Contents

About This Guide ..... **v**

Purpose v

Related documentation v

Kits v

Chapter 1: About the Digi Connect EM **7**

Overview 7

Support information 8

Types of modules 9

Choosing a module for your product 9

Models 55001064-01 and 55001064-02 dimensions 10

Models 55001064-01 and 55001064-02 recommended PCB layout 11

Model 55001064-03 dimensions 12

Model 55001064-03 recommended PCB layout 13

Connectors: power and serial interface (P4) 14

Connectors: Ethernet interface 15

Reset switch 16

LEDs 17

Digi Connect EM Pin Headers 18

Chapter 2: About the Development Board **19**

Overview 19

Basic description 20

Ports 21

Connectors and blocks 23

Power jack (P17) 29

Switches 30

LEDs 33

Test points 35

Chapter 3: Programming Considerations 37

GPIO 37
LEDs 42
Reset 43
Flash 44

Appendix A: Sample Application: TTL Signals to EIA-232 47

Appendix B: Digi Connect EM Specifications 49

Network interfaces 49
Serial interface 49
Data rates (bps) 49
Flow control options 50
Environmental 50
DC characteristics 50
Mechanical 51

Appendix C: Certifications 53

FCC Part 15 Class B 53
Industry Canada 54
Declaration of Conformity 55
International EMC standards 56
Safety standards 56

About This Guide

Purpose

The purpose of this guide is to assist developers integrating the Digi Connect EM module into other devices.

Related documentation

See the *NS 7520 Hardware Reference* for information on the NS 7520 chip.

Kits

This manual is intended for customers who use either the Digi Connect EM Integration Kit or the Digi Connect EM Development Kit, which are described below.

About the integration kit

The integration kit is the ideal platform for product evaluation, rapid prototyping, and integration of the Digi Connect EM embedded device server. Targeted specifically at customers who want to take advantage of the Digi Connect EM embedded device server with Digi plug-and-play firmware functionality, it enables integration of the Digi Connect EM embedded module without any extensive embedded software development with all the additional flexibility and benefits of web user interface customization and application specific java applets. Included in the Digi Connect EM Integration Kit is a complete development board with EIA-232 serial ports, signal status indicators, logic analyzer connectors, test points, and a self-contained GPIO test bed. It also includes cables, power

supply, sample code, tools and utilities with source code and libraries, Microsoft Windows RealPort drivers, and full software and hardware documentation.

About the Development Kit

The Digi Connect EM Development Kit is an easy-to-use and royalty-free development platform that significantly reduces traditional design risk and accelerates the overall software development process. It delivers the integrated building blocks to quickly and cost effectively create your own custom firmware for a Digi Connect EM based high-performance networking solution that fits the specific requirements of your application.

Based on the NET+Works family of platform solutions, the Digi Connect EM development Kit enables you to integrate custom network connectivity into your products quickly by providing a full suite of development tools, a development board, cables, power supply, hardware debugger, a royalty-free runtime environment, and a complete set of networking protocols and applications software.

About the Digi Connect EM

CHAPTER 1

Overview

Digi Connect EM overview

The Digi Connect EM is part of the Digi Connect family of device servers that provide simple, reliable and cost-effective network connections for serial devices. The Digi Connect EM provides fully transparent serial device connectivity over industry-standard Ethernet connections and allows both equipment manufacturers and systems integrators to network-enable products at a fraction of the time and cost required to develop a custom solution. It is a highly flexible and compact single component solution with a robust on-board TCP/IP stack and 10/100 Base-T Ethernet support.

From medical systems to building control and industrial automation, in virtually any application where embedded serial connectivity over Ethernet is needed, the Digi Connect EM is the ideal choice, delivering high-performance functionality.

Cautions

- To guard against damage to the Digi Connect EM due to electrostatic discharge (ESD), do not remove it from its protective packaging until you have been properly grounded. To ground yourself, put the wrist strap on (included in the package) and then attach the clip to a metal surface.
- Input voltage for the Digi Connect EM is 3.3 VDC.

Support information

To get help with a question or technical problem or make comments and recommendations about Digi products and documentation, use the following contact information.

