MCP2120/MCP2150 DEVELOPER'S KIT USER'S GUIDE

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ISO/TS 16949:2002

Microchip received ISO/TS-16949:2002 quality system certification for its worldwide headquarters, design and wafer fabrication facilities in Chandler and Tempe, Arizona and Mountain View, California in October 2003. The Company's quality system processes and procedures are for its PICmicro® 8-bit MCUs, KEELOQ® code hopping devices, Serial EEPROMs, microperipherals, nonvolatile memory and analog products. In addition, Microchip's quality system for the design and manufacture of development systems is ISO 9001:2000 certified.

MCP2120/MCP2150 DEVELOPER'S KIT USER'S GUIDE

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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.

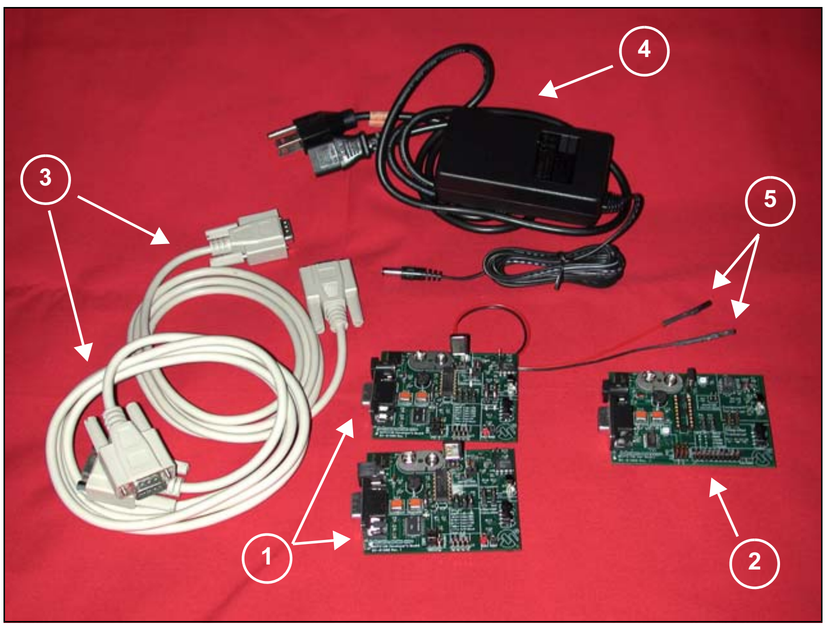
The MCP2120/MCP2150 Developer's Kit comes with the following:

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

<table>
<tr><th>Description</th><th>Represents</th><th>Examples</th></tr>
<tr><td colspan="3">Arial font:</td></tr>
<tr><td rowspan="2">Italic characters</td><td>Referenced books</td><td>MPLAB® IDE User’s Guide</td></tr>
<tr><td>Emphasized text</td><td>...is the only compiler...</td></tr>
<tr><td rowspan="3">Initial caps</td><td>A window</td><td>the Output window</td></tr>
<tr><td>A dialog</td><td>the Settings dialog</td></tr>
<tr><td>A menu selection</td><td>select Enable Programmer</td></tr>
<tr><td>Quotes</td><td>A field name in a window or dialog</td><td>“Save project before build”</td></tr>
<tr><td>Underlined, italic text with right angle bracket</td><td>A menu path</td><td><u>File>Save</u></td></tr>
<tr><td rowspan="2">Bold characters</td><td>A dialog button</td><td>Click OK</td></tr>
<tr><td>A tab</td><td>Click the Power tab</td></tr>
<tr><td>‘bnnnn</td><td>A binary number where n is a digit</td><td>‘b00100, ‘b10</td></tr>
<tr><td>Text in angle brackets < ></td><td>A key on the keyboard</td><td>Press <Enter>, <F1></td></tr>
<tr><td colspan="3">Courier font:</td></tr>
<tr><td rowspan="6">Plain Courier</td><td>Sample source code</td><td>#define START</td></tr>
<tr><td>Filenames</td><td>autoexec.bat</td></tr>
<tr><td>File paths</td><td>c:\mcc18\h</td></tr>
<tr><td>Keywords</td><td>_asm, _endasm, static</td></tr>
<tr><td>Command-line options</td><td>-Opa+, -Opa-</td></tr>
<tr><td>Bit values</td><td>0, 1</td></tr>
<tr><td>Italic Courier</td><td>A variable argument</td><td>file.o, where file can be any valid filename</td></tr>
<tr><td>0xnnnn</td><td>A hexadecimal number where n is a hexadecimal digit</td><td>0xFFFF, 0x007A</td></tr>
<tr><td>Square brackets [ ]</td><td>Optional arguments</td><td>mcc18 [options] file [options]</td></tr>
<tr><td>Curly brackets and pipe character: { | }</td><td>Choice of mutually exclusive arguments; an OR selection</td><td>errorlevel {0|1}</td></tr>
<tr><td rowspan="2">Ellipses...</td><td>Replaces repeated text</td><td>var_name [, var_name...]</td></tr>
<tr><td>Represents code supplied by user</td><td>void main (void)
{ ...
}</td></tr>
</table>

