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MCP2120/MCP2150 DEVELOPER'S KIT USER'S GUIDE

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- Microchip believes that its family of products is one of the most secure families of its kind on the market today, when used in the intended manner and under normal conditions.
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- Neither Microchip nor any other semiconductor manufacturer can guarantee the security of their code. Code protection does not mean that we are guaranteeing the product as "unbreakable."

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NOTES:

Preface

NOTICE TO CUSTOMERS

All documentation becomes dated, and this manual is no exception. Microchip tools and documentation are constantly evolving to meet customer needs, so some actual dialogs and/or tool descriptions may differ from those in this document. Please refer to our web site (www.microchip.com) to obtain the latest documentation available.

Documents are identified with a "DS" number. This number is located on the bottom of each page, in front of the page number. The numbering convention for the DS number is "DSXXXXXA", where "XXXXX" is the document number and "A" is the revision level of the document.

For the most up-to-date information on development tools, see the MPLAB® IDE on-line help. Select the Help menu, and then Topics to open a list of available on-line help files.

INTRODUCTION

The MCP2120/MCP2150 Developer's Kit demonstrates the capabilities of the MCP2120 and MCP2150 infrared communication products. Items discussed in this chapter include:

- About This Guide
- Recommended Reading
- The Microchip Web Site
- Customer Support

OVERVIEW

The MCP2120 and MCP2150 Developer's Board can be connected to either a PC via the DB9 connector, or to another system (such as a PICDEM™ 2 board) via the four pin header.

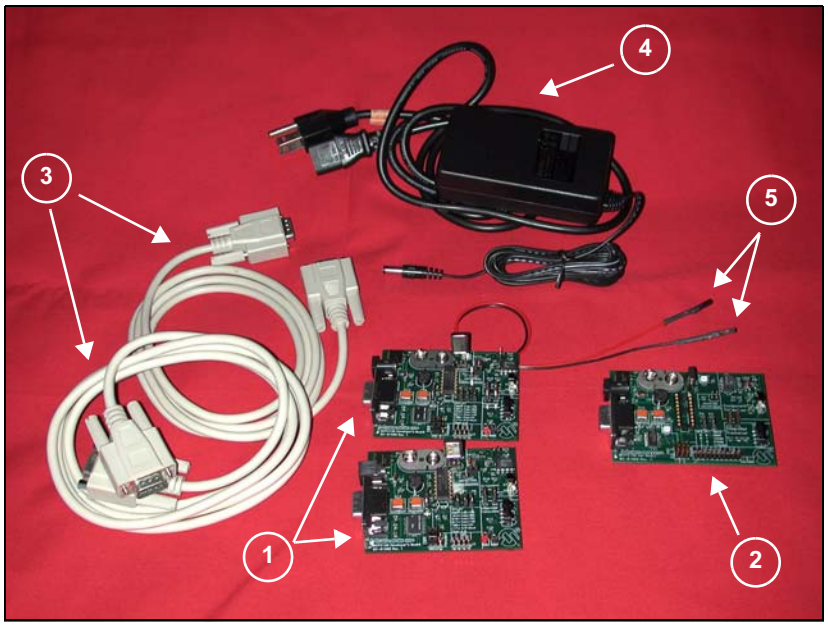
The MCP2120/MCP2150 Developer's Kit comes with the following:

1. Two MCP2120 Developer Boards.
2. One MCP2150 Developer Board.
3. Two serial cables.
4. One 9V power supply, with power cord.
5. One pair 18″ (45 cm) power jumper cables.
6. Sample kit (one MCP2120 device and one MCP2150 device) – not shown.

   Each kit comes with one MCP2120 device and one MCP2150 device. This allows a prototype system to be developed that can be used with an MCP2120 Developer's Board or an MCP2150 Developer's Board.
7. MCP2120/MCP2150 Developer's Kit User's Guide (this document) – not shown.

If you are missing any part of the kit, please contact your nearest Microchip sales office listed in the back of this publication for help.

FIGURE 1-1: MCP2120/MCP2150 DEVELOPER'S KIT



ABOUT THIS GUIDE

Document Layout

This document describes the MCP2120/MCP2150 Developer's Kit and tutorials, giving the user a brief overview of Microchip's MCP2120 and MCP2150 family of infrared communication products. Detailed information on the individual device may be found in the device's respective data sheet. Detailed information on the PICDEM 2 development board may be found in the *PICDEM 2 User's Guide* (DS30374). The manual layout is as follows:

- **Chapter 1: Getting Started** – This chapter gives an overview of the MCP2120 and MCP2150 Developer's Boards, the hardware features of each Developer's Board, the system configurations that can be used to demonstrate the MCP2120 and MCP2150 devices, and the PC requirements.
- **Chapter 2: MCP2120 Tutorial** – This chapter provides a detailed description of the steps to get the MCP2120 Developer's board operating. These steps include the configuration of the Developer's boards and the Terminal Emulation program (Hyperterminal) used on the PC.
- **Chapter 3: MCP2150 Tutorial** – This chapter provides a detailed description of the steps to get the MCP2150 Developer's board operating. These steps include the configuration of the Developer's boards, the Terminal Emulation program (Hyperterminal) used on the PC and the installation and configuration of the PC IrDA™ standard drivers.
- **Chapter 4: Using PICDEM™ 1 or PICDEM 2 Board as Host –** This chapter discusses the use of the PICDEM boards as a demonstration platform as a Host Controller for an MCP2120 Developer's Board or an MCP2150 Developer's Board. This chapter makes reference to Application Notes which contain demonstration code.
- **Appendix A: Hardware Description** – This appendix describes in detail the hardware of the MCP2120 Developer's board and MCP2150 Developer's board. This includes the component layout of each board (silkscreen) and the schematic of each board.

Conventions Used in this Guide

This manual uses the following documentation conventions:

DOCUMENTATION CONVENTIONS

Description	Represents	Examples
Arial font:		
Italic characters	Referenced books	*MPLAB® IDE User's Guide*
	Emphasized text	...is the *only* compiler...
Initial caps	A window	the Output window
	A dialog	the Settings dialog
	A menu selection	select Enable Programmer
Quotes	A field name in a window or dialog	"Save project before build"
Underlined, italic text with right angle bracket	A menu path	*File>Save*
Bold characters	A dialog button	Click **OK**
	A tab	Click the **Power** tab
'b*nnnn*	A binary number where *n* is a digit	'b00100, 'b10
Text in angle brackets < >	A key on the keyboard	Press <Enter>, <F1>
Courier font:		
Plain Courier	Sample source code	`#define START`
	Filenames	`autoexec.bat`
	File paths	`c:\mcc18\h`
	Keywords	`_asm, _endasm, static`
	Command-line options	`-Opa+, -Opa-`
	Bit values	`0, 1`
Italic Courier	A variable argument	*`file`*`.o`, where *`file`* can be any valid filename
`0x`*`nnnn`*	A hexadecimal number where *`n`* is a hexadecimal digit	`0xFFFF`, `0x007A`
Square brackets [ ]	Optional arguments	`mcc18 [options]` *`file`* `[options]`
Curly brackets and pipe character: { | }	Choice of mutually exclusive arguments; an OR selection	`errorlevel {0|1}`
Ellipses...	Replaces repeated text	`var_name [, var_name...]`
	Represents code supplied by user	`void main (void) { ... }`

RECOMMENDED READING

The following Microchip documents are available and recommended as supplemental reference resources.

