL
53	NC	54	PTC6
55	NC	56	NC

3 SYSTEM SETUP

3.1 Overview

P&E's Embedded Multilink driver is required to operate the DEMO9S08QB8 using a PC. The Embedded Multilink driver should be installed with the CodeWarrior Development Studio software or from the DEMOQE Resources in the DVD-ROM before the PC is connected to the DEMO9S08QB8.

3.2 Operating System Requirements

The following are the resources required to run the CodeWarrior Development Studio and the DEMO9S08QB8:

- A PC-compatible system running Windows 2000, Windows XP, or Windows Vista
- 128MB of available system RAM, and 1GB of available hard disk space
- A DVD-ROM drive for software installation
- A USB port

3.3 Software Setup

3.3.1 Installing CodeWarrior Development Studio

To install the CodeWarrior Development Studio, insert the CodeWarrior CD into your computer's DVD-ROM drive. A start-up window will automatically appear. Select CodeWarrior Installation and follow the on-screen instructions.

Note: After installation of CodeWarrior 6.2, it is also required that you install the S08QB8 service pack.

3.3.2 Installing P&E Resources

Use the DEMOQE Resources DVD-ROM to access and install P&E resources for the DEMO9S08QB8. These materials are not required for operation. The support materials contained on the DEMOQE Resources DVD-ROM are listed in **Section 1.4 - Recommended Materials On DEMO9S08QB8 Resources CD**.

3.4 Quick Startup

Only a few steps are required to get the DEMO9S08QB8 up and running:

Step 1. Make sure that both CodeWarrior Development Studio v.6.2 and the S08QB8 service pack are installed on your PC. Additional information regarding CodeWarrior can be found at www.freescale.com.

Step 2. Remove the DEMO9S08QB8 demonstration board from its anti-static pouch. The green MC9S08QB8 daughter card should be plugged into the header on the base board.

Step 3. Connect the USB cable from your computer to the DEMO9S08QB8 demonstration board. Depending on your operating system, you may need to follow steps to install the USB driver from the DEMOQE Resources DVD-ROM. Once the USB cable is connected properly the green USB LED on the DEMO9S08QB8 should illuminate.

Step 4. Turn on the DEMO9S08QB8 power switch (K6). The red Power LED should illuminate.

Step 5. First press the button labeled “PTA2.” The buzzer will sound and PTC0 will output a fixed 75% duty cycle pulse width modulation (PWM) signal. LEDs PTC0 to PTC2 remain on.

Press the PTA2 button a second time. the buzzer will sound again and the PTC0 PWM duty cycle will change to 25%. LEDs PTC0, PTC1,and PTC3 are illuminated.

Press the PTA2 button a third time, and then rotate the potentiometer. The light intensity of LED PTC0 and the tone of the

buzzer will vary as you rotate.

Pressing the PTA2 button a fourth time or pressing the PTA3 button at any time will turn off the buzzer sound and all the LEDs.

Step 6. Optionally, you may run the DEMOQE Logic Analyzer Application available in the DEMOQE toolkit on the CD. This PC-based application graphs the IN0 and IN1 signals on the DEMOQE board. If both J11 jumpers are installed, IN0 shows PTC0 and IN1 shows PTC1. Push button PTA2 three times after reset and turn the potentiometer to change these signals. This application may also be found at:

http://www.pemicro.com/fixedlinks/demoQEtoolkit.html.

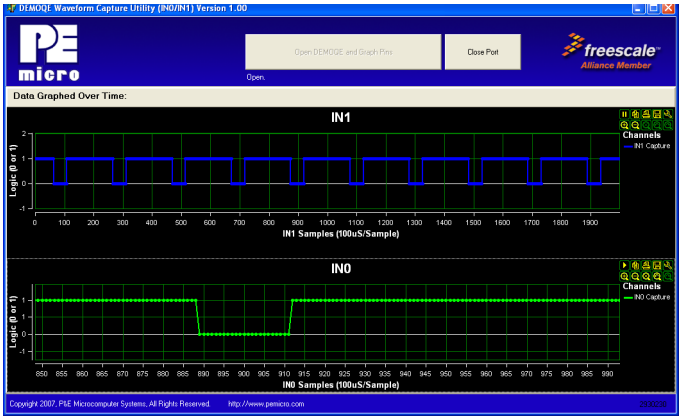


Figure 3-1: DEMOQE Logic Analyzer Application

3.5 Hardware Setup

3.5.1 First-Time Connection

The DEMO9S08QB8 may be connected to a PC through a USB port. Connection steps are listed below in typical order:

1. Install the required software, as described in the previous section.
2. Make sure the jumpers for USB_PWR, 3V for VOLT_EN, and REG_VDD for VDD_SELECT are installed.
3. Plug the USB cable A-M connector into a free USB port of the PC.

4. Plug the USB cable B-M connector into the USB connector on the DEMOQE Base Board.
5. The operating system will recognize P&E's Embedded Multilink circuitry and P&E's USB to Serial circuitry. Depending on the operating system, you may see the "Found New Hardware Wizard" dialog, helping you to install software for "PEMicro USB Multilink (i0). On Windows XP (SP2), the following dialog will appear:



Figure 3-2: Found New Hardware Wizard Dialog (1 of 4)

Select the "Install the software automatically (Recommended)" option and click the "Next" button.

