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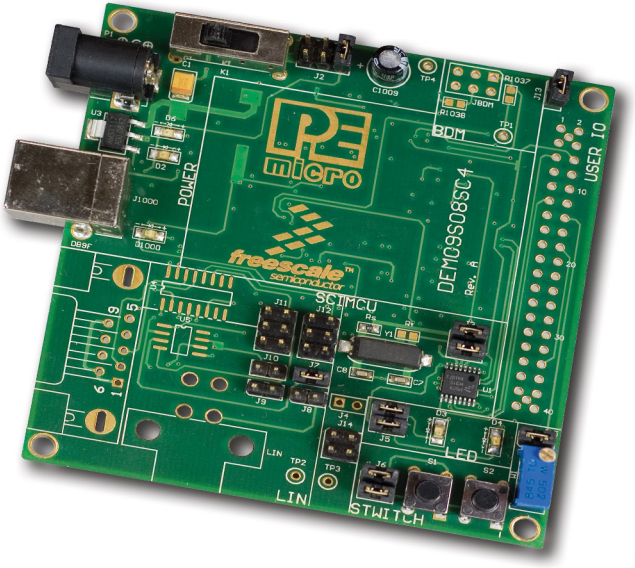
DEMO9S08SC4 User Manual



DEMO9S08SC4UM
Rev. 1.00
June 2009

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Manual version 1.00

1 INTRODUCTION

1.1 Overview

The DEMO9S08SC4 is a low-cost development system designed for demonstrating, evaluating, and debugging the Freescale MC9S08SC4 microcontroller. P&E's Embedded Multilink circuitry on the DEMO9S08SC4 board allows the processor on the DEMO9S08SC4 to be debugged and programmed via USB from the PC. In addition, the demo board can be powered using the USB bus.

1.2 Package Contents

The DEMO9S08SC4 package includes the following items:

- DEMO9S08SC4 Demo board
- USB Cable
- Freescale Warranty Card

1.3 Supported Devices

The DEMO9S08SC4 supports the MC9S08SC4CTG device.

1.4 Recommended Materials On DEMO9S08SC4 Resources CD

- DEMO9S08SC4 Embedded Multilink hardware interface driver
- DEMO9S08SC4 User Manual (this document)
- DEMO9S08SC4 Demo Board Schematics
- DEMO9S08SC4 Component Breakdown List
- Embedded Multilink Toolkit Applications
- Links to P&E Evaluation Software

- Links to Freescale documentation, P&E Discussion Forums, and DEMO9S08SC4 FAQs.

1.5 Handling Precautions

Take care to handle the package contents, including the DEMO9S08SC4 board, in a manner such as to prevent electrostatic discharge.

2 HARDWARE FEATURES

The DEMO9S08SC4 is a demonstration and development system for Freescale's MC9S08SC4 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 DEMO9S08SC4'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 DEMO9S08SC4 Board Features

- On-board Logic Analyzer
- On-board Virtual Serial Port
- P&E's Embedded Multilink circuitry populated on the bottom
- RS-232 Serial Port w/ DB9-F Connector (not populated)
- SCI signals connected to P&E's Embedded Multilink through jumpers
- ON/OFF Power Switch w/ LED indicator
- A 12VDC power supply input barrel connector
- 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 5.0V
  - Power Input from MCU_PORT connector

- External Crystal Circuitry Layout
- LIN PHY with Molex connector (PHY and connector not populated)
- 40-Pin MCU I/O pass-through connector (not populated)
- User Features:
  - 2 User LED's w/ Enable
  - 2 User Push Buttons w/ Enable
  - 5K Ohm POT w/ Enable
- Option Jumpers:
  - COM_SEL to choose SCI connection to LIN PHY or RS232 or PEMICRO virtual COM port
  - INPUT_EN for two input channels to Embedded Multilink
- Specifications:
  - Board Size 3.2 x 2.9
  - Power Input:
  - USB Cable: 5VDC, 500mA max
  - DC Power Jack: 2.1mm barrel connector, 12VDC Center Positive

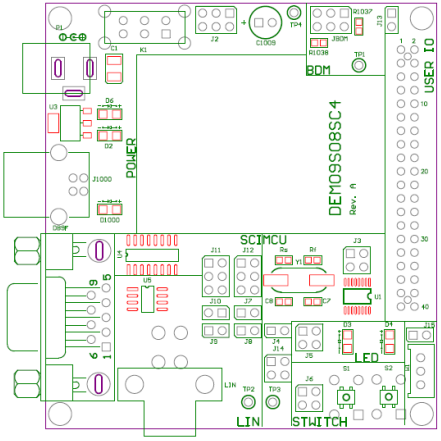


Figure 2-1: DEMO9S08SC4 Top Component Placement

2.2 On-Board Logic Analyzer

The DEMO9S08SC4 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 PTA1 and PTB5 signals on the DEMO9S08SC4 board by default via the J14 jumpers. The channels may be connected to any of the processor pins by wire jumpers (not included).