MCP2120 Data Sheet (DS21618)

MCP2150 Data Sheet (DS21655)

MPASM™ User's Guide with MPLINK™ Linker and MPLIB™ Library (DS33014)

PRO MATE® II User's Guide (DS30082)

PICSTART® Plus User's Guide (DS51028)

MPLAB® ICE User's Guide (DS51159)

MPLAB® ICD User's Guide (DS51184)

AN756, "Using the MCP2120 for Infrared Communication" (DS00756)

AN758, "Using the MCP2150 to Add IrDA® Standard Wireless Connectivity" (DS00758)

TB046, "Connecting the MCP2150 to the Psion Operating System" (DS91046)

TB047, "Connecting the MCP2150 to the Windows® CE Operating System" (DS91047)

TB048, "Connecting the MCP2150 to the Windows® Operating System" (DS91048)

TB049, "Connecting the MCP2150 to the Palm™ Operating System" (DS91049)

THE MICROCHIP WEB SITE

Microchip provides online support via our WWW site at www.microchip.com. This web site is used as a means to make files and information easily available to customers. Accessible by using your favorite Internet browser, the web site contains the following information:

- **Product Support** – Data sheets and errata, application notes and sample programs, design resources, user's guides and hardware support documents, latest software releases and archived software
- **General Technical Support** – Frequently Asked Questions (FAQ), technical support requests, online discussion groups, Microchip consultant program member listing
- **Business of Microchip** – Product selector and ordering guides, latest Microchip press releases, listing of seminars and events, listings of Microchip sales offices, distributors and factory representatives

CUSTOMER SUPPORT

Users of Microchip products can receive assistance through several channels:

- Distributor or Representative
- Local Sales Office
- Field Application Engineer (FAE)
- Technical Support
- Development Systems Information Line

Customers should contact their distributor, representative or field application engineer (FAE) for support. Local sales offices are also available to help customers. A listing of sales offices and locations is included in the back of this document.

Technical support is available through the web site at: http://support@microchip.com

In addition, there is a Development Systems Information Line which lists the latest versions of Microchip's development systems software products. This line also provides information on how customers can receive currently available upgrade kits.

The Development Systems Information Line numbers are:

1-800-755-2345 – United States and most of Canada

1-480-792-7302 – Other International Locations

Chapter 1. Getting Started

1.1 INTRODUCTION

This chapter covers an overview of the MCP2120 and MCP2150 Developer's Boards features, the system configurations that they can be used in and the system requirements for the tutorials.

1.2 HIGHLIGHTS

Items discussed in this chapter are:

- MCP2120 Developer's Board Features
- MCP2150 Developer's Board Features
- System Configurations
- PC Requirements

1.3 DEVELOPER BOARD FEATURES

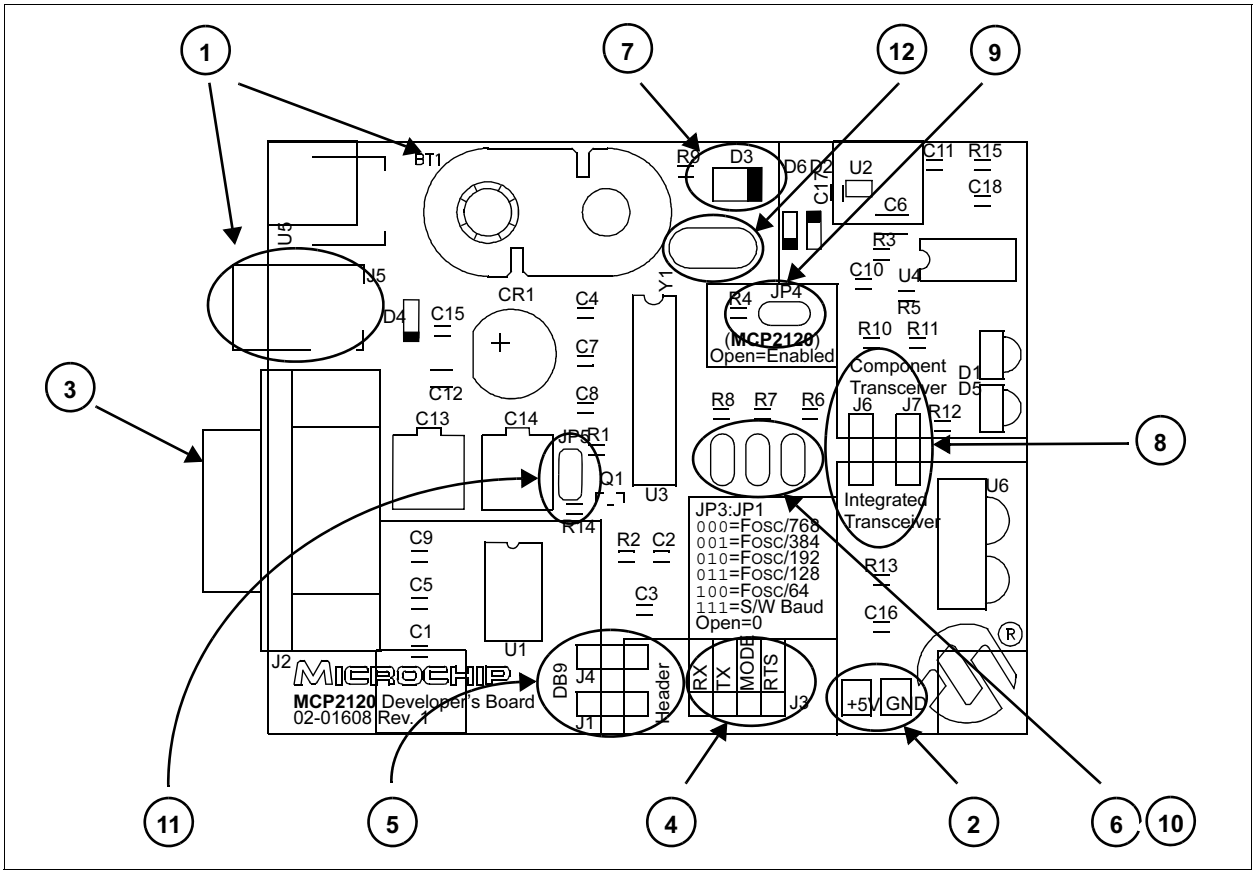
1.3.1 MCP2120 Developer's Board Features