6. Windows will install the driver files to your system. At the end of the installation, the following dialog box will appear:

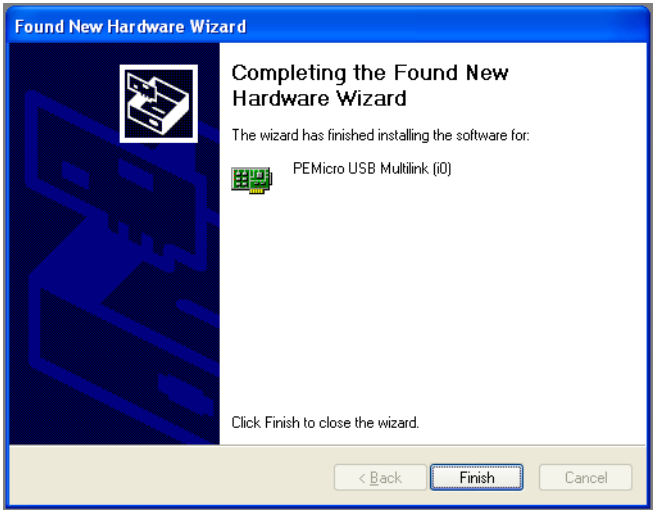


Figure 3-3: Found New Hardware Wizard Dialog (2 of 4)

Click the “Finish” button to exit the current “Found New Hardware Wizard”.

7. Depending on the operating system, you may see the “Found New Hardware Wizard” dialog again, helping you to install software for “PEMicro USB Serial Port (i1). On Windows XP (SP2), the following dialog will appear:

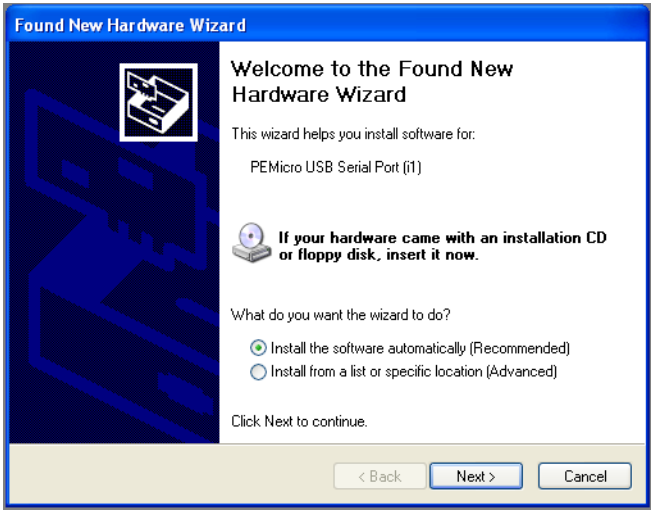


Figure 3-4: Found New Hardware Wizard Dialog (3 of 4)

Select the “Install the software automatically (Recommended)” option and click the “Next” button.

8. Windows will install the driver files to your system. At the end of the installation, the following dialog box will appear:

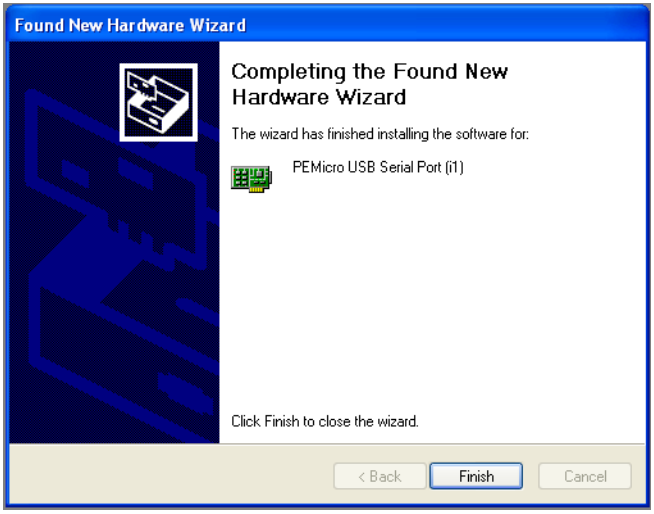


Figure 3-5: Found New Hardware Wizard Dialog (4 of 4)

Click the “Finish” button to exit the “Found New Hardware Wizard”.

If the DEMO9S08QB8 hardware interface driver is now properly installed on your system, the green USB LED on the DEMOQE Base Board should be illuminated. In addition, if you turn on the system power of the DEMO9S08QB8 you will see the red Power LED illuminate.

4 OPERATING MODES

4.1 Overview

The DEMO9S08QB8’s Embedded Multilink circuitry, featured hardware components, and optional external BDM header make it a versatile development tool. Below are some of the featured operating modes of the DEMO9S08QB8.

4.2 Debug Mode

A host communicates with the DEMO9S08QB8 through the Embedded Multilink circuitry. Either the CodeWarrior Development Studio or P&E’s HCS08 software tools will work with the DEMO9S08QB8. Please refer to

Section 8 - DEMO9S08QB8 CODE DEVELOPMENT SOFTWARE for more information.

4.3 Run Mode

The DEMO9S08QB8's rich component list empowers it to perform a variety of tasks. Once an application is developed, debugged, and programmed properly into the QB8 internal flash memory, it can run with or without connecting to a host.

4.4 External BDM Mode

The DEMO9S08QB8 has an optional BDM header for debugging and programming the on-board QB8 device using an external BDM hardware tool, such as P&E's USB Multilink or Cyclone PRO. Please refer to **Section 9 - TRANSITIONING TO YOUR OWN TARGET** for more information. A user can take advantage of this mode to develop a target-specific QB8 system and compare it with the DEMO9S08QB8 when necessary.

5 DEMOQE TOOLKIT PC APPLICATIONS

P&E provides several Windows PC-based applications which work with the DEMO9S08QB8 board. These applications are collectively referred to as the DEMOQE Toolkit. The following applications are included in the toolkit:

5.1 DEMOQE Logic Analyzer Application

The DEMOQE board has a built-in two-channel logic analyzer. This analyzer allows the IN0 and IN1 signals to be captured by the PC and displayed for the user. The IN0 and IN1 signals may be connected to any of the MCU signals which the user would like to view. By default, they are connected to the PTC0 and PTC1 pins of the MCU by jumper J11. At the time of this release, the logic analyzer runs at a capture rate of 10khz.