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

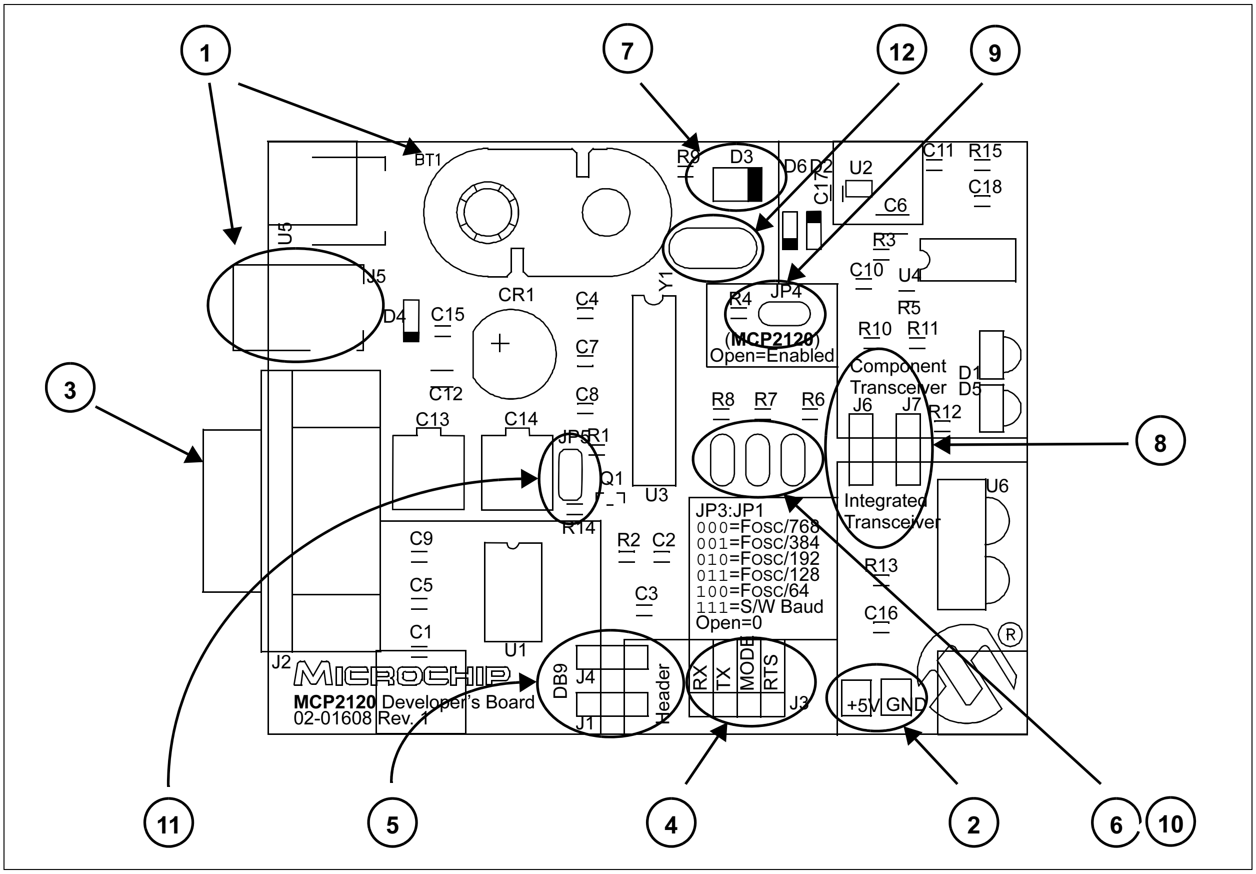
1.3.1 MCP2120 Developer's Board Features