The MCP2120 Developer's Board, as shown in Figure 1-1, has the following hardware features:

1. On-board +5V regulator for direct input from 9V, 750 mA AC/DC wall adapter or 9V battery.
2. Hooks for a +5V, 750 mA regulated DC supply.
3. DB-9 connector and associated hardware for direct connection to MCP2120 UART (DB-9 interface requires RS-232 signal levels).
4. Four-pin header connection to UART interface (Header requires TTL level signals).
5. Two jumpers to select source of UART signals. Either DB-9 connector or the four-pin header.
6. Three jumpers to select desired baud rate.
7. Green power-on indicator LED.
8. Two IR Transceiver options (two jumpers select transceiver).
9. Jumper to disable MCP2120 device operation.
10. Hardware and Software Baud selection.
11. Jumper for Software Baud control when using RS-232C interface.
12. Socketed crystal.

Note: A schematic of the MCP2120 Developer's Board is shown in Figure A-5

FIGURE 1-1: MCP2120 DEVELOPER'S BOARD HARDWARE



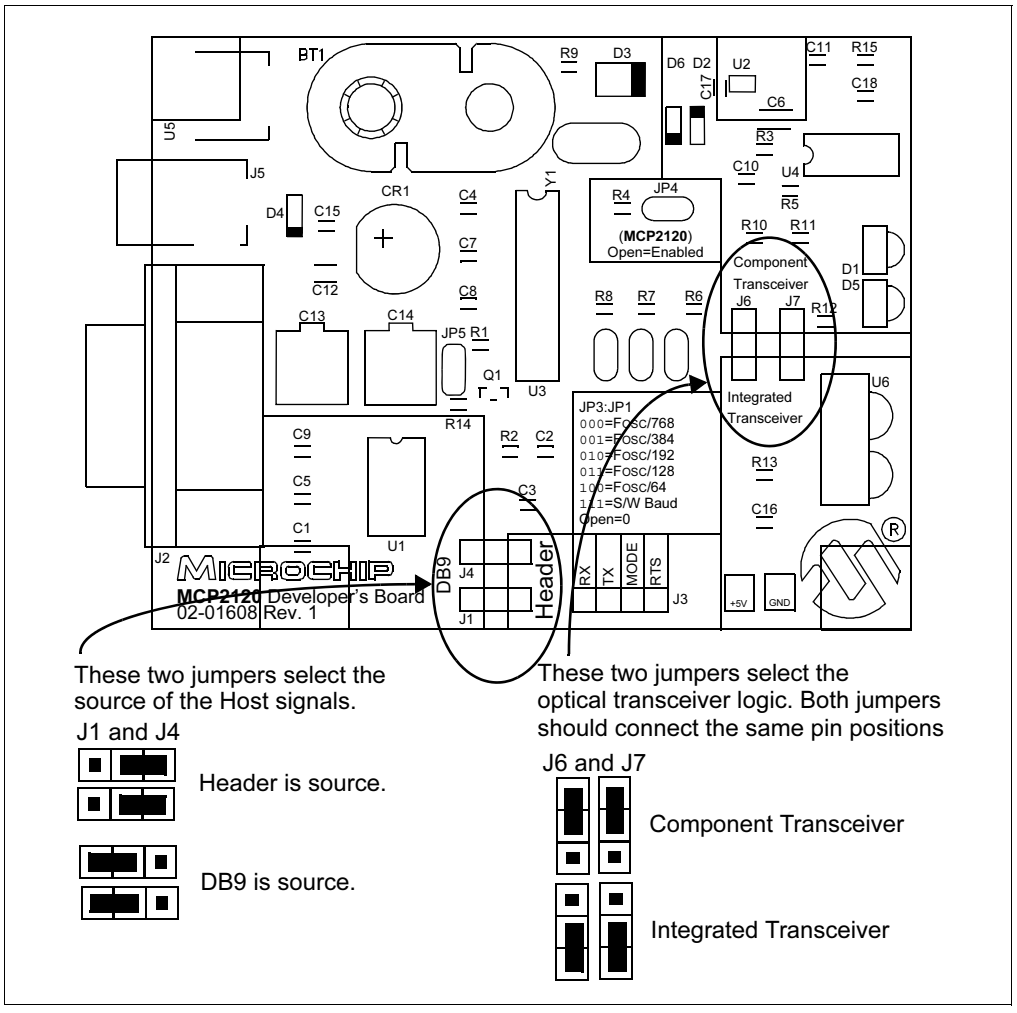
1.3.2 Selecting UART Source and Optical Transceiver Interface

Figure 1-2 shows two pairs of jumpers used to route signals to and from the MCP2120.

Jumpers J1 and J4 are used to determine the source of the signals used by the UART interface. When the header has the pins closest to the “DB9” label jumpered to the center pin, the DB9 is the source of the UART signal. When the header has the pins closest to the “Header” label jumpered to the center pin, the four-pin header is the source of the UART signal.

Jumpers J6 and J7 are used to determine the source and destination of the infrared data signals used by the interface between the MCP2120 and Optical Transceiver. When the header has the pins closest to the “Integrated Transceiver” label jumpered to the center pin, the integrated transceiver is used. When the header has the pins closest to the “Component Transceiver” label jumpered to the center pin, the component transceiver logic is used.

FIGURE 1-2: MCP2120 SELECTING SOURCES



1.3.3 Selecting Baud Rate

Figure 1-3 shows the three Baud Rate Select Jumpers (JP3:JP1) and the baud rate formula that is specified (baud rate dependant on MCP2120 operational frequency). Table 1-1 shows the baud rates for some crystal frequencies.