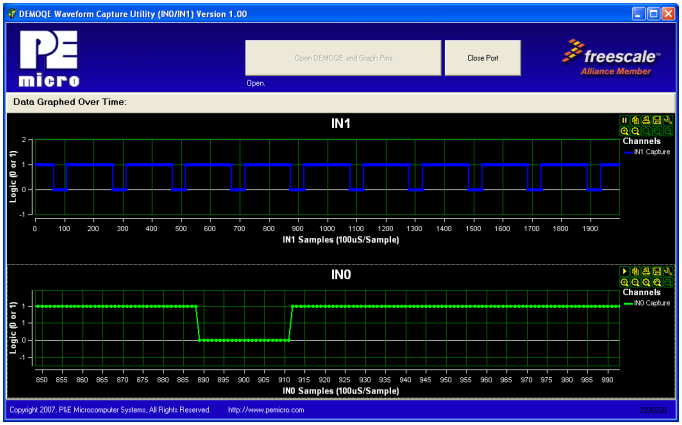


Figure 5-1: Logic Analyzer Application

This PC-based application is used to display the logic analyzer data on the PC. The logic analyzer data is displayed in real-time and each waveform may be paused, zoomed, and printed.

If the microcontroller-based Quick Start Application is programmed into the MCU, the IN0 channel will show the emulated PTC0 signal to have the same output as the PWM signal at port PTB5 (driving the Buzzer). The IN1 channel will show the PWM period waveform on channel PTC1.

Step 1. Press the button labeled “PTA2.” The PTC0 pin will output a fixed 75% duty cycle pulse width modulation (PWM) signal. The Buzzer sound is also turned on.

Step 2. Press the PTA2 button a second time. The PTC0 PWM duty cycle will change to 25%. The Buzzer remains on.

Step 3. Press the PTA2 button a third time. The duty cycle is controlled by the potentiometer (W1). The illumination of LED PTC0 and the tone of the Buzzer will vary as you rotate the potentiometer.

Step 4. Press PTA2 a fourth time, or press button PTA3 at any time, to turn off the Buzzer and all LEDs.

This PC-based application is included on the DVD-ROM that accompanies the DEMOQE, and may also be found at:

http://www.pemicro.com/fixedlinks/demoQEtoolkit.html.

5.2 DEMOQE Terminal Application

This PC-based application acts as a standard serial port terminal application on the PC. It works with standard serial ports as well as the virtual serial port on the DEMOQE board. The application includes settings to adjust the COM port number, baud rate, parity, and number of data bits. There is a button to take a file on the PC and transmit it out of the serial port. There are also delays which are automatically inserted in the transmission output to prevent overruns. It is recommended that these defaults not be changed.

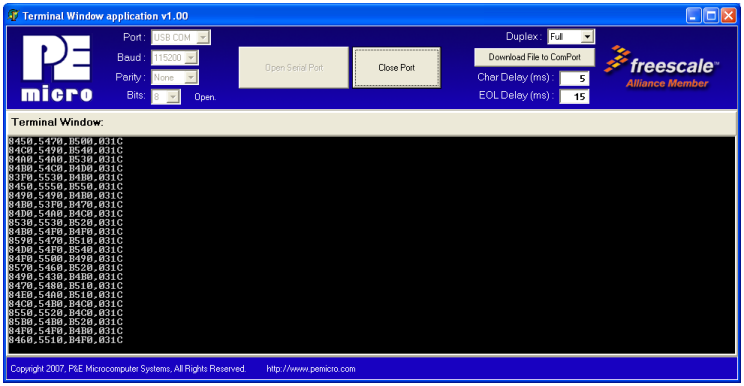


Figure 5-2: DEMOQE Terminal Application

The terminal window may be set for full duplex or half duplex. In full duplex mode, only received characters are displayed in the terminal window. In half duplex mode, both transmitted and received characters are displayed.

This PC-based application is included on the DVD-ROM that accompanies the DEMOQE, and may also be found at:

http://www.pemicro.com/fixedlinks/demoQEtoolkit.html.

5.3 DEMOQE Unsecure Application

This application allows secure HCS08 microcontrollers to be unsecured. The Unsecure application will erase a secure device to make it unsecure. This application works with the DEMOQE board as well as other user hardware connected to the PC via the USB Multilink or Cyclone PRO hardware interfaces.

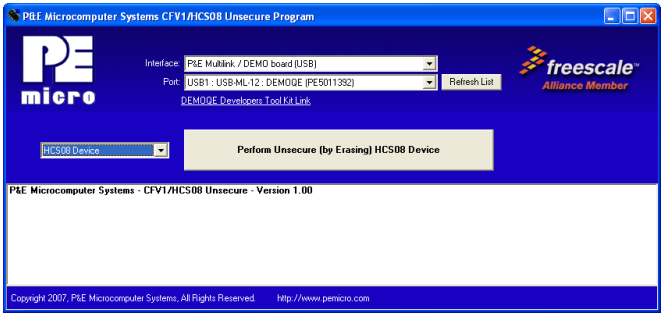


Figure 5-3: DEMOQE Unsecure Application

This PC-based application is included on the DVD-ROM that accompanies the DEMOQE, and may also be found at:

http://www.pemicro.com/fixedlinks/demoQEtoolkit.html.

5.4 DEMOQE Accelerometer Demo Application

This PC-based application will graph serial data output from the microcontroller-based serial accelerometer application documented in **Section 6.2 - Serial Accelerometer Application**. The graphed data includes the magnitude of the X, Y, and Z accelerometer signals, as well as the current processor loading. For this application to work properly, the *microcontroller-based* serial accelerometer application must be programmed into the microcontroller which is plugged into the DEMOQE board.