The DEMO9S08SC4 Logic Analyzer Utility, included in the Embedded Multilink Toolkit on the accompanying CD-ROM, displays the logic analyzer signals on a PC.

2.3 On-Board Virtual Serial Port

The DEMO9S08SC4 board has a built-in virtual serial port which may be connected to the SC4 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 Terminal Window Utility, included in the Embedded Multilink Toolkit on the accompanying CD-ROM, is a generic serial port utility which works with the virtual serial port or actual serial port hardware.

3 SYSTEM SETUP

3.1 Overview

P&E's Embedded Multilink driver is required to operate the DEMO9S08SC4 using a PC. The Embedded Multilink driver should be installed with the CodeWarrior Development Studio software or from the DEMO9S08SC4 Resources in the CD-ROM before the PC is connected to the DEMO9S08SC4.

3.2 Operating System Requirements

The following are the resources required to run the CodeWarrior Development Studio and the DEMO9S08SC4:

- 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 CD-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 CD-ROM drive. A start-up window will automatically appear. Select CodeWarrior Installation and follow the on-screen instructions.

3.3.2 Installing P&E Resources

Use the DEMO9S08SC4 Resources CD-ROM to access and install P&E resources for the DEMO9S08SC4. These materials are not required for operation. The support materials contained on the DEMO9S08SC4 Resources CD-ROM are listed in **Section 1.4 - Recommended Materials On DEMO9S08SC4 Resources CD**.

3.4 Quick Startup

Only a few steps are required to get the DEMO9S08SC4 up and running:

Step 1. If you do not have CodeWarrior Development Studio version 6.0 installed on your computer, please install it using the accompanying CD-ROM. Additional information regarding CodeWarrior can be found at www.freescale.com.

Step 2. Remove the DEMO9S08SC4 demonstration board from its anti-static pouch.

Step 3. Connect the USB cable from your computer to the DEMO9S08SC4 demonstration board. Depending on your operating system, you may need to follow steps to install the USB driver from the DEMO9S08SC4 Resources CD-ROM. Once the USB cable is connected properly the green USB LED on the DEMO9S08SC4 should illuminate.

Step 4. Turn on the DEMO9S08SC4 power switch (K1). The red Power LED should illuminate.

Step 5. [Will be updated with Quick Start Guide code operations]

Step 6. [Will be updated with DEMO code] Optionally, you may run the Logic Analyzer Application available in the Embedded Multilink toolkit on the CD. This PC-based application graphs the IN0 and IN1 signals on the DEMO9S08SC4 board. If both J14 jumpers are installed, IN0 shows PTA1 and IN1 shows PTB5. Push button S1 and turn the potentiometer to change these signals. This application may also be found at:

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

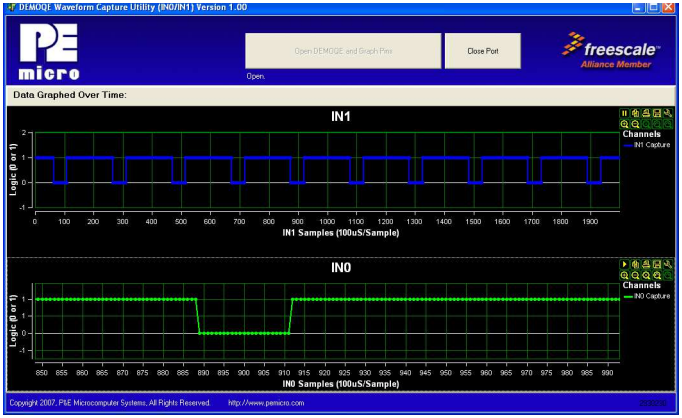


Figure 3-1: Logic Analyzer Application

3.5 Hardware Setup

3.5.1 First-Time Connection

The DEMO9S08SC4 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 jumpers 1&2 for PWR_SEL (J2) 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 DEMO9S08SC4 board.
5. The operating system will recognize P&E's Embedded Multilink cir-

cuitry 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:

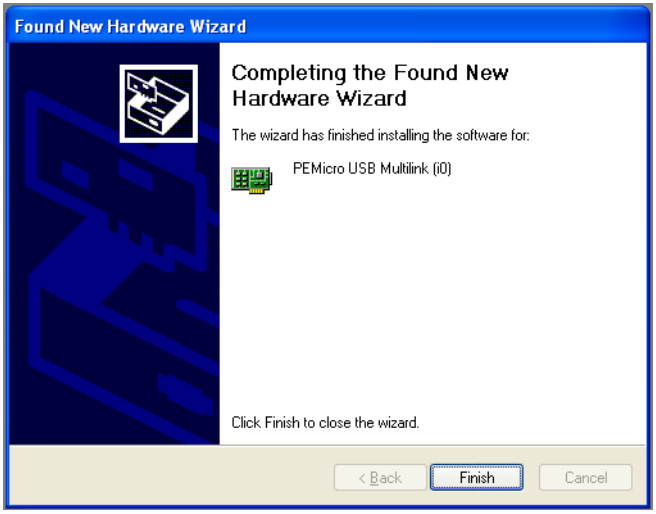


Figure 3-3: Found New Hardware Wizard Dialog (2 of 4)

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:

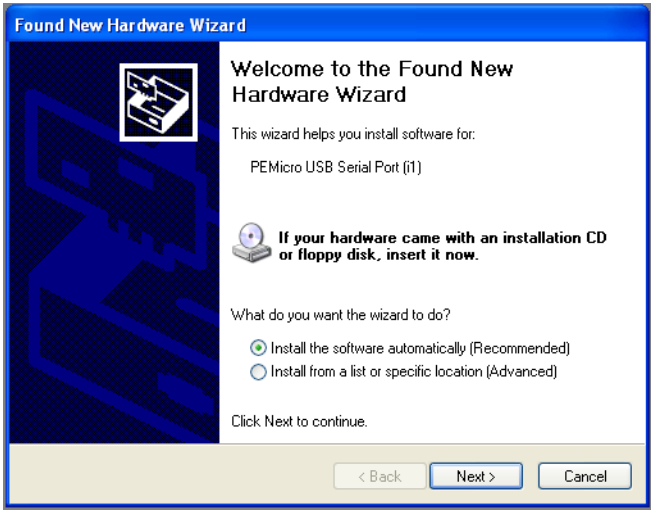


Figure 3-4: Found New Hardware Wizard Dialog (3 of 4)

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:

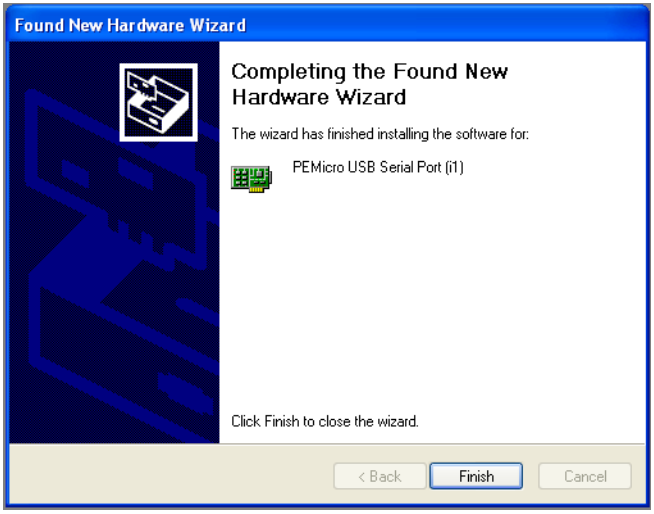


Figure 3-5: Found New Hardware Wizard Dialog (4 of 4)

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

If the DEMO9S08SC4 hardware interface driver is now properly installed on your system, the green USB LED on the DEMO9S08SC4 board should be illuminated. In addition, if you turn on the system power of the DEMO9S08SC4 you will see the red Power LED illuminate.

4 OPERATING MODES

4.1 Overview

The DEMO9S08SC4’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 DEMO9S08SC4.

4.2 Debug Mode

A host communicates with the DEMO9S08SC4 through the Embedded Multilink circuitry. Either the CodeWarrior Development Studio or P&E’s HCS08 software tools will work with the DEMO9S08SC4. Please refer to

Section 7 - DEMO9S08SC4 CODE DEVELOPMENT SOFTWARE for more information.

4.3 Run Mode

The DEMO9S08SC4's rich component list empowers it to perform a variety of tasks. Once an application is developed, debugged, and programmed properly into the SC4 internal flash memory, it can run with or without connecting to a host.