FIGURE 1-3: MCP2120 BAUD RATE

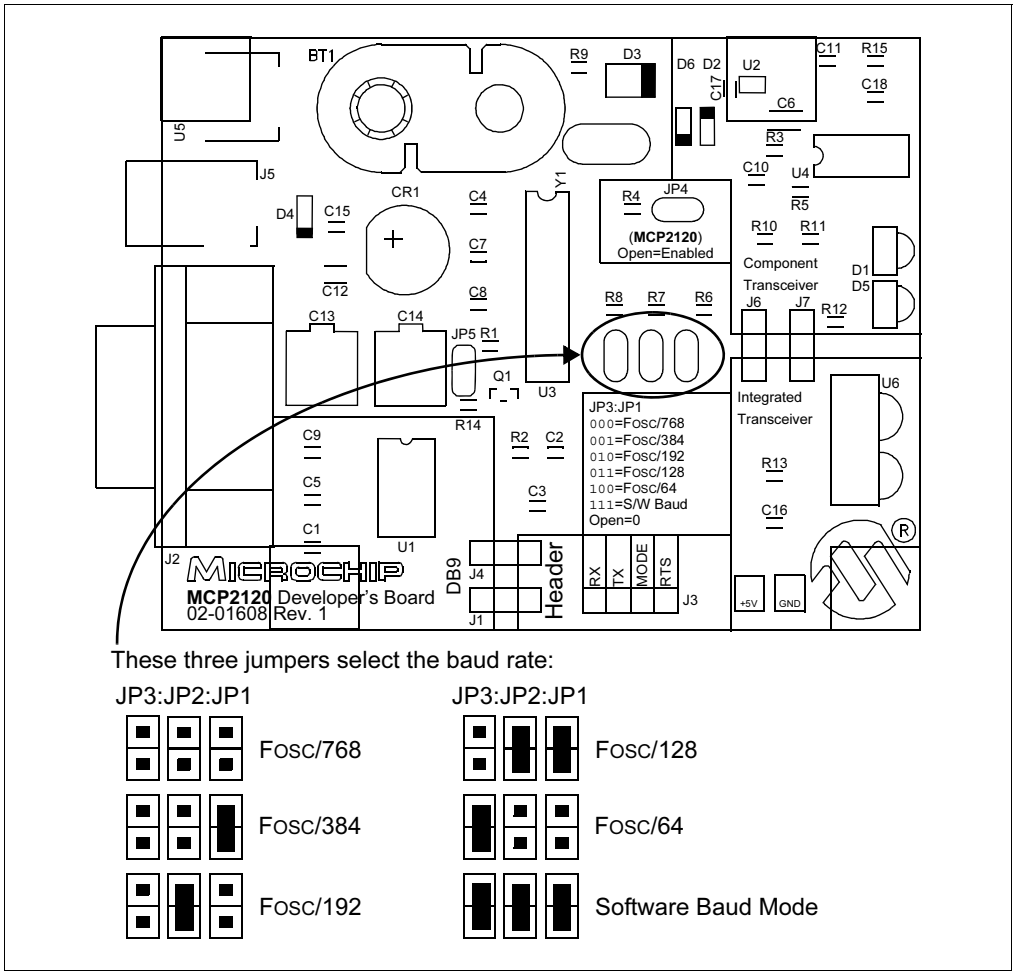


TABLE 1-1: HARDWARE BAUD RATE SELECTION VS. FREQUENCY

	Fosc Frequency (MHz)							
BAUD2:BAUD0	**0.6144 (1)**	**2.000**	**3.6864**	**4.9152**	**7.3728**	**14.7456(2)**	**20.000(2)**	**Bit Rate**
000	800	2604	4800	6400	9600	19200	26042	Fosc / 768
001	1600	5208	9600	12800	19200	38400	52083	Fosc / 384
010	3200	10417	19200	25600	38400	78600	104167	Fosc / 192
011	4800	15625	28800	38400	57600	115200	156250	Fosc / 128
100	9600	31250	57600	78600	115200	230400	312500	Fosc / 64

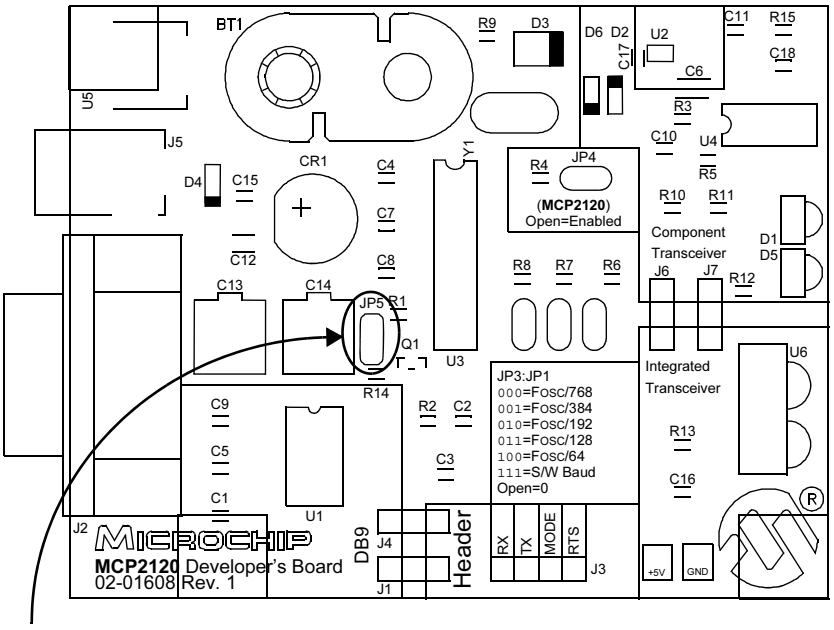
Note 1: An external clock is recommended for frequencies below 2 MHz.

2: For frequencies above 7.5 MHz, the TXIR pulse width (MCP2120 Data Sheet, Electrical Specification, parameter IR121) will be shorter than the minimum pulse width of 1.6 ms in the IrDA standard specification.

1.3.4 UART Mode

Figure 1-4 shows the jumper which determines if the MCP2120 Developer's Board is to be used in Hardware Baud operation, or Software Baud operation. When in Software Baud operation, an additional signal is required, Request To Send (RTS), which is used to drive the $\overline{\text{RESET}}$ pin low to cause a change of baud rate to occur.