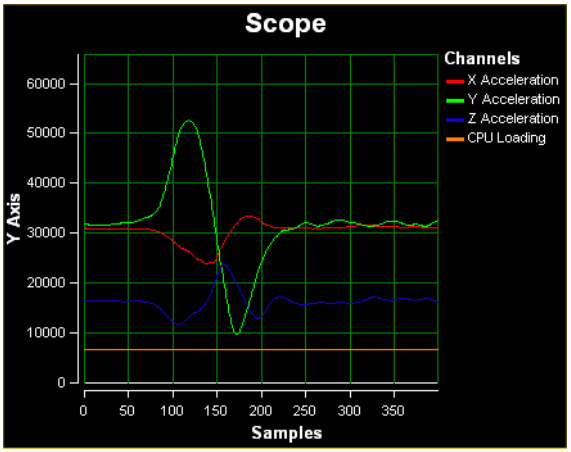


Figure 5-4: Accelererometer Demo Application

The data that is graphed may come from either the PC serial port or the virtual serial port on the DEMOQE board. The serial port of the microcontroller on the DEMOQE board is routed to either serial port hardware or the virtual COM port based upon the setting of jumpers J6 and J7.

This PC-based application is included on the DVD-ROM that accompanies the DEMOQE, and may also be found at:

http://www.pemicro.com/fixedlinks/demoQEtoolkit.html.

5.5 DEMOQE Serial Grapher Application

This PC-based application is a more generalized version of the accelerometer demo application. It may be used with the microcontroller based serial accelerometer application or customer microcontroller code which transmits data in the correct format. The serial graphing utility allows incoming data on the PC serial port, or one of P&E's virtual serial ports, to be automatically graphed in time or displayed upon a series of bar graphs. The virtual serial port exists on several of P&E's embedded USB multilink designs including the DEMOQE board.

This PC-based application is included on the DVD-ROM that accompanies the DEMOQE and may also be found at:

http://www.pemicro.com/fixedlinks/demoQEtoolkit.html.

All data to be displayed must be in hexadecimal format. The data can be accepted and displayed either as incoming byte values ($00-$FF) or word values ($0000-$FFFF). The data format indicates whether the data is byte or word data. The graphical components automatically size their range depending upon the incoming data.

5.5.1 Visual Components

The Bar Graph has four separate bars A, B, C, and D. On each bar a percentage value is displayed which indicates the current value relative to the full range. A byte value of $7F (max is $FF) would show up as approximately 50% as would a word value of $7FFF (max is $FFFF). As can be seen in the data formatting section, all four bars must be written at the same time. The bars are shown here:

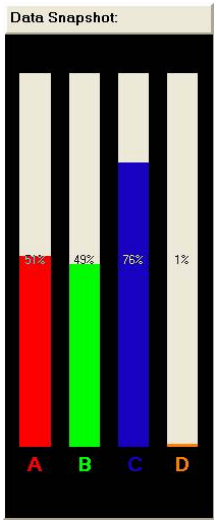


Figure 5-5: Serial Grapher Bar Graph

The graphing component shows four waveforms X, Y, Z, and W. The magnitude axis either has a range of $00-$FF (if byte values are incoming on the serial port) or $0000-$FFFF (if word values are incoming). Each new set of values which comes through the serial port is added to the far right side of the graph and the rest of the data values move to the left. The vertical axis displays the incoming data as the magnitude of each waveform, and the horizontal axis displays the number of samples. The graph has a limited size,

so older samples will eventually fall off the left part of the graph. As can be seen in **Section 5.5.2 - Data Format**, each incoming data command affecting the graphing component must have new data for all four waveforms. An example graph is shown here:

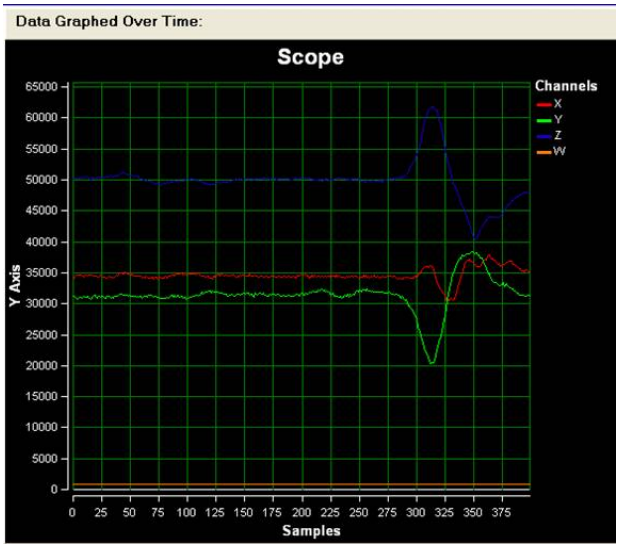


Figure 5-6: Serial Grapher Graphing Component

5.5.2 Data Format

The data format is broken into two sections depending upon whether the incoming data is in byte format or word format.

5.5.2.1 Byte Formatted Data

There are two commands which may be accepted. Both commands must end in the special characters #$0D and #$0A which are CR (carriage return) and LF (line feed). The accepted commands are:

WnnZnnYnnXnn

The nn values are 00-FF and correspond in order to the data displayed on the following graph lines: W, Z, Y, X.

AnnBnnCnnDnn

The nn values are 00-FF and correspond in order to the data displayed on the

following bar graphs lines: A, B, C, D.

5.5.2.2 Word Formatted Data

There are three commands which may be accepted. All commands must end in the special characters #$0D and #$0A which are CR (carriage return) and LF (line feed). The accepted commands are:

nnnn,nnnn,nnnn,nnnn

The nnnn values are 0000-FFFF and correspond in order to the data displayed on both the graph and bar graphs as follows: X/A, Y/B, Z/C, W/D.

nnnn:nnnn:nnnn:nnnn

The nnnn values are 0000-FFFF and correspond in order to the data displayed the graphing component as follows: X, Y, Z, W.

nnnn=nnnn=nnnn=nnnn

The nnnn values are 0000-FFFF and correspond in order to the data displayed on the bar graph component as follows: A, B, C, D.

6 DEMONSTRATION MICROCONTROLLER APPLICATIONS

The following microcontroller applications are designed to run on the QB8 processors.