4.4 External BDM Mode

The DEMO9S08SC4 has an optional BDM header for debugging and programming the on-board SC4 device using an external BDM hardware tool, such as P&E's USB Multilink or Cyclone PRO. Please refer to **Section 8 - TRANSITIONING TO YOUR OWN TARGET** for more information. A user can take advantage of this mode to develop a target-specific SC4 system and compare it with the DEMO9S08SC4 when necessary.

5 EMBEDDED MULTILINK TOOLKIT PC APPLICATIONS

P&E provides several Windows PC-based applications which work with the DEMO9S08SC4 board. These applications are collectively referred to as the Embedded Multilink Toolkit. The following applications are included in the toolkit:

5.1 DEMO9S08SC4 Logic Analyzer Application

The DEMO9S08SC4 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 PTA1 and PTB5 pins of the MCU by jumper J14. At the time of this release, the logic analyzer runs at a capture rate of 10khz.

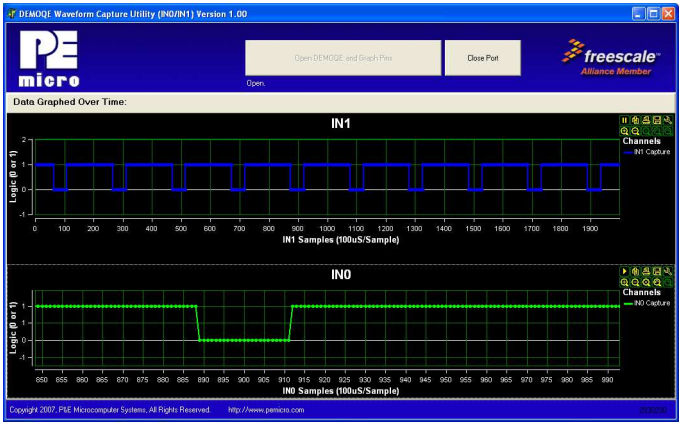


Figure 5-1: Logic Analyzer Application

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.

This PC-based application is included on the CD-ROM that accompanies the DEMO9S08SC4, and may also be found at:

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

5.2 DEMO9S08SC4 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 DEMO9S08SC4 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.

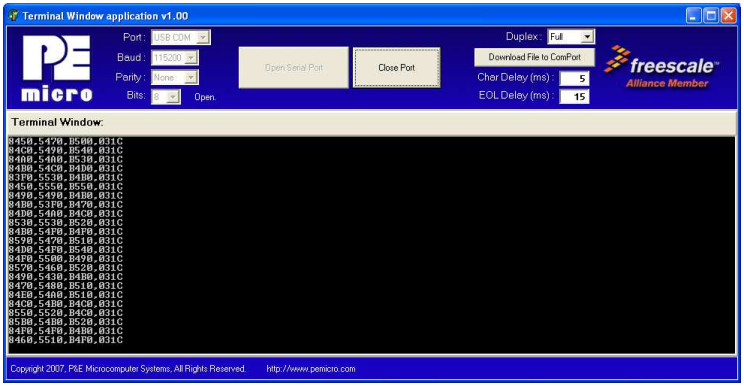


Figure 5-2: DEMO9S08SC4 Terminal Application

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 CD-ROM that accompanies the DEMO9S08SC4, and may also be found at:

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

5.3 DEMO9S08SC4 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 DEMO9S08SC4 board as well as other user hardware connected to the PC via the USB Multilink or Cyclone PRO hardware interfaces.

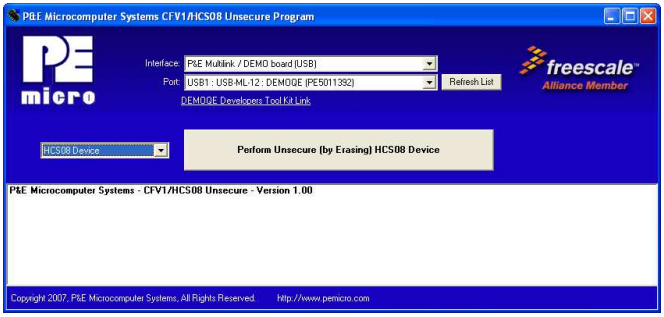


Figure 5-3: DEMO9S08SC4 Unsecure Application

This PC-based application is included on the CD-ROM that accompanies the DEMO9S08SC4, and may also be found at:

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

5.4 DEMO9S08SC4 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 DEMO9S08SC4 board.

This PC-based application is included on the CD-ROM that accompanies the DEMO9S08SC4 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.