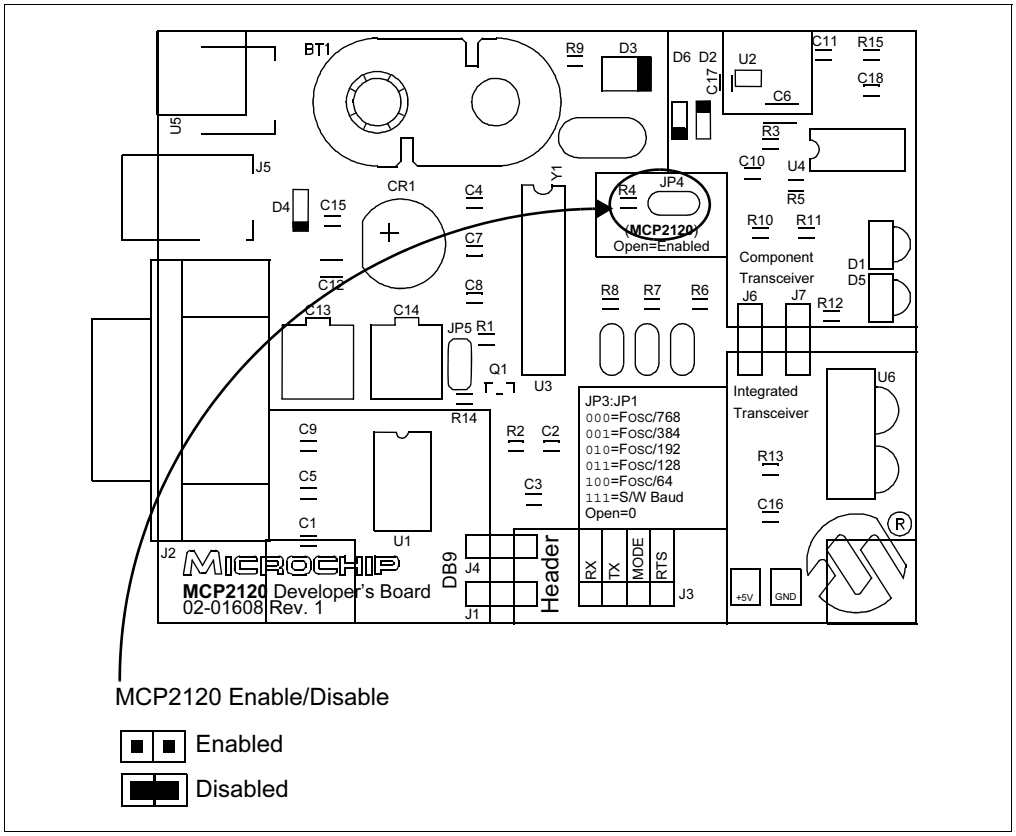
FIGURE 1-4: MCP2120 UART



1.3.5 Disabling the MCP2120

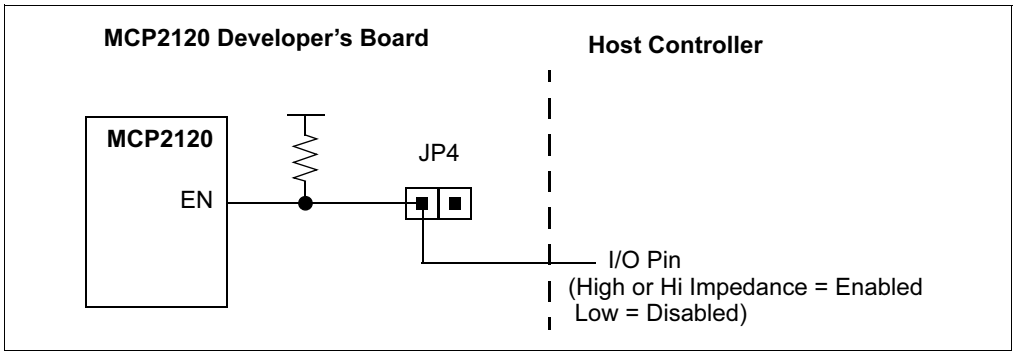
Figure 1-5 shows the jumper, JP4, which will enable or disable the MCP2120 device. When the MCP2120 is disabled, the device will consume less current.

FIGURE 1-5: MCP2120 ENABLE/DISABLE



In most cases, this jumper will be open. It may be closed to test system operation when the MCP2120 is disabled. The Host Controller board may control the operation of the MCP2120 by connecting a signal to the JP4 header as shown in Figure 1-6.

FIGURE 1-6: HOST CONTROLLER DISABLING THE MCP2120



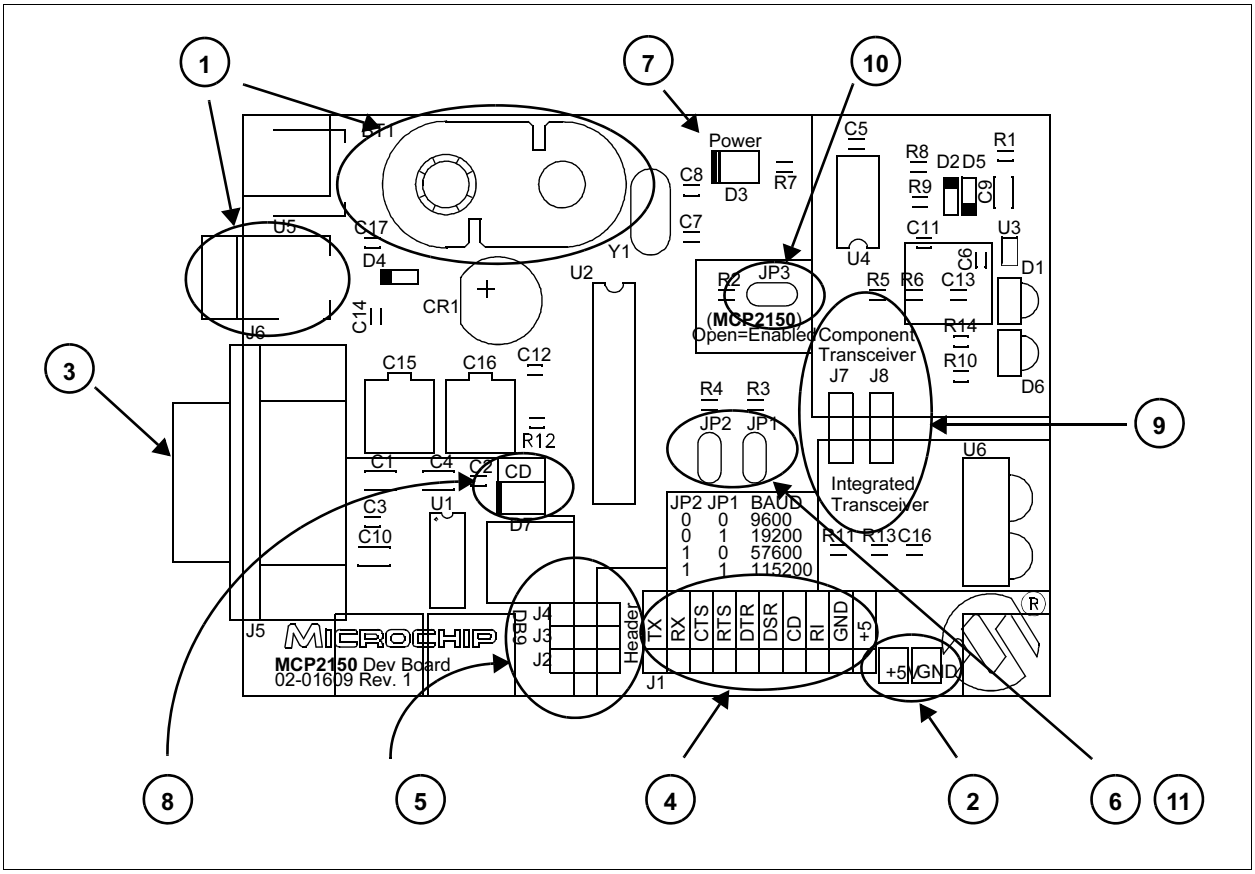
1.3.6 MCP2150 Developer's Board Features