General

Digi International
11001 Bren Road East
Minnetonka, MN 55343
U.S.A.
www.digi.com

Customer Service and Support

United States: 1 877-912-3444

Other Locations: 1 952-912-3444

support.digi.com

Types of modules

The following describes the three types of Digi Connect EM modules:

Model	Description
55001064-01	■ Ships with the development kit ■ Includes JTAG interface ■ Provides pin headers for Ethernet and LED connections ■ Contact Digi for order information
55001064-02	■ Ships with the integration kit ■ Does not include JTAG interface ■ Provides pin headers for Ethernet and LED connections ■ Order part number DC-EM-02T-NC
55001064-03	■ Ordered separately ■ Does not include JTAG interface ■ RJ-45 Ethernet connector and LED array instead of pin headers ■ Order part number DC-EM-02T

Types of Modules

Choosing a module for your product

Although any of the Digi Connect EM modules can be designed into your product, a JTAG header would typically be used only for debugging during the development process. The 55001064-03 module is appropriate when its integrated LEDs and RJ-45 Ethernet connectors are accessible and visible to the end-users of your product. The 55001064-02 module is the right choice when you want more control over RJ-45 Ethernet connector and LED locations or when you will provide custom connectors or indicators.

Please refer to the Digi website for part number and ordering information for the Digi Connect EM modules.

Models 55001064-01 and 55001064-02 dimensions

Note All dimensions are in inches.

55001064-01 and 55001064-02 Dimensions: Top

55001064-01 and 55001064-02 Dimensions: Front

55001064-01 and 55001064-02 Dimensions: Bottom

Models 55001064-01 and 55001064-02 recommended PCB layout

Note All dimensions are in inches.

55001064-01 and 55001064-02 Recommended PCB Layout

Model 55001064-03 dimensions

Note All dimensions are in inches.

55001064-03 Dimensions: Top

55001064-03 Dimensions: Front

55001064-03 Dimensions: Bottom

Model 55001064-03 recommended PCB layout

Note All dimensions are in inches.

55001064-03 Recommended PCB Layout

Connectors: power and serial interface (P4)

This single 12-pin, serial interface port (labeled P4) supports EIA-232 (TTL levels only), data rates to 230 Kbps and full-modem control. See the figure for help locating pins and the table for pin assignments.

Power and Serial Interface (P4)

Pin	Signal Name	Description and Notes
1	VCC	+3.3 VDC (input only)
2	GND	Reference Ground for input power
3	RXD/GPIO-7	Port 1 RXD (input)/GPIO-7
4	TXD/GPIO-6	Port 1 TXD (output)/GPIO-6
5	RTS/GPIO-4/SPI_CLK	Port 1 RTS/GPIO-4/SPI clock
6	DTR/GPIO-5	Port 1 DTR (output)/GPIO-5
7	CTS/GPIO-2	Port 1 CTS (input)/GPIO-2
8	DCD/GPIO-1/SPI_EN	Port 1 DCD (input)/GPIO-1/SPI enable
9	DSR/GPIO-3	Port 1 DSR (input)/GPIO-3
10	/RST	Reset (input)
11	RXD/GPIO-9	Port 2 RXD (input)/GPIO-9
12	TXD/GPIO-8	Port 2 TXD (output)/GPIO-8

Power and Serial Interface Pin Assignments

Connectors: Ethernet interface

The Digi Connect EM provides two Ethernet options. Model 55001064-03 has an eight-wire RJ-45 connector (labeled P1) that meets the requirements of ISO 8877 for 10/100Base-T. Models 55001064-01 and 55001064-02 provide a pin header interface. See the following table for pin assignments.

Pin	Signal Name	Pin	Signal Name
1	TXD+ (Transmit Data)	5	Not used
2	TXD- (Transmit Data)	6	RXD- (Receive Data)
3	RXD+ (Receive Data)	7	Not used
4	Not used	8	Not used

RJ-45 Ethernet interface

Pin	Signal Name
1	TXD+ (Transmit Data)
2	TXD- (Transmit Data)
3	RXD+ (Receive Data)
4	RXD- (Receive Data)

Pin header Ethernet interface

For a diagram of the Ethernet pin header location and assignments see "Digi Connect EM Pin Headers" on page 18b

Reset switch

The behavior of the reset switch is determined by software, which means that it has a predefined behavior in the integration kit. In the development kit, its behavior is determined by your implementation. See the following table for details.