6.1 Quick Start Application

The function of the Quick Start Application is to output two PWM signals at the QB8's PTB5 pin and PTC0 pin. The PTB5 pin drives the sound of the Buzzer, and outputs a PWM signal that is generated by the dedicated PWM module from the QB8 microcontroller. The PTC0 pin drives the illumination of the LED labeled PTC0. The PTC0 pin outputs a PWM signal that is emulated and synchronized with the PTB5 pin's PWM signal.

The LEDs that can be enabled by the LED_ENABLE jumpers light up in different combinations each time the PTA2 button on the DEMO9S08QB8 board is pressed. The potentiometer will control the intensity of the PTC0 LED via PWM signals on the DEMO9S08QB8 board when the PTA2 button is pressed three times after reset.

This application comes pre-programmed into the memory of the QB8 processor, so the user should be able to run this program the first time the

board is powered on without having to flash and program the device.

The source code for this Quick Start Application is also included on the DVD-ROM.

The DEMOQE toolkit may also be found at:

http://www.pemicro.com/fixedlinks/demoQEtoolkit.html.

6.2 Serial Accelerometer Application

This microcontroller application samples the state of the on-board three-axis accelerometer using on-chip A/D converter channels. This data is converted into ASCII characters and sent out using the serial pins of the QB8 processor. These serial pins may be connected to either serial port hardware or to P&E's virtual serial port (which is part of the Embedded Multilink design). This connection is controlled by jumpers J6 and J7.

P&E has two PC-based DEMOQE Toolkit applications which allow the serial port data generated by this application to be graphed. These are documented in **Section 5.4 - DEMOQE Accelerometer Demo Application** and **Section 5.5 - DEMOQE Serial Grapher Application**.

The source code for this microcontroller based Serial Accelerometer Application is included on the DVD-ROM included with the DEMOQE and also may be found at http://www.pemicro.com/fixedlinks/demoQEtoolkit.html.

7 JUMPER SETTINGS

7.1 System Power

The QB8 processor may obtain its power from either the on-board regulator, a 2-cell battery pack, or through MCU_PORT J1. The on-board regulator obtains its input from either the Embedded Multilink circuitry or a 2.5mm barrel connector. The on-board regulator can regulate the output to either 2.1V or 3V. The DEMO9S08QB8 is fully functional at both voltages. Power input and voltage selection are achieved by using 3 option headers.

7.1.1 J3 - Regulator Input Selection Jumper

Jumper 3 determines whether the DEMO9S08QB8's on-board regulator obtains its power from the DC power jack or from the Embedded Multilink circuitry. The regulator input selection is mutually exclusive. It prevents power

input contention from damaging the board and the host. **Figure 7-1** shows the regulator input selection details.



Select regulator input from DC power jack. A 5-8VDC center positive power supply must be used.

Note: The DEMOQE board power connector is incorrectly labelled as 5-12VDC. The maximum voltage is 8VDC.



Select regulator input from the Embedded Multilink circuitry, which derives its power from the USB bus

Figure 7-1: PWR Selection Header (J3)

7.1.2 J4 - Regulator Output Selection Jumper VOLT_EN

The regulator can output either a 2.1VDC or 3VDC voltage for the DEMO9S08QB8. The VOLT_EN jumper J4 selects the voltage. **Figure 7-2** shows the regulator output selection details.



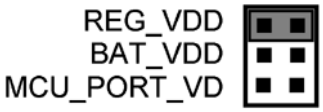
Select regulator output to be 2.1V.



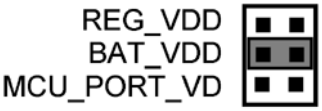
Select regulator output to be 3V

Figure 7-2: Regulator Voltage Output Selection VOLT_EN (J4)

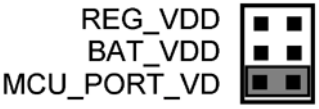
7.1.3 J5 - VDD Source Selection Jumper VDD_SELECT



Select the regulator to supply microcontroller VDD. This is the default setting.



Select the battery pack to supply microcontroller VDD



Select the MCU_PORT to supply microcontroller VDD. This setting also allows power to be supplied to the target connected to the MCU_PORT. By default this jumper is installed.

Figure 7-3: VDD_SELECT Option Header (J5)

7.2 RS232 Communications

The DEMO9S08QB8 integrates an RS232 transceiver for the microcontroller SCI signals. The transceiver operates from 1.8V to 4.25V, and it can be enabled or disabled via jumper settings or through firmware control. The DEMO9S08QB8 also integrates the SCI signal into the Embedded Multilink circuitry. A user can communicate with the microcontroller SCI module via either the on-board DB9 connector or the Embedded Multilink circuitry. There are three jumpers associated with SCI communication.

7.2.1 J6 - SCI RXD Signal Selection Jumper RXD_EN



Connects the microcontroller PTB0/RXD signal to the RS232 transceiver.



Connects the microcontroller PTB0/RXD signal to the Embedded Multilink SCI circuitry. This is the default setting.

Figure 7-4: SCI RXD Signal Selection Jumper RXD_EN (J6)

7.2.2 J7 - SCI TXD Signal Selection Jumper TXD_EN (J7)



Connects the microcontroller PTB1/TXD signal to the RS232 transceiver.



Connects the microcontroller PTB1/TXD signal to the Embedded Multilink SCI circuitry. This is the default setting.

Figure 7-5: SCI TXD Signal Selection Jumper TXD_EN (J7)

7.2.3 J8 - SCI Transceiver Enable COM_EN (J8)



Enables the SCI Transceiver. The user may control PTC5 in firmware to enable or disable the transceiver.



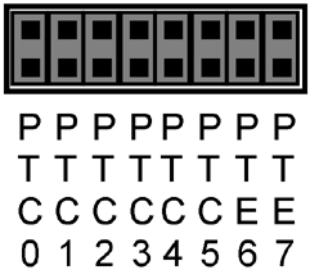
Disables the SCI Transceiver. This is the default setting.

