Meridian/P
Technical Reference Manual

Quick Reference

What is in this document?	▪ Detailed information about the Meridian/P hardware ▪ Mechanical drawings
What is not in this document (and where do I find it)?	▪ Setup information. See the *Getting Started Guide.* ▪ Detailed software development information. Refer to the online help in the Software Development Kit (*SDK)* for this information.
Where can I get support?	http://DeviceSolutions.net/Support.aspx
Where can I find out about updates?	Device Solutions Blog: http://blog.DeviceSolutions.net

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Table of Contents

1 Introduction

The Meridian/P Micro Development board contains all the functionality of the Meridian CPU, but in a prototype-friendly format.

It incorporates a Freescale i.MXS ARM920T based processor, 8Mbytes of SDRAM, 4Mbytes of flash memory, along with an LCD controller, USB function, GPIO, SPI bus, I2C bus and serial ports. The I/O pins are all available through 0.1" headers. These have not been populated to allow you to mount them on the top or bottom of the board. Two of the expansion connectors are identical to the Tahoe-II expansion connectors, allowing Ethernet and future expansion boards to be used on the Meridian/P.

The Meridian/P form-factor fits with the SchmartBoard system. Schmartboards provide a quick and easy way to solder surface mount components, including fine pitch QFPs and BGAs.
For more information see www.schmartboard.com

The Meridian/P runs the .NET Micro Framework. This allows you to write applications in C# and use the Visual Studio tools to develop and debug applications. This document details the technical specifications of the Meridian CPU module. For information of software development, please refer to the online help within Visual Studio.

The product details presented in this manual are subject to change. Please contact Device Solutions for the latest information before beginning any new designs based on this information.

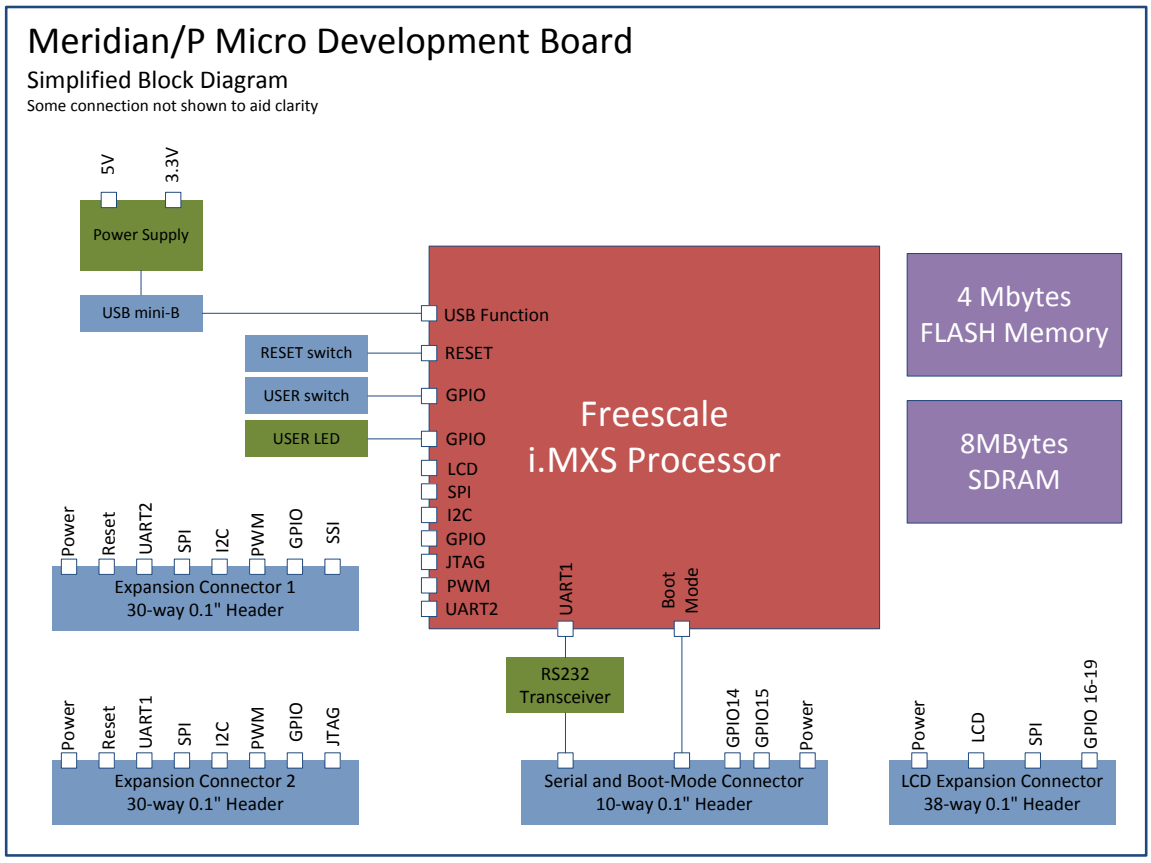
References:

- Freescale i.MXS Reference Manual
- Online help in Visual Studio 2008 (requires the installation of the Microsoft .NET Micro Framework SDK and Device Solutions SDK)

2 System Components

This section shows details on each of the system components that make up the Meridian/P Micro Development Board.

2.1 Block Diagram



2.2 System Components

Freescale i.MXS Processor	The Meridian/P CPU includes a 100MHz Freescale i.MXS processor. This has an ARM920T core, and peripherals including LCD controller, serial ports, SPI, I2C, SSI, PWM and timers.
Flash Memory	4MByte NOR flash stores the .NET Micro Framework and your custom applications.
SDRAM	Meridian includes 8MByte of SDRAM running at 96MHz.
USB Function	The USB function provides power and communications to the Meridian/P. This is the primary method to download and debug applications. USB function can also be used from managed applications.

Power Supply	The Meridian/P can operate on 5V or 3.3V. Power supplies on the Meridian/P provide the core voltage required for the i.MXS. To power the board off 5V, connect 4.3V – 6V to any of the 5V pins. You can also power the board from the USB connector. If the board is powered with 5V, the Meridian/P can supply up to 100mA on the 3.3V rail for your applications. This is only available when powering the board from 5V. To power the board off 3.3V, connect 3.3V to any of the 3.3V pins.
Serial Ports	The Meridian/P has 2 UART serial ports. UART1 is available at RS232 levels on the Serial and Boot-Mode expansion connector. UART2 is available as logic-level signals on the EXP1 Expansion Connector. Both ports support RTS/CTS hardware handshaking.
Expansion Connectors	Four 0.1” connectors are provided to enable easy interface to the Meridian/P. Two of these connectors are identical to those found on the Tahoe-II, and the others provide LCD signals, and UART signals at RS232 levels for quick interfacing to serial devices.
LED and Switch	The Meridian/P includes an LED and switch available for use in applications.

3 Signal Descriptions

This section describes all of the signals available on the Meridian/P, and includes information on where to find these signals. The major function blocks described are:

- GPIO
- I2C
- SPI
- UARTs (Serial Ports)
- Timers
- SSI
- LCD
- JTAG

3.1 GPIO

The Meridian/P has 27 pins available for use as general purpose I/O pins. 19 of these are labelled as GPIO pins, with the remaining pins part of other functions that are not currently supported by the .NET Micro Framework. All of the following pins are identical and can be configured as inputs, output or interrupt pins using the functions provided by the .NET Micro Framework. Note that GPIO20 is connected to the LED and not available for other functions (unless you want to get fancy with your soldering iron!).

Signal	Location	i.MXS GPIO Port	Cpu.Pin number
GPIO1	EXP2-9 SW1	PB19	51
GPIO2	EXP2-13	PB18	50
GPIO3	EXP1-17	PB17	49
GPIO4	EXP1-21	PB16	48
GPIO5	EXP1-23	PB15	47
GPIO6	EXP2-17	PB14	46
GPIO7	EXP2-21	PB8	40
GPIO8	EXP2-23	PB9	41
GPIO9	EXP1-25	PB10	42
GPIO10	EXP1-14	PB11	43
GPIO11	EXP2-12	PB12	44
GPIO12	EXP2-14	PB13	45
GPIO13	EXP2-25	PA7	7
GPIO14	J2-5	PA8	8
GPIO15	J2-7	PA9	9
GPIO16	J3-32	PA4	4
GPIO17	J3-34	PA5	5
GPIO18	J3-26	PA10	10
GPIO19	J3-38	PA11	11
GPIO20	LED	PA6	6