Kit	Behavior
Integration	The reset switch does one of the following: ■ If pressed and released immediately, the device is rebooted. ■ If pressed and held down (for about 20 seconds) during power-up, the device is rebooted and restored to the default configuration.
Development	■ The behavior of the switch is user-defined. See "Reset" on page 43 for more information.

Reset Switch Behavior

LEDs

The Digi Connect EM provides two hardware options for LEDs. Model 55001064-03 comes with a bank of four LEDs. Models 55001064-01 and 55001064-02 provide a pin header interface. The integration kit provides predefined LED behavior. With the development kit, some LED behavior can be determined by your implementation. See the following table for more information.

LED Option		Integration Kit	Development Kit
LED	**Pin Header**		
Top left (green)	1 (+) 3 (-)	Serial port activity: ■ Off means that the serial channel is idle. ■ Blinking indicates an active connection.	This LED is software programmable
Top right (green)	5 (+) 7 (-)	Network link status: ■ Off means that no link has been detected. ■ On means that a link has been detected.	Same as Integration Kit (Network link status)
Bottom left (red)	2 (+) 4 (-)	Diagnostics: ■ Blinking 1-1-1 means starting the operating system. ■ Blinking 1-5-1 means configuration has been returned to factory defaults. **Note:** If other blinking patterns occur, contact Digi Technical Support.	This LED is software programmable
Bottom right (yellow)	6 (+) 8 (-)	Reserved	This LED is software programmable

LED Behavior

Digi Connect EM Pin Headers

About the Development Board

CHAPTER 2

Overview

This chapter provides information on the development board, a hardware platform from which you can determine how to integrate the Digi Connect EM into your design. For additional information, see the schematic and mechanical drawings. If you have installed the development kit or integration kit, you can access the schematic from the Start menu.

Basic description

Use the following figure to locate components on the development board.

Basic Description

Ports

The development board provides the following ports:

- Serial port 1 (P1) and serial port 2 (P2)
- Ethernet port (P12)
- GPIO port (P3)

Serial port 1 (P1) and serial port 2 (P2)

Serial port 1 and port 2 are DB-9 male connectors labeled P1 and P2. Use the following figure and table for pin orientation and pin assignment information.

Serial Port Pin Orientation

Port	Pin	Signal	Port	Pin	Signal
1	1	DCD	2	1	Not connected
	2	RXD		2	RXD
	3	TXD		3	TXD
	4	DTR		4	Not connected
	5	GND		5	GND
	6	DSR		6	Not connected
	7	RTS		7	Not connected
	8	CTS		8	Not connected
	9	Not connected		9	Not connected

Serial Port Pin Assignments

Ethernet port (P12)

The Ethernet port (labeled P12) is an 8-pin RJ-45 jack meeting the requirements of ISO 8877 for 10/100Base-T. When two descriptions are shown for a pin, the second is for use with 802.3af powered Ethernet.

Pin	Signal Name	Pin	Signal Name
1	TXD+ (Transmit Data)	5	Not used / 802.3af power (+)
2	TXD- (Transmit Data)	6	RXD- (Receive Data)
3	RXD+ (Receive Data)	7	Not used / 802.3af power (-)
4	Not used / 802.3af power (+)	8	Not used / 802.3af power (-)

For additional information about the 802.3af standard, refer to the corresponding IEEE specification.

The Digi Connect EM development board provides a reference design of an 802.3af power supply. A schematic for this reference design is installed by the setup program on the CD.

GPIO port (P3)

The GPIO port is a 10-pin male right-angle connector (labeled P3). See the following figure and table for pin orientation and pin assignments.

GPIO Port Pin Orientation

Pin	Signal Name	Pin	Signal Name
1	GND	6	GPIO-5
2	GPIO-9	7	GPIO-4
3	GPIO-8	8	GPIO-3
4	GPIO-7	9	GPIO-2
5	GPIO-6	10	GPIO-1

GPIO Port Pin Assignments

Connectors and blocks

The development board provides the following connectors and blocks:

- JTAG debugger connector (P4)
- SPI connector (P11) and SPI jumper block
- Logical signal analyzer header (P6)
- Digi Connect EM main connector (P8)

JTAG debugger connector (P4)

This 14-pin male vertical header labeled P4 mates with a JTAG debugger plug (for example, a Macraigor Raven). It is used with the development kit only. See the following figure and table for pin orientation and assignments.