Figure 7-6: SCI Transceiver Enable/Disable Selection COM_EN (J8)

7.3 LED Display Port

The DEMOQE Base Board has 8 LEDs connected to signals PTC0, PTC1, PTC2, PTC3, PTC4, PTC5, PTE6, and PTE7. They can be enabled or disabled by installing or removing the corresponding jumper, J9, in the LED_ENABLE header.

7.3.1 J9 - LED Display Enable Port LED_ENABLE



Enables all LED outputs. This is the default setting.

Figure 7-7: LED Display Enable Header LED_ENABLE (J9)

Note: LED PTE6 and LED PTE7 are mapped to QB8 ports PTC6 and PTC7 respectively.

7.4 Input and Reset Switches

The DEMO9S08QB8 has an option to connect two signals, PTC0 and PTC1, to the Embedded Multilink for signal processing. The two signals are connected or disconnected to IN0 or IN1 correspondingly, via jumpers P&E INPUT_EN (J11).

The DEMO9S08QB8 has 4 switches that are connected to signals PTA2, PTA3, PTD2, and PTD3 respectively, and are enabled or disabled by the 4 corresponding jumpers KEY_ENABLE (J12).

The DEMO9S08QB8 has one Reset switch and one Reset LED associated with it. These are enabled or disabled by the two corresponding jumpers RESET_EN (J18).

7.4.1 J11 - P&E's Logic Analyzer Inputs IN0/IN1

The logic analyzer inputs are marked on one side of the J11 jumper. The inputs allow P&E's PC-based logic analyzer application to display these signals in real-time.



By installing both jumpers, the logic analyzer pins IN0 and IN1 will be connected to PTC0 and PTC1 respectively.



By removing these jumpers IN0 and IN1 will be unconnected. The user may connect these signals, via wires, to any other signals on the processor which they wish to view on the PC.

Figure 7-8: Jumper Settings for Input Signals to P&E's Embedded Multilink, P&E INPUT_EN (J11)

7.4.2 J12 - Light Touch Switch Enable Jumper KEY_ENABLE

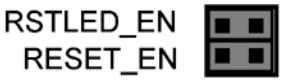


Enables the corresponding switch. Each jumper may be individually installed or removed. By default, all jumpers are installed to enable all the switches.

Figure 7-9: Jumper Settings for Light Touch Switches KEY_ENABLE (J12)

Note: Switch PTD2 and Switch PTD3 are mapped to QB8 ports PTA6 and PTA7 respectively.

7.4.3 J18 - Reset Switch Enable and Reset LED Display Enable Jumper RESET_EN



Enables the Reset Switch and the Reset LED Display. Each jumper may be individually installed or removed. This is the default setting.

Figure 7-10: Reset Switch and Reset LED enable Jumper (J18)

Note: The J18 labels for RSTLED_EN and RESET_EN are incorrectly switched on the DEMOQE board silk screen. The correct label is as displayed above.

7.5 3-Axis Accelerometer Jumper Settings

The DEMO9S08QB8 integrates a 3-axis accelerometer. Its enable or disable, sensitivity levels, and output signal connections can all be set with jumpers. Jumpers J13, J14, J15 and J16 are associated with the accelerometer.

TABLE 1. Accelerometer G-Select Pin Descriptions

G-SEL2	G-SEL1	g-Range	Sensitivity
0	0	1.5g	800 mV/g
0	1	2g	600 mV/g

TABLE 1. **Accelerometer G-Select Pin Descriptions**

G-SEL2	G-SEL1	g-Range	Sensitivity
1	0	4g	300 mV/g
1	1	6g	200 mV/g

7.5.1 J13 - Accelerometer g-Select1 Jumper G-SEL1



Selects g-Select1 to be logic low. This is the default setting.



Selects g-Select1 to be logic high. A user may control PTD0 in firmware to set g-Select1.

Figure 7-11: Accelerometer g-Select1 Jumper settings (J13)

7.5.2 J14 - Accelerometer g-Select2 Jumper G-SEL2



Selects g-Select2 to be logic low. This is the default setting.



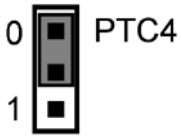
Selects g-Select2 to be logic high. A user may control PTD0 in firmware to set g-Select2

Figure 7-12: Accelerometer g-Select2 Jumper settings (J14)

7.5.3 J15 - Accelerometer Sleep Mode Select Jumper SLEEP (J15)



Enables the 3-axis accelerometer. This is the default setting.



Puts the 3-axis accelerometer into sleep mode. The user may control PTC4 in firmware to enable or disable the accelerometer. In this configuration, the user needs to pay close attention to LED PTC4 and RSTO configuration.

Figure 7-13: Accelerometer Sleep Mode Jumper settings (J15)

7.5.4 J16 - Accelerometer 3-axis Signals Connection Jumper ACC_EN



The accelerometer output signals are jumper settable to PTA7, PTA6, PTC7, and PTA1. PTA6 and PTC7 share the same Y-axis signal. By default, the Y-axis signal is connected to PTA6.

Figure 7-14: Accelerometer Signal Output ACC_EN (J16)

7.6 Buzzer

The DEMO9S08QB8 integrates a Piezo Transducer whose resonant frequency is 4.0KHz. Jumper J19 connects to PTB5 to control this buzzer.

7.6.1 J19 - Buzzer enable jumper BUZ_EN



Enables Buzzer to be controlled by PTB5. This is the default setting.

Figure 7-15: Accelerometer Signal Output ACC_EN (J19)

7.7 IIC Pull-up

The MC9S08QB8 does not have a dedicated IIC module. Installing IIC_EN jumpers has no effect on the device.

7.7.1 J20 - IIC Pullup Enable Jumpers IIC_EN



Enables IIC external pullup. This is the default setting.

Figure 7-16: IIC External Pullup Enable IIC_EN (J20)

7.8 Analog Input Potentiometer

The DEMO9S08QB8 provides an easy access 10Kohm potentiometer whose output may be connected to PTC6 and/or PTA0, selectable by J21, POT_EN.