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



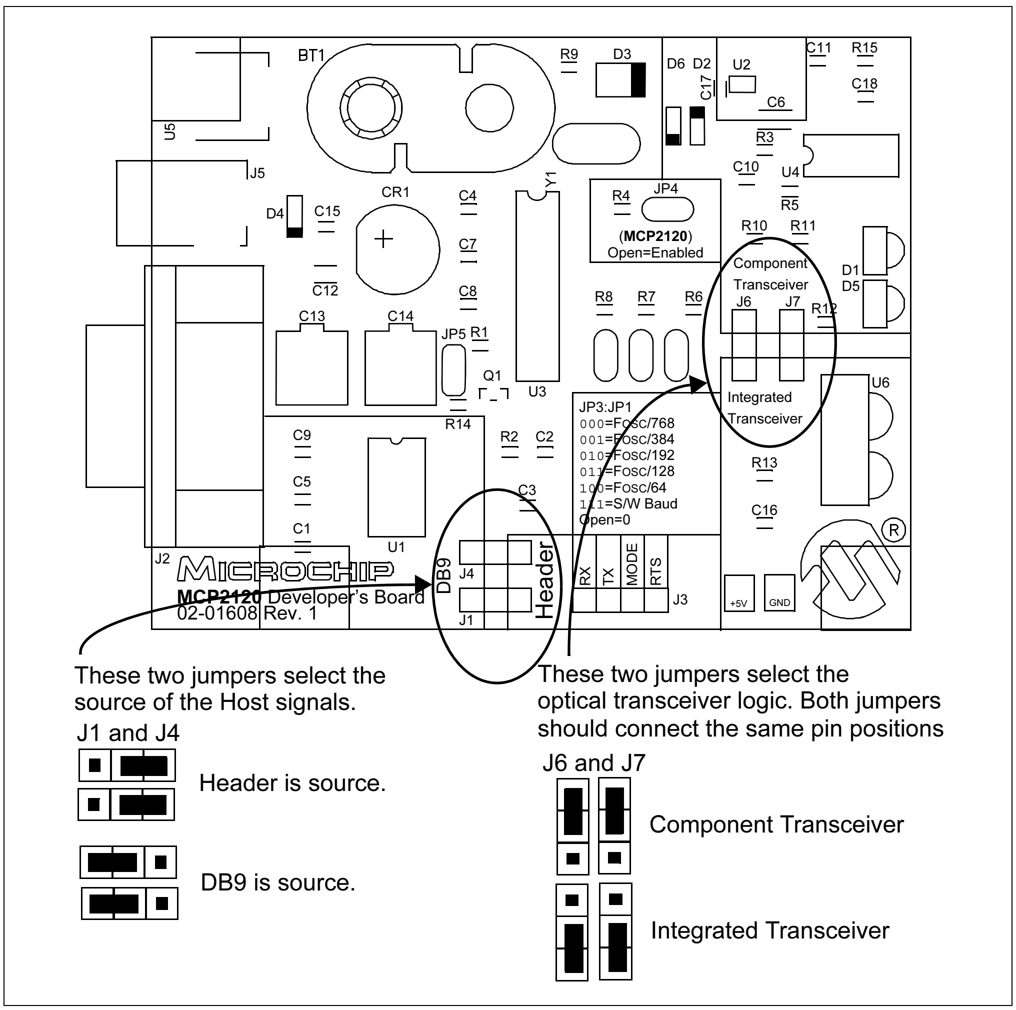
1.3.2 Selecting UART Source and Optical Transceiver Interface