The MCP2150 Developer's Board, as shown in Figure 1-7, has the following hardware features:

1. On-board +5V regulator for direct input from 9V, 750 mA AC/DC wall adapter or 9V battery.
2. Hooks for a +5V, 750 mA regulated DC supply.
3. DB-9 connector and associated hardware for direct connection to MCP2150 UART (DB-9 interface requires RS-232 signal levels).
4. Ten-pin header connection to UART interface (Header requires TTL level signals).
5. Three jumpers to select source of UART signals. Either DB-9 connector or the eight-pin header.
6. Two jumpers to select desired baud rate.
7. Green power-on indicator LED.
8. Green LED for Carrier Detect.
9. Two IR Transceiver options (two jumpers select transceiver).
10. Jumper to disable MCP2150 device operation.
11. Hardware Baud selection.

Note: A schematic of the MCP2150 Developer's Board is shown in Figure A-6

FIGURE 1-7: MCP2150 BOARD HARDWARE



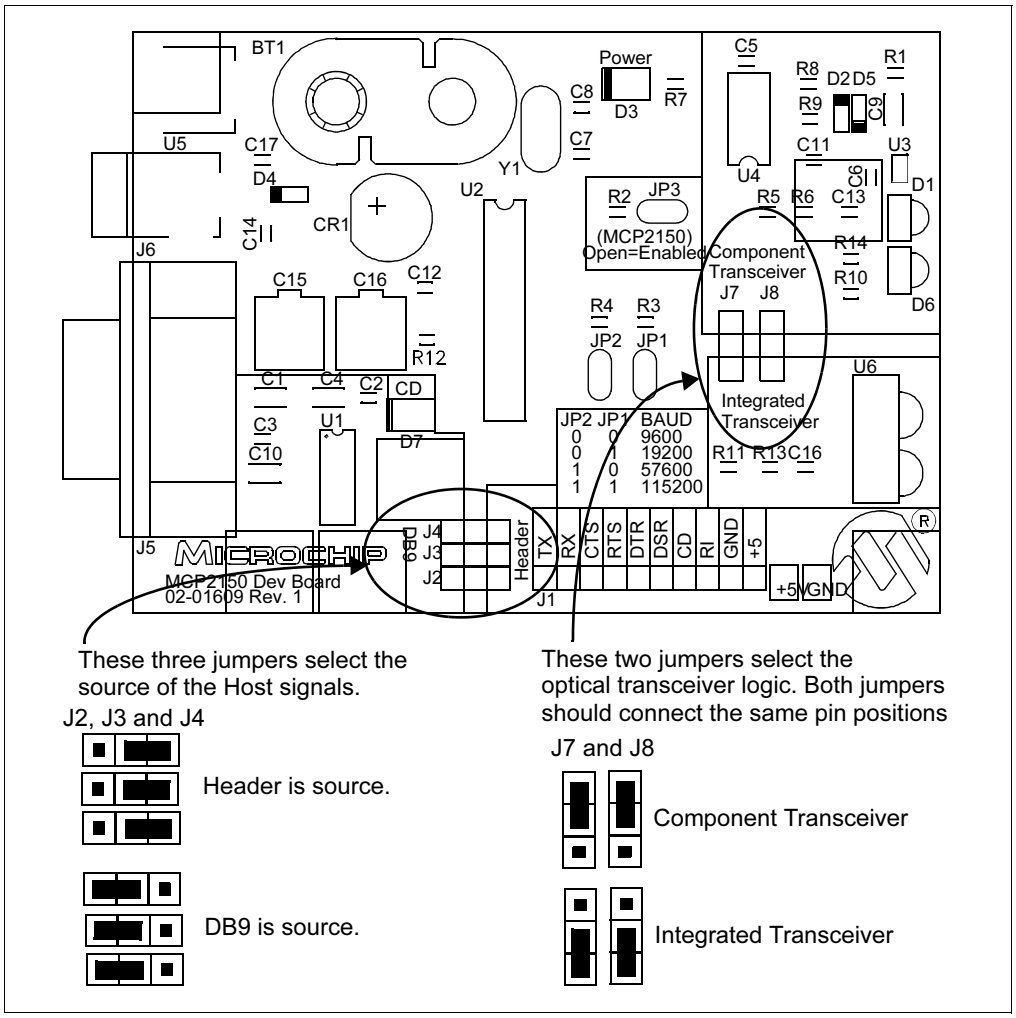
1.3.7 Selecting UART Source and Optical Transceiver Interface

Figure 1-8 shows two sets of jumpers used to route signals to and from the MCP2150.

Jumpers J2, J3 and J4 are used to determine the source of the signals used by the UART interface. When the header has the pins closest to the "DB9" label jumpered to the center pin, the DB9 is the source of the UART signal. When the header has the pins closest to the "Header" label jumpered to the center pin, the four-pin header is the source of the UART signal.

Jumpers J7 and J8 are used to determine the source and destination of the IrDA signals used by the interface between the MCP2150 and Optical Transceiver. When the header has the pins closest to the "Integrated Transceiver" label jumpered to the center pin, the integrated transceiver is used. When the header has the pins closest to the "Component Transceiver" label jumpered to the center pin, the component transceiver logic is used.

FIGURE 1-8: MCP2150 SELECTING SOURCES



1.3.8 Selecting Baud Rate

Figure 1-9 shows the two Baud Rate Select jumpers (JP2:JP1) and the baud rate. Table 1-2 shows the baud rates for some crystal frequencies.