7.8.1 J21 - Potentiometer Output Selection Jumpers POT_EN



Selects the potentiometer output connection. By default it is connected to PTA0.

Figure 7-17: Potentiometer Output Selection Jumpers POT_EN (J21)

7.9 Optional External Crystal Circuitry Jumper Enable

The DEMO9S08QB8 provides external crystal circuitry without components populated. A user may elect to populate the components, and may use jumper J17, CLOCK_EN, to enable the external crystal circuitry.

7.9.1 J17 - External Crystal Circuitry Enable Jumpers CLOCK_EN



Enables or disables the external crystal circuitry. Both positions must be installed to enable use of crystal circuitry.

Figure 7-18: External Crystal Circuitry Enable Jumper CLOCK_EN (J17)

7.10 Optional Jumpers For Various VDD And VSS

The DEMO9S08QB8 provides 5 jumpers, J22 through J25, for different VDD and VSS connections on the bottom of the board. By default, they are not populated and are shorted correspondingly with zero-ohm resistors in parallel, except J24 which is populated. A user may take off the zero-ohm resistor and install a corresponding jumper.

Note: JR2 (Jumper 23) and JR5 (Jumper 26) have no effect on QB8 devices.

8 DEMO9S08QB8 CODE DEVELOPMENT SOFTWARE

The DEMO9S08QB8 includes P&E's Embedded Multilink circuitry, so no external hardware BDM tool is needed to debug and program the DEMO9S08QB8. A user only needs to connect the DEMO9S08QB8 to their PC to start developing code for it.

The DEMO9S08QB8 package comes with a special edition of Freescale's CodeWarrior studio. In addition, P&E's evaluation software for HCS08 is available online at www.pemicro.com. A user may use either CodeWarrior or P&E software tools to develop code for the DEMO9S08QB8.

8.1 Using CodeWarrior With The DEMO9S08QB8

The CodeWarrior studio supports Freescale's HCS08 devices. It offers C, C++, and assembly-level support, and provides debugging capabilities based on P&E's debug and programming technologies.

A programming or debug session with the project-based CodeWarrior IDE may be launched by double-clicking on the project name (the format is projectname.mcp) from your file storage. Its tutorials, FAQs, and quick start guides are easy to follow and will allow you use pre-built templates to begin creating a new project in a short time.

8.2 Using P&E Software With The DEMO9S08QB8

P&E offers software tools for Freescale's HCS08 devices that can be used to develop code for the DEMO9S08QB8 board. P&E offers an integrated development environment, which combines a command-line assembler, in-circuit debugger, and flash memory programmer. The assembler includes features such as a full string replacement macro, conditional assembly, include files, and more. The debugger supports both assembly and C source-level debugging. The programmer can program/reprogram both internal and external flash devices in-circuit.

9 TRANSITIONING TO YOUR OWN TARGET

Once you have finished working with the DEMO9S08QB8 and are ready to build your own target, you will need a hardware tool to allow you to develop using your own board. P&E's USB Multilink and P&E's Cyclone PRO offer two effective solutions, depending on your needs. Both work with Freescale's CodeWarrior as well as P&E software, and both provide a seamless transition to working with your own hardware.

The USB Multilink is a development tool that is functionally comparable to the Embedded Multilink circuitry on the DEMO9S08QB8. It will enable you to debug your code and program it onto your target. The Cyclone PRO is a more versatile and robust development tool with advanced features and production capabilities.

More information is available below to assist you in choosing the appropriate development tool for your needs.

9.1 Hardware Solutions At A Glance

The USB Multilink offers an affordable and compact solution for your development needs, and allows debugging and programming to be accomplished simply and efficiently. Those doing rapid development will find the USB Multilink easy to use and fully capable of fast-paced debugging and programming.

The Cyclone PRO is a more complete solution designed for both development and production. The Cyclone PRO features automated power switching, multiple communications interfaces (including USB, Ethernet, and Serial), stand-alone programming functionality, and many other advanced capabilities.

Below is an overview of the features and intended use of the USB Multilink and Cyclone PRO.

9.1.1 USB Multilink Key Features

- Direct user control of target's execution
- Programming and debugging capabilities
- Read/write registers and memory values
- Compact and lightweight
- Communication via USB 2.0
- Supported by P&E software and Freescale's CodeWarrior

9.1.2 Cyclone PRO Key Features

- Advanced programming and debugging capabilities, including:
  - PC-Controlled and User-Controlled Stand-Alone Operation
  - Interactive Programming via Host PC
  - In-Circuit Debugging, Programming, and Testing
- Compatible with Freescale's ColdFireV1, HCS08, RS08, and HC(S)12(X) microcontroller families
- Communication via USB, Serial, and Ethernet Ports
- Multiple image storage
- LCD screen menu interface
- Supported by P&E software and Freescale's CodeWarrior

9.2 Working With P&E's USB Multilink



Figure 9-1: P&E's USB Multilink (USB-ML-12 shown)

9.2.1 Product Features & Implementation

P&E's USB Multilink Interface (USB-ML-12) connects your target to your PC and allows the PC access to the Background Debug Mode (BDM) on Freescale's ColdFireV1, HCS08, RS08, and HC(S)12(X) microcontrollers. It connects between a USB port on a Windows 2000/XP/2003 machine and a standard 6-pin debug connector on the target.

By using the USB Multilink Interface, the user can take advantage of the background debug mode to halt normal processor execution and use a PC to control the processor. The user can then directly control the target's execution, read/write registers and memory values, debug code on the processor, and program internal or external FLASH memory devices.The USB Multilink enables you to debug, program, and test your code on your board.

9.2.2 Software

The USB Multilink Interface works with CodeWarrior as well as P&E's in-circuit debugger and flash programmer to allow debug and flash programming of the target processor. P&E's USB Multilink Development Packages come with the USB Multilink Interface, as well as flash programming software, in-circuit debugging software, Windows IDE, and register file editor.