3.2 I2C

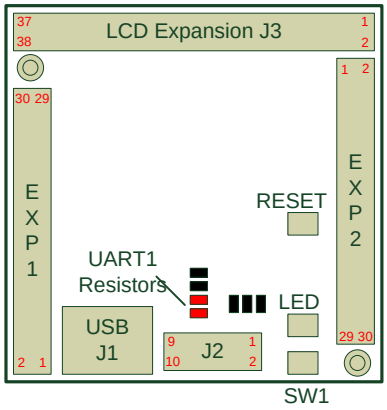
The Meridian/P supports interfacing to devices through the internal I2C bus master. The bus is accessible through the normal .NET Micro Framework I2C Classes or a simplified driver is available as part of the FusionWare::SPOT libraries (www.codeplex.com/FusionWareSPOT).

The base input frequency to the I2C module is 96MHz. The internal divider supports a divisor in the range 22-3840 inclusive to provide a frequency range of 4.36 MHz to 25 kHz
If you request a frequency N, the actual clock frequency will be set to the closest divider frequency that is less than N.

Signal	Location	Description
I2C_SCL	EXP1-22 EXP2-22	This is the I2C Serial clock line used to clock data on the bus. If I2C is not used this pin may be used as a GPIO.
I2C_SDA	EXP1-20 EXP2-20	This is the standard I2C Serial Data line the controller will send/receive data on this line. If I2C is not used this pin may be used as a GPIO

3.3 UARTS

The Meridian/P contains two Universal Asynchronous Receive/Transmitters (UARTs).
The default configuration of UART1 is RS232 levels on the J2 connector. The signals from this port are also available as logic level signals; however you MUST remove 2 resistors from the board in order to use this.



Both UART2 and UART2 are available as standard serial ports (COM1 and COM2) under the .NET Micro Framework. The hardware handshake signals are enabled by selecting that option when setting up the serial port.
Standard baud rates supported are: 230,400bps, 115,200bps, 57,600bps, 38,400bps, 19,200bps, and 9,600bps. Other baud rates are possible (up to 1Mbps), however you should verify the timing as it may not be possible to generate the exact baud rate you require.

Signal	Location	Description
UART1_RXD	J2-4 (RS232) EXP2-28 (Logic)	This is the receive data line for the UART. Data received on this pin is processed by the internal UART and made available to applications through the SerialPort class Read() method.
UART1_TXD	J2-2 (RS232) EXP2-24 (Logic)	This is the transmit data line for the UART. Data is transmitted on this pin when applications call the Write() method of the SerialPort classes.
UART1_RTS	J2-6 (RS232) EXP2-26 (Logic)	Hardware flow control line. This is an INPUT line to the Meridian/P. It is used by a connected device to control the flow of data from the TXD signal.
UART1_CTS	J2-8 (RS232) EXP2-30 (Logic)	Hardware flow control signal. This is an OUTPUT from Meridian/P and is used to signal to a connected device when Meridian/P is ready to receive data.

Signal	Location	Description
UART2_RXD	EXP1-28	This is the receive data line for the UART. Data received on this pin is processed by the internal UART and made available to applications through the SerialPort class Read() method.
UART2_TXD	EXP1-24	This is the transmit data line for the UART. Data is transmitted on this pin when applications call the Write() method of the SerialPort classes.
UART2_RTS	EXP1-26	Hardware flow control line. This is an INPUT line to the Meridian/P. It is used by a connected device to control the flow of data from the TXD signal.
UART2_CTS	EXP1-30	Hardware flow control signal. This is an OUTPUT from Meridian/P and is used to signal to a connected device when Meridian/P is ready to receive data.

3.4 Pulse Width Modulator (PWM)

The Meridian/P includes a Pulse Width Modulator (PWM). The Device Solutions SDK includes a class which provides application level access to the PWM.

Signal	Location	Description
PWM	EXP1-18 EXP2-18	PWM output pin. Application code can set the frequency and duty cycle of the output signal via the Configure() method of the PWM class.