FIGURE 1-9: MCP2150 BAUD RATE

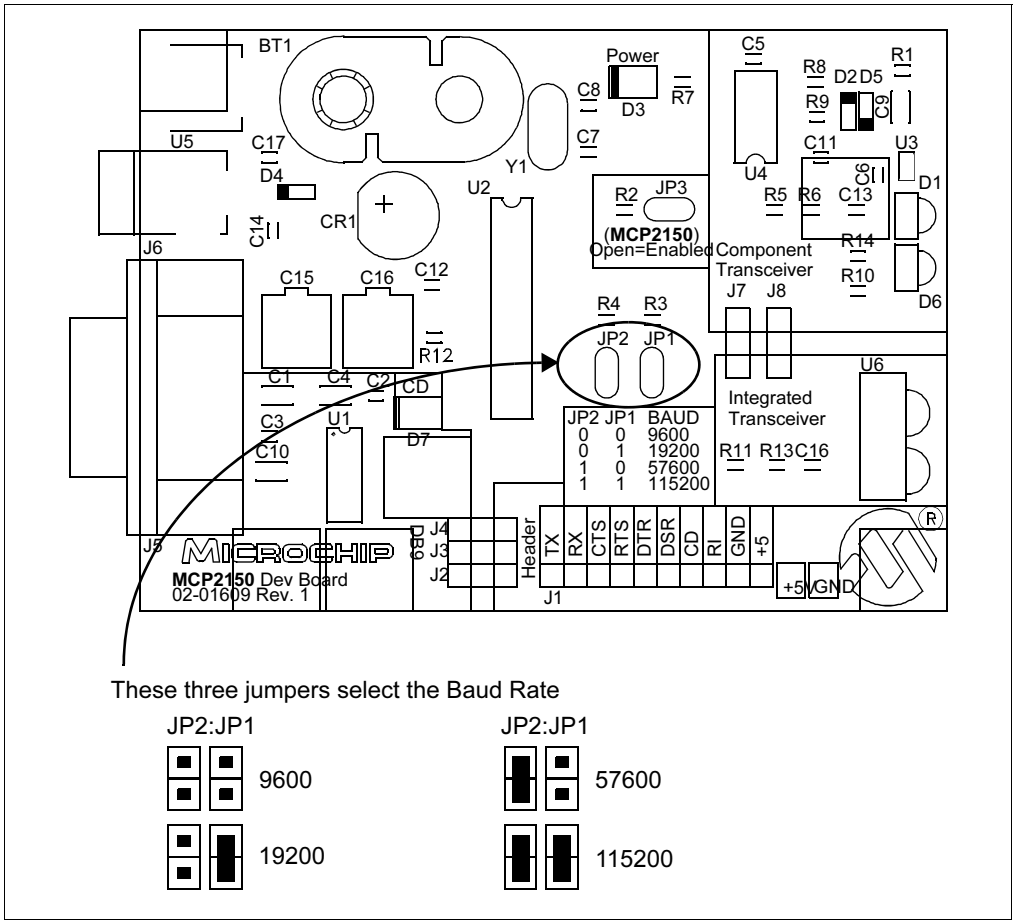


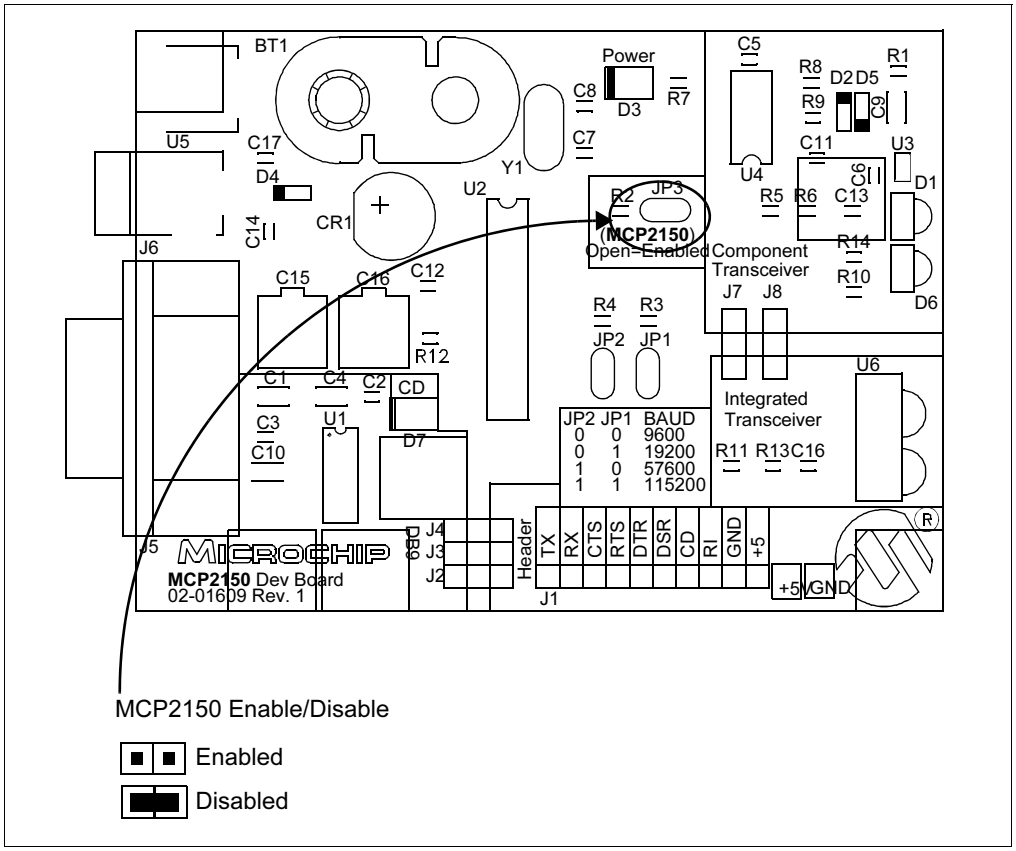
TABLE 1-2: SERIAL BAUD RATE SELECTION VS. FREQUENCY

BAUD1:BAUD0	Baud Rate @ 11.0592 MHz	Bit Rate
00	9600	FOSC / 1152
01	19200	FOSC / 576
10	57600	FOSC / 192
11	115200	FOSC / 96

1.3.9 Disabling the MCP2150

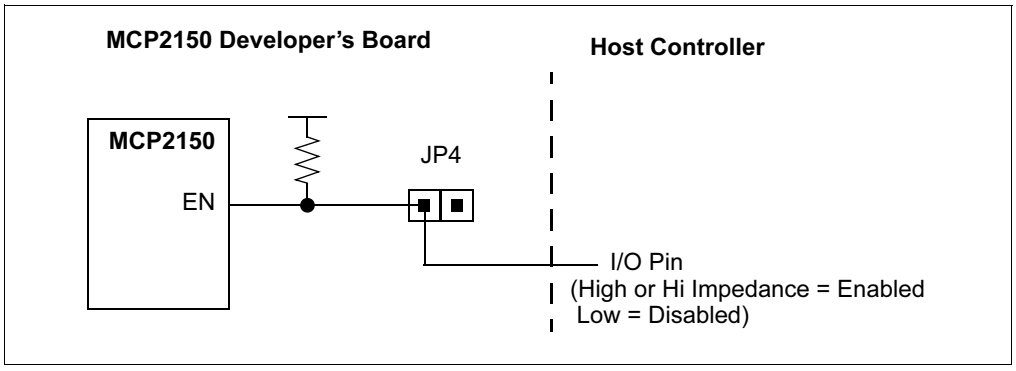
Figure 1-10 shows the jumper (JP3) which will enable or disable the MCP2150 device. When the MCP2150 is disabled, the device will consume less current.