JTAG Debugger Connector Pin Orientation

Pin	Signal	Pin	Signal
1	VCC+	8	GND
2	GND	9	TCK
3	/TRST	10	GND
4	GND	11	TDO
5	TDI	12	/SRST
6	GND	13	VCC+
7	TMS	14	GND

JTAG Debugger Connector Pin Assignments

SPI connector (P11)

This connector is used for a Serial Peripheral Interface (SPI) connection. When enabled, signals are disconnected from serial port 1 and GPIO connectors. See the following figure and table for pin orientation and pin assignments.

SPI Connector Pin Orientation

Pin	Signal	Pin	Signal
1	SPI_EN	5	SPI_TX
2	GND	6	GND
3	SPI_CLK	7	SPI_RX
4	GND	8	GND
9	Not connected	10	Not connected

SPI Pin Assignments

SPI jumper block

The SPI jumper block determines whether the SPI connector is connected or not. If SPI is off (the default), serial and GPIO signals are routed to switch banks 1 through 4. (See "Serial/GPIO switch bank 3 (SW3) and switch bank 4 (SW4)" on page 31 and "GPIO switch bank 1 (SW1) and 2 (SW2)" on page 32.) If SPI is on, SPI signals are routed to the SPI connector (P11).

The following figures demonstrate how to set the SPI jumper block.

SPI Off **SPI On**

SPI Jumper Settings

Logical signal analyzer header (P6)

This 20-pin male vertical header (labeled P6) connects a digital signal analyzer (for example, a logic analyzer) to the development board. It is used with the development kit only. See the following figure and table for pin orientation and pin assignments.

Logical Signal Analyzer Header Pin Orientation

Pin	Signal	Pin	Signal
1	Not connected	11	DTR/GPIO-5
2	Not connected	12	TXD-2/GPIO-8
3	Not connected	13	CTS/GPIO-2
4	Not connected	14	RXD-2/GPIO-9
5	Not connected	15	DSR/GPIO-3
6	Not connected	16	TXD-1/GPIO-6
7	Not connected	17	RTS/GPIO-4/SPI_CLK
8	Not connected	18	RXD-1/GPIO-7
9	/RST	19	DCD/GPIO-1/SPI_EN
10	Not connected	20	GND

Logical Signal Analyzer Header Pin Assignments

Digi Connect EM main connector (P8)

This 12-pin connector is used to interface with the Digi Connect EM. See the following figure for pin orientation.

Digi Connect EM Main Connector Pin Orientation

Power jack (P17)

The Power Jack is a barrel connector that accepts 9 to 30 VDC +/- 5%. The jack is labeled P17. The following table shows the polarity of the power jack.

Contact	Polarity
Center	+9 to +30 VDC
Outer	Ground

Power Jack Polarity

The following figure schematically represents the polarity of the power jack.

Power Jack Polarity Schematic

Switches

The development board provides the following switches:

- Reset switch (SW5)
- Serial/GPIO switch bank 3 (SW3) and switch bank 4 (SW4)
- GPIO switch bank 1 (SW1) and 2 (SW2)

Reset switch (SW5)

This push button switch is labeled SW5. Pressing it sets the module's /RST line low, holding the module in a hard reset until the switch is released.

Note: This is a "hard" reset using the /RST pin on the main connector, not a "soft" reset. The reset button on the Connect EM module performs a "soft" reset (see also "Digi Connect EM main connector (P8)" on page 28).

Serial/GPIO switch bank 3 (SW3) and switch bank 4 (SW4)

Each switch bank holds five slide switches that enable either serial or GPIO signaling between the development board and the module. When set for GPIO signaling, SW3 works in conjunction with SW1, and SW4 works with SW2. See "GPIO switch bank 1 (SW1) and 2 (SW2)" on page 32 for more information. See the following table for SW3 and SW4 switch definitions.

Note: These switches control where the development board routes a signal. They do not reconfigure the NS7520 processor. Software should be configured to track with switch settings. See "GPIO" on page 37 for more information.