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

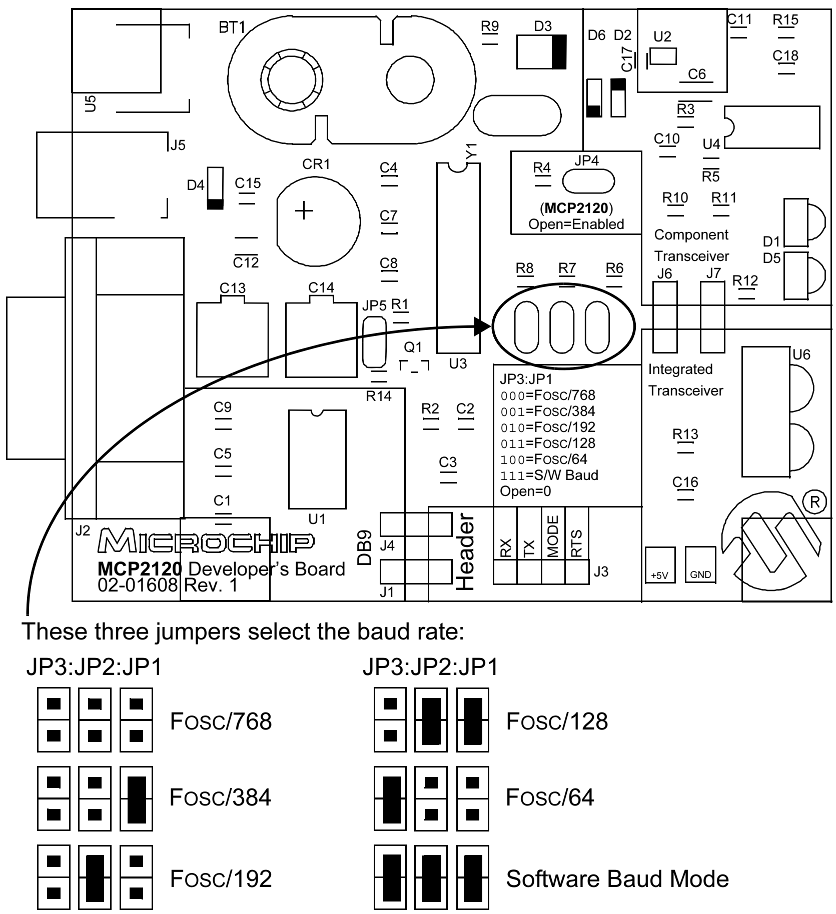


TABLE 1-1: HARDWARE BAUD RATE SELECTION VS. FREQUENCY

	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

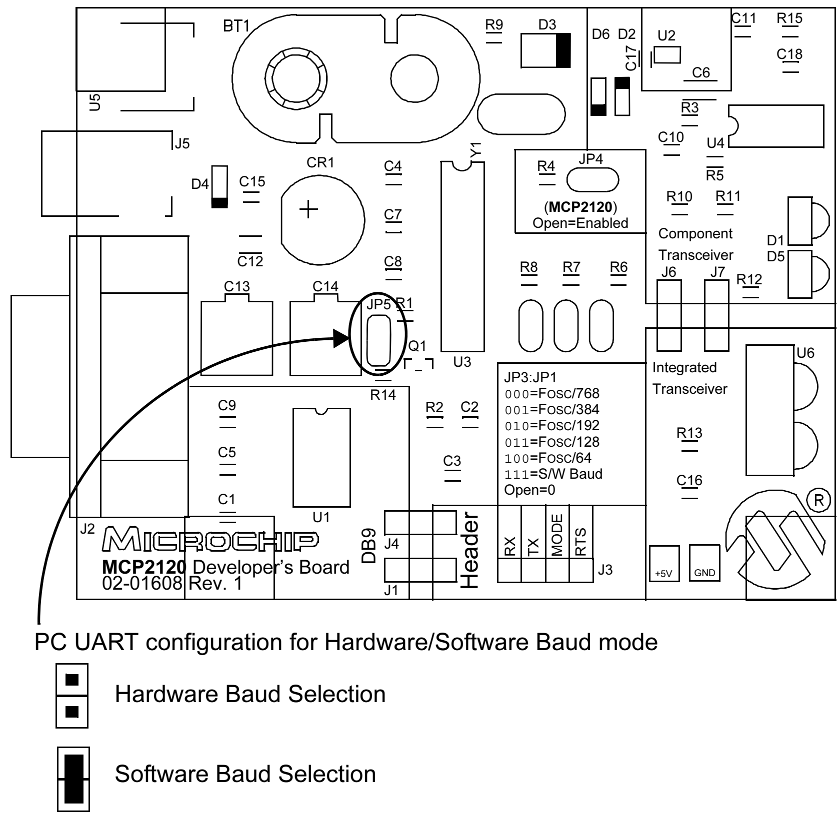
Note 1: An external clock is recommended for frequencies below 2 MHz.