9.3 Working With P&E's Cyclone PRO



Figure 9-2: P&E's Cyclone PRO

9.3.1 Product Features & Implementation

P&E's Cyclone PRO is an extremely flexible tool designed for debugging, testing, and in-circuit flash programming of Freescale's ColdFireV1, HC08, HCS08, RS08, and HC(S)12(X) microcontrollers. The Cyclone PRO connects your target to the PC via USB, Ethernet, or Serial Port and enables you to debug your code, program, and test it on your board. After development is complete the Cyclone PRO can be used as a production tool on your manufacturing floor.

For production, the Cyclone PRO may be operated interactively via Windows-based programming applications as well as under batch or .dll commands from a PC. Once loaded with data by a PC it can be disconnected and operated manually in a stand-alone mode via the LCD menu and control buttons. The Cyclone PRO has over 3Mbytes of non-volatile memory, which allows the onboard storage of multiple programming images. When connected to a PC for programming or loading it can communicate via the ethernet, USB, or serial interfaces.

9.3.2 Software

The Cyclone PRO comes with intuitive configuration software and interactive programming software, as well as easy to use automated control software. The Cyclone PRO also functions as a full-featured debug interface, and is supported by Freescale's CodeWarrior as well as development software from P&E.

P&E's Cyclone PRO is also available bundled with additional software as part of various Development Packages. In addition to the Cyclone PRO, these Development Packages include in-circuit debugging software, flash programming software, a Windows IDE, and register file editor.

10 TROUBLESHOOTING

10.1 DEMO9S08QB8 Is Undetected

Q: The connection assistant indicates that my DEMO9S08QB8 is undetected even though I have connected the hardware to my USB port. What should I do?

A: The connection assistant, which displays in either CodeWarrior or P&E's development software, is a dialog which allows the user to connect to the

DEMO9S08QB8 hardware. If this dialog indicates that the DEMO9S08QB8 hardware is not connected to the PC, the first step is to make sure that the DEMO9S08QB8 hardware is connected to the PC via a USB 2.0 high-speed cable. If it is connected, unplug and then plug in the USB cable on the DEMO9S08QB8 board and click refresh in the connection assistant. If the hardware still does not show up, try the following remedies:

(A) Re-Enable the USB driver

If you connected the DEMO9S08QB8 interface prior to installing P&E's Embedded Multilink drivers, Windows will not have been able to find the appropriate driver and may have disabled the device. The DEMO9S08QB8 board shows up in Window's device manager as a "P&E Multilink," since it contains P&E's Embedded Multilink circuitry. If you unplug and then plug in the device, Windows will automatically disable it even if you have installed the drivers. To force windows to try to load the driver again, perform the following steps while the DEMO9S08QB8 interface is connected to the computer:

1. Open the Control Panel (Start Button->Settings->Control Panel)
2. Double Click the "System" Icon
3. Select the "Hardware" tab
4. Click the "Device Manager" Button
5. The "P&E Multilink" device will be shown with an exclamation mark next to it. Double-click this device.
6. Click the "Reinstall Driver…" button and follow the dialog instructions to have Windows automatically install the driver.

(B) Re-Install the USB driver

If the Multilink device does not show up in the device manager, use the driver installation utility located in the DEMOQE Resources DVD-ROM. After driver installation, unplug the DEMO9S08QB8 from the PC and reboot the PC. When the reboot has completed, connect the interface to the PC with the USB 2.0 cable. Run the software again to see if the interface is now detected.

If you have an error attempting to install the drivers, please view the installation troubleshooting FAQ on P&E's website at:

http://www.pemicro.com/faqs/faq_view.cfm?id=89.

(C) Test for installation of the USB driver files

To test the driver installation, use the driver test utility in the DEMOQE

Resources DVD-ROM to make sure all files were properly installed. This may give some indication of what the problem is.

(D) Using a USB Hub

The DEMO9S08QB8 is a high-power USB device. If a USB Hub is used, it must be a self-powered hub (i.e., with its own power supply). If the Hub is not self-powered the DEMO9S08QB8 will not work. In general, USB ports located directly on the PC are high-power (self-powered) ports.

10.2 CodeWarrior Installation Fails (WinDriver Error)

Q: When I try to install the CodeWarrior or P&E software, installation fails with this message: “There are currently 2 open applications using WinDriver. Please close all applications and press Retry. To reload WinDriver, press Cancel and reboot.“ How do I solve this?

A: Some software applications on your PC are connected to the Windriver system driver which manages P&E's USB connections. This system driver needs to be disabled for the installation to continue. Directions to disable Windriver are as follows:

In Windows Explorer, right-click on My Computer and select Properties from the drop-down menu.

1. Select the Hardware tab.
2. Click on the Device Manager button.
3. Select the "System Devices" in the Device Manager window.
4. Expand the tree index (+) for System Devices.
5. At the bottom of the System Devices list you should see the Win-Driver item.
6. Right-click on WinDriver and select Disable from the drop-down menu.
7. Click Yes/OK when the confirmation dialog appears.

WinDriver is now disabled and you should be able to complete the installation. After the installation finishes, you should re-enable the WinDriver system driver using the following steps:

In Windows Explorer, right-click on My Computer and select Properties from the drop-down menu.

1. Select the Hardware tab.
2. Click on the Device Manager button.
3. Select the "System Devices" in the Device Manager window.
4. Expand the tree index (+) for System Devices.
5. At the bottom of the System Devices list, you should see a WinDriver item.
6. Right-click on WinDriver and select Enable from the drop-down menu.

Reboot your PC after the installation finishes.

If you are unable to disable the WinDriver system driver in the above fashion, you can delete the file c:\windows\system32\windrvr6.sys and then reboot your machine. You should then re-run the installer and complete the procedure. Reboot your machine after the installation has finished.

DEMO9S08QB8UM
Rev. 1.03
September 2009

Freescale Controller Continuum

68HC08/S08/RS08/(S)12(X) ColdFire® V1 ColdFire® V2/V3/V4 Power Architecture® ARM®



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