Switch Bank	Switch Number	Left Position	Right Position
SW3	1	DCD	GPIO-1
	2	CTS	GPIO-2
	3	DSR	GPIO-3
	4	RTS	GPIO-4
	5	DTR	GPIO-5
SW4	6	TXD-1	GPIO-6
	7	RXD-1	GPIO-7
	8	TXD-2	GPIO-8
	9	RXD-2	GPIO-9
	10	Not connected	Not connected

GPIO Switch Banks 3 and 4 Settings

GPIO switch bank 1 (SW1) and 2 (SW2)

GPIO Switch Bank 1 and Switch Bank 2, labeled SW1 and SW2, are two sets of five slide switches that set GPIO inputs to logic levels of high (switch to left) or low (switch to right).

If the GPIO port is configured as an output, then the switch should always be to the left. If there is an external device connected to P3, the switch should always be set to the left.

Each GPIO port can be used independently.

Notes:

- These switches do not determine whether the GPIO is an input or output. That is determined by the module software.
- If GPIO is set to an output by software, switches must be set to the left (high).
- These switches are used in conjunction with SW3 and SW4.

LEDs

The development board contains 21 LEDs labeled CR1 through CR21. The following table lists and describes the LEDs.

Board Label	Description	Color or State	Indication
CR1	TXD-2	Flickering	Serial activity
		Green	Inactive
CR2	RXD-2	Flickering	Serial activity
		Green	Inactive
CR3	CTS	Yellow	Active
		Green	Inactive
		Off	Not connected or signal not being driven
CR4	DTR	Yellow	Active
		Green	Inactive
		Off	Not connected or signal not being driven
CR5	TXD-1	Flickering	Serial activity
		Green	Inactive
CR6	RXD-1	Flickering	Serial activity
		Green	Inactive

Board Label	Description	Color or State	Indication
CR7	RTS	Yellow	Active
		Green	Inactive
		Off	Not connected or signal not being driven
CR8	DCD	Yellow	Active
		Green	Inactive
		Off	Not connected or signal not being driven
CR9	DSR	Yellow	Active
		Green	Inactive
		Off	Not connected or signal not being driven
CR10 -18	GPIO-1through GPIO-9. (CR10 =GPIO-1, CR11=GPIO-2, etc. All can be used for input or output.)	On	Logic high
		Off	Logic low
CR20	3.3V Indicator	On	Power on
		Off	Power off
CR21	EPWR, Powered Ethernet Enabled	On	Ethernet power present from external powered Ethernet connector (Ethernet hub or switch)
		Off	No powered Ethernet voltage

LED Descriptions

Test points

The development board provides 25 test points that can be identified by board label or test point number. The board labels are adjacent to each test point on the board. The test point numbers are in the development board schematic drawings. The following table lists the test point number, board label, and a brief description of each test point.

Test Point	Board Label	Description	Test Point	Board Label	Description
TP2	TXD	TXD-2	TP15	IO-5	GPIO-5
TP3	RXD	RXD-2	TP17	3.3V	3.3V Supply
TP4	CTS	CTS	TP20	RESET	Reset (active low)
TP5	DTR	DTR	TP21	E+	Ethernet Power +
TP6	TXD	TXD-1	TP22	E-	Ethernet Power -
TP7	RXD	RXD-1	TP23	V-IN	9-30 VDC Input
TP8	RTS	RTS	TP24	GND	Ground
TP9	DCD	DCD	TP25	GND	Ground
TP10	DSR	DSR	TP26	IO-8	GPIO-8
TP11	IO-1	GPIO-1	TP27	IO-7	GPIO-7
TP12	IO-2	GPIO-2	TP28	IO-6	GPIO-6
TP13	IO-3	GPIO-3	TP29	IO-9	GPIO-9
TP14	IO-4	GPIO-4			

Test Point Descriptions

Programming Considerations

CHAPTER 3

This chapter addresses Digi Connect EM programming considerations.

Note This chapter applies only to development kit customers.

GPIO

General information

The NS7520 processor supports 16 general purpose I/O (GPIO) lines, some of which are reserved for specific functions and some of which can be customized. These GPIO lines fall into three categories:

- Those labeled “Reserved” in the following table are reserved for a specific use and must not be reprogrammed, or the unit may not operate correctly. Often, these lines are not connected to external interfaces.
- Those labeled “Allocated” in the following table are exposed to an external interface and allocated to a specific use by the software, but they can be customized safely with code modifications.
- Those labeled “Available” are exposed to an external interface, not controlled directly by the software, and can be customized.