5.4.1 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:

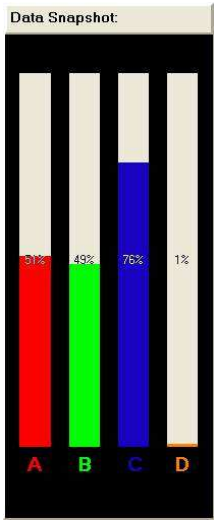


Figure 5-4: Serial Grapher Bar Graph

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 5.4.2 - Data Format**, each incoming data command affecting the graphing component must have new data for all four waveforms. An example graph is shown here:

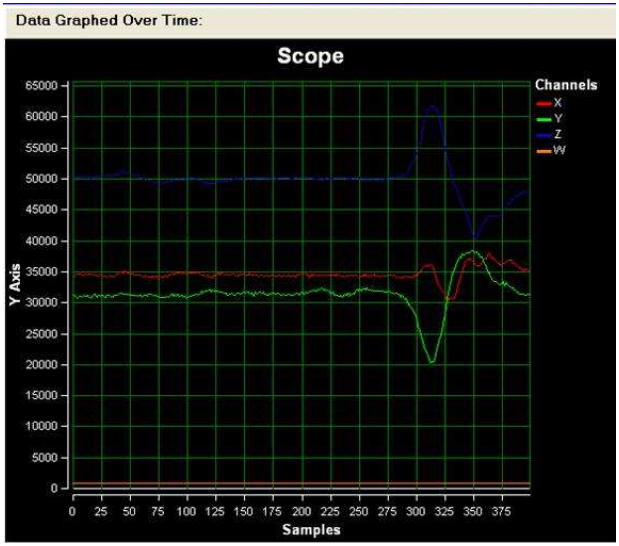


Figure 5-5: Serial Grapher Graphing Component

5.4.2 Data Format

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

5.4.2.1 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.

5.4.2.2 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 JUMPER SETTINGS

6.1 System Power

The SC4 processor may obtain its power from either the on-board regulator or through MCU_PORT J1. The on-board regulator regulates the output to 5V. Power input is achieved by using J2 and J13 headers.

6.1.1 J2 - VDD Source Selection Jumper VDD_SELECT

Select the Embedded Multilink Circuitry USB to supply

microcontroller VDD. This is the default setting.

Select the MCU_PORT_VDD to supply microcontroller VDD. This setting also allows power to be supplied to the target connected to the MCU PORT. Please note that J13 must be installed to use this option.

Select the REG_VDD to supply microcontroller VDD.

Figure 6-1: VDD_SELECT Option Header (J2)

Figure 6-2: MCU_PORT and MCU_PORT_VDD Option Header (J13)

6.2 RS232/LIN Communications

The DEMO9S08SC4 integrates an RS232 transceiver (not populated) and a

LIN PHY driver (not populated) for the microcontroller SCI signals. The DEMO9S08SC4 also integrates the SCI signal into the Embedded Multilink circuitry. A user can communicate with the microcontroller SCI module via the on-board DB9 connector (not populated), the Molex 4-position LIN connector, or the Embedded Multilink circuitry.

There are two jumpers associated with SCI communication selection.

6.2.1 J12 - 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 LIN transceiver

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

Figure 6-3: SCI RXD Signal Selection Jumper RXD_EN (J12)

6.2.2 J11 - SCI TXD Signal Selection Jumper TXD_EN)

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

Connects the microcontroller PTB1/TXD signal to the LIN transceiver

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

Figure 6-4: SCI TXD Signal Selection Jumper TXD_EN (J11)

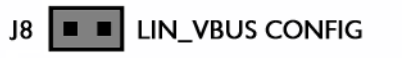
6.2.3 LIN Jumper Settings

J7 – LIN Enable

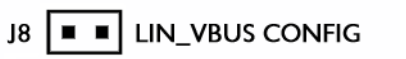
Jumper ON : Enables the LIN transceiver

Jumper OFF : Disables the LIN transceiver

J8 – LIN VBUS Configuration

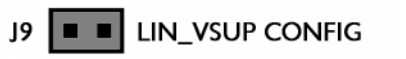


Jumper ON : LIN VBUS is connected to 12V

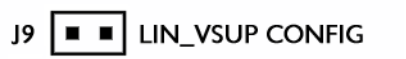


Jumper OFF : LIN VBUS is not connected to 12V

J9 – LIN VSUP Configuration



Jumper ON : LIN VSUP is connected to 12V



Jumper OFF : LIN VSUP is not connected to 12V

J10 – LIN Master Selection

Jumper ON : LIN is configured as a master node

Jumper OFF : LIN is configured as a slave node

6.3 LED Display Port

The DEMO9S08SC4 Board has 2 LEDs connected to signals PTA0 and