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.

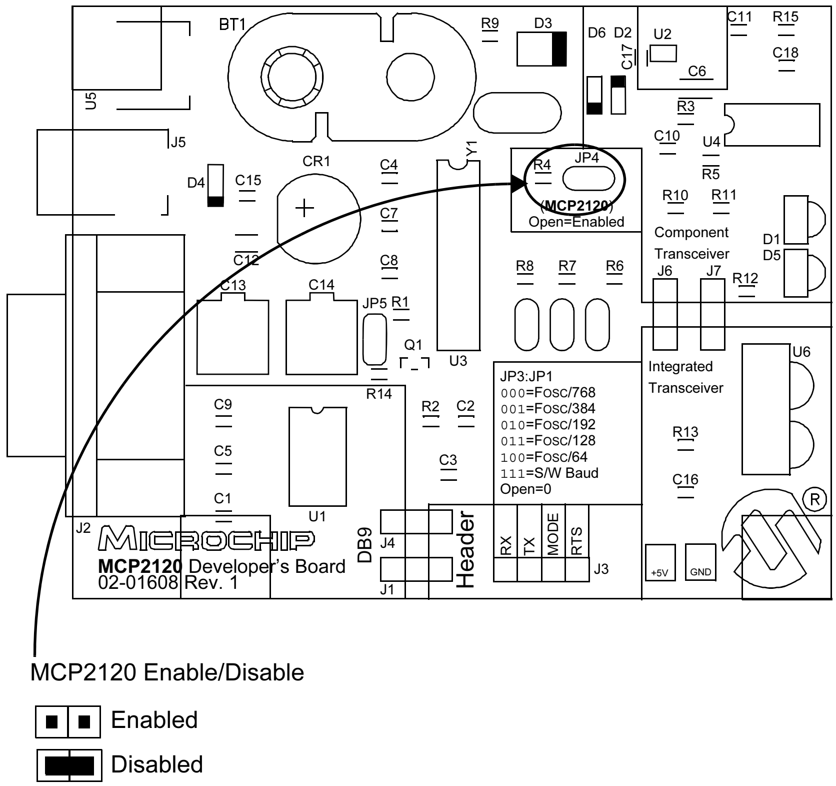
FIGURE 1-4: MCP2120 UART



1.3.5 Disabling the MCP2120

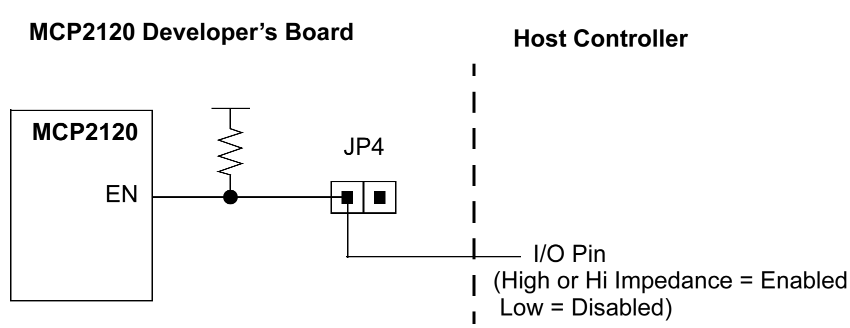
Figure 1-5 shows the jumper, JP4, which will enable or disable the MCP2120 device. When the MCP2120 is disabled, the device will consume less current.