3.5 Serial Peripheral Interface (SPI)

The Meridian/P contains a built in SPI controller that is accessible through the standard Micro Framework class libraries[1]. At this time the .NET Micro Framework only supports SPI in Master mode. There is no support for making a Micro Framework device appear as an SPI slave device.

Signal	Location	Description
SPI_MOSI	EXP1-11 EXP2-11 J3-35	This is the standard Master Out Slave In (MOSI) signal for the SPI bus. Data from the Meridian is sent out on this pin.
SPI_MISO	EXP1-7 EXP2-7 J3-31	This is the standard Master In Slave Out (MISO) signal for the SPI bus. Data sent from the external slave device is received by the Meridian on this pin.
SPI_SCLK	EXP1-15 EXP2-15 J3-37	This is the data clock for the SPI bus. The Meridian supports the following clock rates: 12MHz, 6MHz, 3MHz, 1.5MHz, 750kHz, 375kHz, 187.5kHz, 93.75kHz
SPI_SS	EXP1-13	SPI_SS is the Slave Select (SS) pin (sometimes referred to as a chip select) Any GPIO can be used as a chip select.
SPI_RDY	EXP1-9	This is an optional signal available on many SPI devices, particularly data provider type devices like an A/D converter. It is normally used to signal the master the device has data available. While the Micro Framework libraries do not have any direct support for the SPI RDY signal this pin can be used as a GPIO interrupt to trigger the application or driver code to read data from the device. There are a few SPI devices on the market that support a RDY signal, but

[1] FusionWare::SPOT also includes an excellent SPI class library that is worth taking at look at – www.codeplex.com/FusionWareSPOT.

		multiplex it on the data or clock lines depending on the state of the Slave Select signal. This is NOT directly supported by the Meridian; to use such a device would require additional logic to generate an independent RDY signal that could be connected to this (or any other GPIO line)

3.6 TIMERS

The Meridian contains a number of internal timers that are not currently supported by the Micro Framework or Meridian Specific SDK extensions. These may be supported in a future release. Until then the timer related pins are available as GPIO.

Signal	Location	Description
TIN	EXP1-16	Input signal for a timer. This pin is currently not supported except as a GPIO.
TMR2OUT	EXP2-16	Output clock of an internal timer. This pin is currently not supported except as a GPIO.

3.7 SYNCHRONOUS SERIAL INTERFACE (SSI)

The Meridian/P hardware supports a Synchronous Serial Interface; however, the .NET Micro Framework currently has no support for either interface. Thus, the SSI pins are all available for use as GPIO only at this time.

Signal	Location
SSI_TXCLK	EXP1-2
SSI_TXFS	EXP1-4
SSI_TXDAT	EXP1-6
SSI_RXDAT	EXP1-8
SSI_RXCLK	EXP1-10
SSI_RXFS	EXP1-12

3.8 LCD CONTROLLER

The Meridian/P contains an LCD controller suitable for many small LCD panels used for .NET Micro Framework based devices.
For detailed signal descriptions and timing information please refer to the Freescale i.MXS Reference Manual.

3.9 RESET

There are two reset signals on the Meridian/P.

Signal	Location	Description
MODULE_RESET	EXP1-29 EXP2-29 RESET SWITCH	This signal will reset the Meridian/P. It can be activated by pressing the onboard switch, or by activating it via the EXP connectors.
RESET_OUT	EXP1-27 EXP2-27	This signal is output from the Meridian/P when it is performing a reset, and can be used to reset external devices.

3.10 JTAG

The JTAG signals connect directly to the i.MXS processor and can be used for production programming or download and debugging of firmware when used in conjunction with the porting kit. (USB is the recommended way of debugging applications).
Device Solutions can supply an adapter to convert EXP2 into a standard 20-pin ARM JTAG connector.