FIGURE 1-10: MCP2150 ENABLE/DISABLE



In most cases, this jumper will be open. It may be closed to test system operation when the MCP2150 is disabled. The Host Controller board may control the operation of the MCP2150 by connecting a signal to the JP3 header as shown in Figure 1-11.

FIGURE 1-11: HOST CONTROLLER DISABLING THE MCP2150



1.4 SYSTEM CONFIGURATIONS

There are five configurations that one would use for initial evaluation of these two Developer's Boards. These configurations are shown in Table 1-3.

TABLE 1-3: CONFIGURATIONS FOR EVALUATION OF DEVELOPER'S BOARDS

	Developer's Board #1		Developer's Board #2
1.	MCP2120 Dev Board (ASCII)	↔	MCP2120 Dev Board (ASCII)
2.	MCP2120 Dev Board (IR Driver)	→	MCP2120 Dev Board (IR Driver)
3.	MCP2150 Dev Board (ASCII)	↔	MCP2120 Dev Board (IR Driver)
4.	MCP2120 Dev Board (IR Driver)	→	IrDA standard port (Palm Pilot, cell phone, ...)
5.	MCP2150 Dev Board (ASCII)	→	IrDA standard port (Palm Pilot, cell phone, ...)

The Host controller for each board can be either a Personal Computer (PC) or another system connected to the Host header. The PC operating system (OS) may be any desired OS that has a terminal emulation program which can connect to the serial port and can treat the IR port as a virtual serial port. For our tutorial, we will use the Windows 9x OS.

Note 1: Windows NT® 4.x (and lower) does not support the IrDA standard functionality. Third Party programs exist, but are not supported or recommended by Microsoft, so are also not recommended by Microchip.

2: Windows 2000 does support the IrDA standard, but does not treat the IR port as a virtual serial port. This means that you cannot access the IR port as a serial port. This causes issues with some terminal emulation programs, such as Hyperterminal. Windows 2000 considers the IrDA port to be a network device. Applications that can access a network service through a network protocol (i.e., TCP/IP) can use the MCP2120 Developer's Board using the appropriate Windows 2000 driver.

1.4.1 Configuration 1

Developer's Board #1		Developer's Board #2
MCP2120 Dev Board (ASCII)	↔	MCP2120 Dev Board (ASCII)

This is the typical mode that will be used for the two MCP2120 Developer's Board. In this configuration, the MCP2120 board receives data as a single ASCII byte. This byte is then translated to the IR data format, and transmitted out of the selected optical transceiver logic.

The host interface can be from either the DB-9 (PC or other UART) or the Header.

A PC running a terminal emulation program, such as Hyperterminal, connected to the serial port will create this ASCII data stream. The PC can then be connected to the Developer's Board DB-9 connector.

1.4.2 Configuration 2

Developer's Board #1		Developer's Board #2
MCP2120 Dev Board (IR Driver)	→	MCP2120 Dev Board (IR Driver)

This is used to view the effects of the IrDA standard stack protocol on the data stream. This can be used to better understand the construction of the IrDA standard data packet, or as a diagnostic tool.

The host interface can be from either the DB-9 (PC or other UART) or the Header.

A PC running a terminal emulation program, such as Hyperterminal, connected to the IR port as a virtual serial port will create this ASCII data stream. The PC can then be connected to the MCP2120 Developer's Board DB-9 connector.

1.4.3 Configuration 3

Developer's Board #1		Developer's Board #2
MCP2150 Dev Board (ASCII)	↔	MCP2120 Dev Board (IR Driver)

This is the configuration when using one MCP2120 Developer's Board and one MCP2150 Developer's Board.

The MCP2150 Developer's Board can have the host interface be from either the DB-9 (PC or other UART) or the Header.

The MCP2120 Developer's Board would interface to a PC running a terminal emulation program, such as Hyperterminal, that connects the IR port to a virtual serial port.

1.4.4 Configuration 4

Developer's Board #1		Developer's Board #2
MCP2120 Dev Board (IR Driver)	→	IrDA standard port (Palm Pilot, cell phone, ...)

This configuration is used to evaluate the MCP2120 for an IrDA system, where the Host Controller is responsible for the IrDA protocol stack.

The MCP2120 Developer's Board interfaces to a PC running a terminal emulation program, such as Hyperterminal, that connects the IR port to a virtual serial port.

1.4.5 Configuration 5

Developer's Board #1		Developer's Board #2
MCP2150 Dev Board (ASCII)	→	IrDA standard port (Palm Pilot, cell phone, ...)

This configuration is used to evaluate the MCP2150 for adding the IrDA feature to a system. The Host controller only needs to send and receive the required ASCII data, while the MCP2150 handles the IrDA standard protocol stack.

The MCP2150 Developer's Board can have the host interface be from either the DB-9 (PC or other UART) or the Header.

1.5 PC REQUIREMENTS

The PC used has three main requirements. These are:

1. Standard Serial Port.
2. Terminal Emulation Program.
3. IrDA standard driver installed, which treats the IR port as a virtual serial port.

A non-legacy-free Intel compatible model with Windows 9x/2000 Operating System (OS) would meet these requirements. The Windows OS includes a Terminal Emulation program called Hyperterminal. Section 2.5 shows instructions to configure Hyperterminal and demonstrate the Developer's Boards.

Note 1:	Windows 2000 does support the IrDA standard, but does not treat the IR port as a virtual serial port. This means that you cannot access the IR port as a serial port. This causes issues with some terminal emulation programs, such as Hyperterminal. Windows 2000 considers the IrDA port to be a network device. Applications that can access a network service through a network protocol (i.e., TCP/IP) can use the MCP2120 Developer's Board using the appropriate Windows 2000 driver.

NOTES:

Chapter 2. MCP2120 Tutorial

2.1 INTRODUCTION

This chapter covers a tutorial for using the MCP2120 Developer's Board.

2.2 HIGHLIGHTS

Items discussed in this chapter include:

- MCP2120 Tutorial Setup
- Hardware Setup
- Setting Up the Terminal Program
- Transmitting/Receiving Data

2.3 MCP2120 TUTORIAL SETUP

This tutorial will use both MCP2120 Developer's Boards. The system will operate at 9600 Baud. Each board will be connected via the UART to the serial port of a personal computer (PC). This means that either two PCs are required, or a PC with two serial ports, as shown in Figure 2-1. It is assumed that two PCs will be used, and that each PC will have the Terminal Emulation program configured identically.

FIGURE 2-1: SYSTEM BLOCK DIAGRAM