GPIO registers

Two registers, PORTA and PORTC, govern the 16 GPIO pins. Each is responsible for eight GPIO pins, and each pin has four bits that completely describe its behavior. The four bits that describe the GPIO behavior are its mode (CMODE), direction (CDIR), special function (CSF--only applicable to PORTC), and data value. The first three bits describe the functionality of the GPIO pin. The "data" bit provides the current value of the pin when read and allows control of the value of an output pin when written. Use the following table for information on configuring a bit position in the appropriate register for GPIO input or output.

To configure a GPIO Pin for ...	
Input	**Output**
■ CMODE = 0 ■ CDIR = 0 ■ CSF = 0	■ CMODE = 0 ■ CDIR = 1 ■ CSF = 0

Configuring a GPIO Pin for Input and Output

Since each register controls 8 GPIO lines, it is safest to read the full 32 bit register, modify the bits corresponding to the GPIO line of interest, and then write the full 32 bits back. In this way, the behavior of the other GPIO lines will be preserved.

For more information regarding the format and programming of the GPIO registers, see the *NS7520 Hardware Reference*.

Digi Connect EM GPIO pin use

Name	Register Bit	Category	External Interface	Description
TXD/ GPIO-6	PORTA7	Allocated	Pin 4 on the header	Used for port 1 serial transmit but can be reassigned as GPIO input or output. If used with the development board, this pin maps to GPIO-6.
DTR/ GPIO-5	PORTA6	Allocated	Pin 6 on the header	Used for the port 1 serial DTR signal but can be reassigned as GPIO input or output. If used with the development board, this pin maps to GPIO-5.
See the description .	PORTA5, PORTA4	Allocated	Pin 5 on the header	Since these two processor pins map to the same header pin, one must be configured as an input to avoid contention. Under normal serial conditions, PORTA5 is configured to deliver the port 1 RTS signal and PORTA4 for GPIO input. To use the port for SPI, configure PORTA5 for GPIO input and PORTA4 to deliver SPI clock. When used with the development board, header pin 5 maps to GPIO-4.
RXD/ GPIO-7	PORTA3	Allocated	Pin 3 on the header	Used for port 1 serial receive but can be reassigned as GPIO input or output. If used with the development board, this pin maps to GPIO-7.

GPIO Pin Use

Name	Register Bit	Category	External Interface	Description
DSR/ GPIO-3	PORTA2	Allocated	Pin 9 on the header	Used for the port1 serial DSR signal but can be reassigned as GPIO input or output. If used with the development board, this pin maps to GPIO-3.
CTS/ GPIO-2	PORTA1	Allocated	Pin 7 on the header	Used for the port 1 serial CTS signal but can be reassigned as GPIO input or output. If used with the development board, this pin maps to GPIO-2.
DCD/ GPIO-1	PORTA0	Allocated	Pin 8 on the header	Used for the port 1 serial DCD signal but can be reassigned as GPIO input or output. If used with the development board, this pin maps to GPIO-1.
TXD2/ GPIO-8	PORTC7	Allocated	Pin 12 on the header	Used for port 2 serial transmit but can be reassigned as GPIO input or output. If used with the development board, this pin maps to GPIO-8.
Power indicator LED	PORTC6	Allocated	Connected to the red LED	Used as the power indicator (always on) but can be reassigned as a general purpose LED. It must remain a GPIO output for the LED to operate correctly. This LED is lit when the signal is low.
/INIT	PORTC5	Available	Connected to the button on the module	Should be configured as a GPIO input.