Signal	Location
TMS	EXP2-2
TCK	EXP2-4
TDI	EXP2-6
TDO	EXP2-8
TRST	EXP2-10

4 Connector Reference

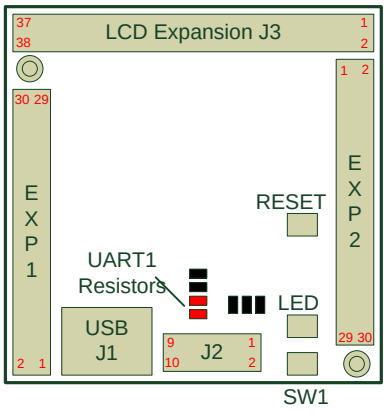
This section is a reference for all the connectors on the Meridian/P. It includes:

- A summary of all connectors
- Pin-out and part number details for each connector

4.1 Connector Summary

There are 4 main expansion connectors on the Meridian/P. These are setup to take a 0.1" pin header which can be soldered in from the top or bottom of the board. The other connector on Meridian/P is the USB mini-B connector which is used to power the board and download/debug applications.
The table below summarizes the connectors and switches found on Meridian/P, and the illustration on the right shows their location looking down on the top of the board.

Designator	Connector
J1	USB Function (Mini-B)
J2	Serial and Boot-Mode
J3	LCD Expansion
EXP1	30-way expansion 1
EXP2	30-way expansion 2
RESET	Manual reset switch
SW1	User push-button
LED	User LED



4.2 Connector Details

4.2.1 Serial and Boot-Mode Header (J2)

Pin	Signal	Pin	Signal
1	+5V	**2**	TXD
3	+3.3V	**4**	RXD
5	GPIO14	**6**	RTS
7	GPIO15	**8**	CTS
9	0V	**10**	BOOT-MODE

4.2.2 LCD Expansion (J3)

Pin	Signal	Pin	Signal
1	+5V	**2**	VSYNC
3	+3.3V	**4**	CONTRAST
5	0V	**6**	CLS
7	LCDD10	**8**	REV
9	LCDD11	**10**	PS
11	LCDD12	**12**	SPL_SPR

13	LCDD13	**14**	ADC/OE
15	LCDD14	**16**	LSCLK
17	LCDD15	**18**	HSYNC
19	0V	**20**	0V
21	LCDD5	**22**	LCDD0
23	LCDD6	**24**	LCDD1
25	LCDD7	**26**	LCDD2
27	LCDD8	**28**	LCDD3
29	LCDD9	**30**	LCDD4
31	SPI_MISO*	**32**	GPIO16
33	SPI_RDY*	**34**	GPIO17
35	SPI_MOSI*	**36**	GPIO18
37	SPI_SCLK*	**38**	GPIO19

*Note that the SPI signals on this connector are the same as those on EXP1 and EXP2.

4.2.3 Expansion Headers (EXP1 and EXP2)

The Meridian/P expansion connectors are identical to the expansion connectors on the Tahoe-II board. Both connectors have a similar pin-out, allowing some expansion boards to operate in either position (with a few software modifications). This allows flexibility in creating these boards.
Each expansion header includes:

- Power
- SPI
- I2C
- GPIO
- UART
- PWM

The complete pin-out for each connector is shown below. Each pin is also marked on the Tahoe-II board for easy reference; however you should always check the exact specification of the pin here before connecting to it. These specifications can be found in the Meridian Technical Reference Manual.
Note that the SPI, I2C and PWM signals and the same signals routed to both connectors, not 2 different instances of these functions.

EXP1

Pin	Signal	Pin	Signal
1	+5V	2	SSI-TXCLK
3	+3.3V	4	SSI-TXFS
5	0V	6	SSI-TXDAT
7	SPI-MISO	8	SSI-RXDAT
9	SPI-RDY	10	SSI-RXCLK
11	SPI-MOSI	12	SSI-RXFS
13	SPI-SS	14	GPIO10
15	SPI-CLK	16	TIN
17	GPIO3	18	PWM
19	+3.3V	20	I2C-SDA
21	GPIO4	22	I2C-SCL
23	GPIO5	24	UART2-TXD
25	GPIO9	26	UART2-RTS

EXP2

Pin	Signal	Pin	Signal
1	+5V	2	TMS
3	+3.3V	4	TCK
5	0V	6	TDI
7	SPI-MISO	8	TDO
9	GPIO1	10	TRST
11	SPI-MOSI	12	GPIO11
13	GPIO2	14	GPIO12
15	SPI-CLK	16	TMR2OUT
17	GPIO6	18	PWM
19	+3.3V	20	I2C-SDA
21	GPIO7	22	I2C-SCL
23	GPIO8	24	UART1-TXD
25	GPIO13	26	UART1-RTS