GPIO Pin Use

Name	Register Bit	Category	External Interface	Description
Green LED	PORTC4	Allocated	Connected to the green LED (the one above the red LED)	Used as the NET+OS green LED but can be reassigned as a general purpose LED. It must remain a GPIO output for the LED to operate correctly. The LED is lit when the signal is low.
RXD2/ GPIO-9	PORTC3	Allocated	Pin 11 on the header	Used for port 2 serial receive but can be reassigned as GPIO input or output. If used with the development board, this pin maps to GPIO-9.
Yellow LED	PORTC2	Allocated	Connected to the yellow LED	Used as the NET+OS yellow LED but can be reassigned as a general purpose LED. It must remain a GPIO output for the LED to operate correctly. The LED is lit when the signal is a low.
	PORTC1-PORTC0	Reserved	NA	NA

GPIO Pin Use

LEDs

General information

The Digi Connect EM has two types of LEDs:

- LEDs connected directly to GPIO pins on the processor and controlled directly in software
- LEDs connected to other hardware components (Ethernet hardware) and not directly programmable by the operating system

For information on LED control, see the *NET+Works BSP Porting Guide*.

About Digi Connect EM LEDs

LED	Description
Green (above yellow LED)	This LED is wired to the Ethernet hardware and provides an indication of link.
Green (the one above the red LED)	This LED is software programmable and is wired to processor GPIO register bit PORTC4 and wired to be lit when low.
Yellow	This LED is software programmable, wired to processor GPIO register bit PORTC2, and wired to be lit when low.
Red	This LED is software programmable, wired to processor GPIO register bit PORTC6, and wired to be lit when low.The default is that this LED indicates power (and is therefore always on).

LEDs

Reset

Hard reset

The Digi Connect EM supports a hardware reset on pin 10 of the 12-pin header. The unit will be forced into a hard reset if this pin is pulled low. When used with the development board, this pin is wired to reset button SW5, which means it acts as a hard reset button.

Characteristic	Specification
Delay	200 milliseconds (typical)
Threshold	2.93 V
Minimum Hold Time	1 microsecond pulse

Reset Characteristics

Soft reset

NET+OS provides an internal facility to enact a soft reset, but it is the responsibility of a specific implementation to choose a reasonable trigger to invoke it. One choice is to use a GPIO pin as a signal to trigger a soft reset. The Digi Connect ME has one GPIO pin (PORTC5) which is not normally assigned to any other task named "/INIT." It is an ideal candidate for use as a signal for soft reset. The signal is wired to the push button on the module (next to the LEDs), and is pulled high unless the button is pushed.

The "naresetapp" sample application demonstrates a simple mechanism for monitoring a GPIO pin and then initiating a soft reset when the pin achieves a particular value.

Flash

General Information

Logical regions within flash are assigned to particular uses. As a result, its use for general purposes in development kit applications is limited. In particular, the flash file system region can be used for general purposes if the BSP is not configured to create the flash files system, and all but the first sector of the NVRAM region can be used since the NET+OS NVRAM parameters easily fit into one sector. See the table that follows for specific information.

Note: The Boot, POST, and Reserved sections should not be touched.

Digi Connect EM has 4 MB of flash memory, which is controlled by chip select 0, located at 0x02000000.

Region	Sector	Size
Boot	0 - 8	128K
POST	9 - 10	128K
Image	11 - 47	2369K
NVRAM	48 - 53	384K
File system	54 - 69	1M
Reserved	70	64K

Flash Mappings

Memory

Digi Connect EM has 8 MB of SDRAM memory, which is controlled by chip select 1, located at 0x00000000 in the processor address space and aliased at 0x04000000 and 0x08000000. The application program (EOS) is loaded at address 0x08080000.

Sample Application: TTL Signals to EIA-232

A P P E N D I X A

The following figure is an example of how to convert the Digi Connect EM signals to normal serial voltage levels.

RS-232 SERIAL 9-PIN CONNECTOR
P1
DB9
DCD
RXD
TXD
DTR
DSR
RTS
CTS
SHIELD
SHIELD
GND
232OUT
C3
0.1uF
C5
0.1uF
+5V
U1
RS-232 LINE REC/VR 5RX 4TX
V+
V-
C1+
C1-
C2+
C2-
RIN1
RIN2
RIN3
RIN4
RIN5
ROUT1
ROUT2
ROUT3
ROUT4
ROUT5
TOUT1
TOUT2
TOUT3
TOUT4
TIN1
TIN2
TIN3
TIN4
SD
EN
ADM211E
C6
0.1uF
C4
0.1uF
RXDTTL
CTSTTL
DSRTTL
DCDTTL
TXDTTL
RTSTTL
DTRTTL
232TTL
+5V
P6
DIGI ONE EM CONNECTOR
SOCKET 2X6
RESET
SW1
RESET SWITCH

Digi Connect EM Specifications

A P P E N D I X B

Network interfaces

- RJ-45 connector
- 10/100Base-T
- Half- and full-duplex support

Serial interface

Two serial ports, one with full modem control signals and the other with TXD and RXD only.