27	RESET_OUT	28	UART2-RXD
29	MOD_RESET	30	UART2-CTS

27	RESET_OUT	28	UART1-RXD
29	MOD_RESET	30	UART1-CTS

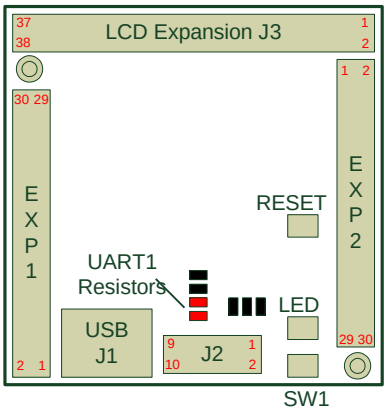
To create an expansion board that will work in either expansion slot, you should design your board to only use the signals shown below.

Pin	Signal	Pin	Signal
1	+5V	2	
3	+3.3V	4	
5	0V	6	
7	SPI-MISO	8	
9	SPI-Interrupt	10	
11	SPI-MOSI	12	
13	SPI-Chip Select	14	GPIO-D
15	SPI-CLK	16	
17	GPIO	18	PWM
19	+3.3V	20	I2C-SDA
21	GPIO-A	22	I2C-SCL
23	GPIO-B	24	UART-TXD
25	GPIO-C	26	UART-RTS
27	RESET_OUT	28	UART-RXD
29	MOD_RESET	30	UART-CTS

5 Connector Quick Reference

SPI_SCLK	SPI_MOSI	SPI_RDY	SPI_MISO	LCDD9	LCDD8	LCDD7	LCDD6	LCDD5	0V	LCDD15	LCDD14	LCDD13	LCDD12	LCDD11	LCDD10	0V	+3.3V	+5V
37	35	33	31	29	27	25	23	21	19	17	15	13	11	9	7	5	3	1
38	36	34	32	30	28	26	24	22	20	18	16	14	12	10	8	6	4	2
GPIO19	GPIO18	GPIO17	GPIO16	LCDD4	LCDD3	LCDD2	LCDD1	LCDD0	0V	HSYNC	LSCLK	ADC/OE	SPL_SPR	PS	REV	CLS	CONTRAST	VSYNC

UART2-CTS	30	29	MOD_RESET
UART2-RXD	28	27	RESET_OUT
UART2-RTS	26	25	GPIO9
UART2-TXD	24	23	GPIO5
I2C-SCL	22	21	GPIO4
I2C-SDA	20	19	+3.3V
PWM	18	17	GPIO3
TIN	16	15	SPI-CLK
GPIO10	14	13	SPI-SS
SSI-RXFS	12	11	SPI-MOSI
SSI-RXCLK	10	9	SPI-RDY
SSI-RXDAT	8	7	SPI-MISO
SSI-TXDAT	6	5	0V
SSI-TXFS	4	3	+3.3V
SSI-TXCLK	2	1	+5V



+5V	1	2	TMS
+3.3V	3	4	TCK
0V	5	6	TDI
SPI-MISO	7	8	TDO
GPIO1	9	10	TRST
SPI-MOSI	11	12	GPIO11
GPIO2	13	14	GPIO12
SPI-CLK	15	16	TMR2OUT
GPIO6	17	18	PWM
+3.3V	19	20	I2C-SDA
GPIO7	21	22	I2C-SCL
GPIO8	23	24	UART1-TXD
GPIO13	25	26	UART1-RTS
RESET_OUT	27	28	UART1-RXD
MOD_RESET	29	30	UART1-CTS

0V	GPIO15	GPIO14	+3.3V	+5V	
9	7	5	3	1	
10	8	6	4	2	
BOOT-MODE	CTS	RTS	RXD	TXD	

6 Specifications

6.1 TECHNICAL SPECIFICATIONS

Absolute Maximum Input Voltage	• -0.3 V to 6 V
Operating Input Voltage	When powered via 5V signal (or USB function): • 4.3 to 6V When powered via 3.3V signal: • 3.1V to 3.3V
I/O pin max voltage	• 3.3V
Operating Temperature	• 0 to 70˚C
Typical Power Consumption	• 5mA (5V power supply) • 2.6mA (3.3V power supply)
RoHS Compliance	• RoHS compliant