Data rates (bps)

50, 110, 134, 150, 200, 300, 600, 1200, 2400, 3600, 4800, 9600, 19200, 38400, 57600, 115200, 230400

Flow control options

RTS/CTS, XON/XOFF, None

Environmental

- Operating Temperature: -40 ^{0}F to 185 ^{0}F (-40 ^{0}C to 85 ^{0}C)
- Humidity: 5% to 90%
- Altitude: 12,000 feet (3657.60 meters)

DC characteristics

The following tables provide DC characteristics for operating conditions, inputs, and outputs.

Symbol	Description	Min	Typ	Max	Unit
V_{CC}	Supply Voltage	3.14	3.3	3.45	V
I_{CC}	Supply Current	—	—	270	mA
I_{IL}	Input Current as “0” (no pull-up)	10	—	10	µA
I_{IH}	Input Threshold (no pull-up)	-10	—	10	µA
I_{OZ}	HighZ Leakage Current	-10	—	10	µA
I_{OD}	Output Drive Strength	—	—	2	mA
C_{IO}	Pin Capacitance (V_O=0)	—	—	4	pF

Operating Conditions

Symbol	Description	Min	Typ	Max	Unit
V_{IH}	Input High Voltage	2	—	3.45	V
V_{IL}	Input Low Voltage	V_{SS}-0.3	—	0.2*V_{CC}	V

Inputs

Symbol	Description	Min	Typ	Max	Unit
V_{OH}	Output High Voltage	2.4	—	3.45	V
V_{OL}	Output Low Voltage	0	—	0.4	V

Outputs

Mechanical

- Length: 1.93 inches (49.02 millimeters)
- Width: 1.57 inches (39.87 millimeters)
- Height: 0.974 inches (24.73 millimeters)

Certifications

APPENDIX C

This product complies with the following standards.

FCC Part 15 Class B

Radio frequency interference (RFI)(FCC 15.105)

The Digi Connect EM has been tested and found to comply with the limits for Class B digital devices pursuant to Part 15 Subpart B, of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential environment. This equipment generates, uses, and can radiate radio frequency energy, and if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try and correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and the receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Labeling requirements (FCC 15.19)

This device complies with Part 15 of FCC rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Modifications (FCC 15.21)

Changes or modifications to this equipment not expressly approved by Digi may void the user's authority to operate this equipment.

Industry Canada

This digital apparatus does not exceed the Class B limits for radio noise emissions from digital apparatus set out in the Radio Interference Regulations of the Canadian Department of Communications.

Le present appareil numerique n'emet pas de bruits radioelectriques depassant les limites applicables aux appareils numeriques de la class B prescrites dans le Reglement sur le brouillage radioelectrique edicte par le ministere des Communications du Canada.

Declaration of Conformity

(In accordance with FCC Dockets 96-208 and 95-19)

Manufacturer's Name:	Digi International
Corporate Headquarters:	11001 Bren Road East Minnetonka MN 55343
Manufacturing Headquarters:	10000 West 76th Street Eden Prairie MN 55344

Digi International declares, that the products:

Product Name:	Digi Connect EM
Model Numbers:	50000873-01, 50000873-02, 50000873-03

to which this declaration relates, meet the requirements specified by the Federal Communications Commission as detailed in the following specifications:

- Part 15, Subpart B, for Class B Equipment
- FCC Docket 96-208 as it applies to Class B personal
- Computers and Peripherals

The products listed above have been tested at an External Test Laboratory certified per FCC rules and has been found to meet the FCC, Part 15, Class B, Emission Limits. Documentation is on file and available from the Digi International Homologation Department.

International EMC standards

The Digi Connect EM meets the following electromagnetic emissions standards:

- EN55022: 1998
- EN55024: 1998
- VCCI
- AS 3548

Safety standards

The Digi Connect EM meets the following safety standards:

- UL 60950
- CSA 22.2 No. 60950
- EN60950