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



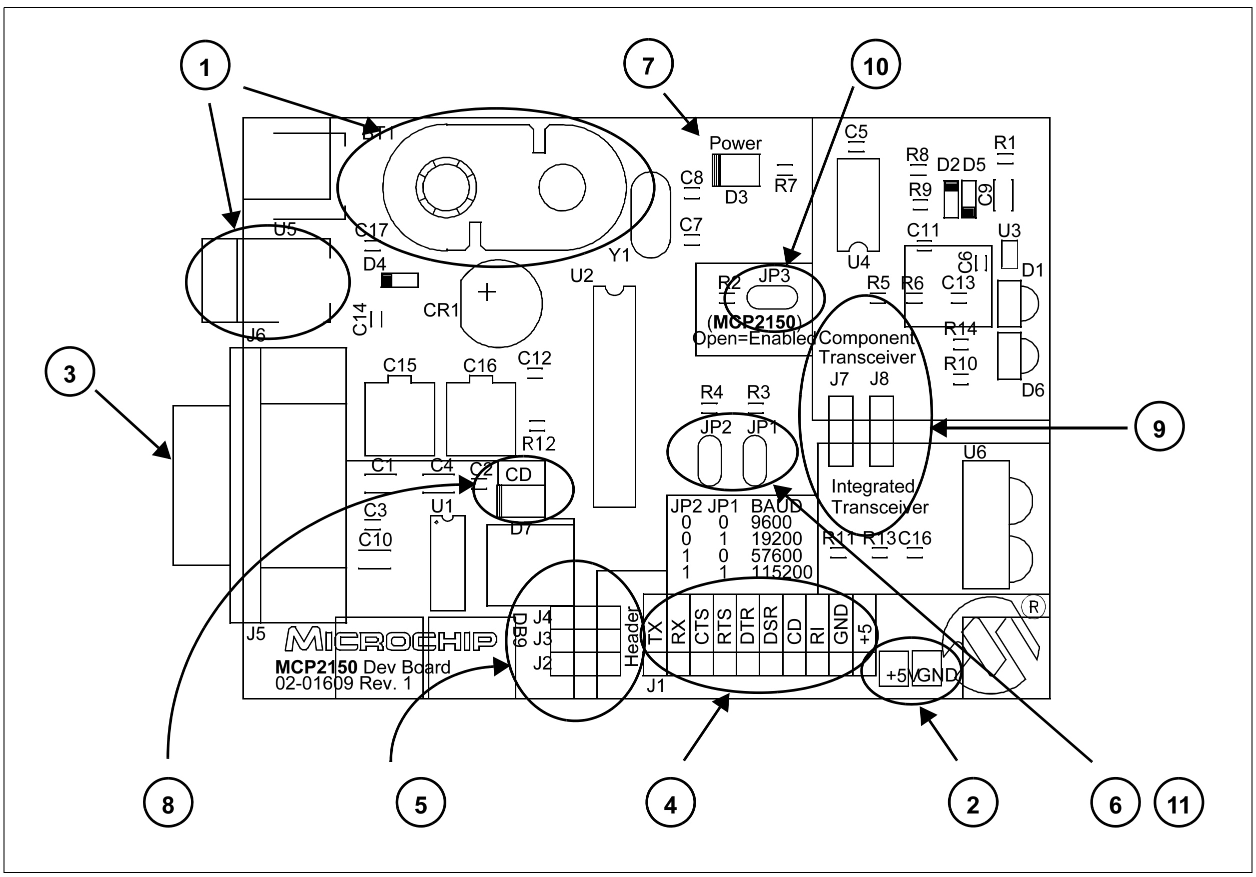
1.3.6 MCP2150 Developer's Board Features

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



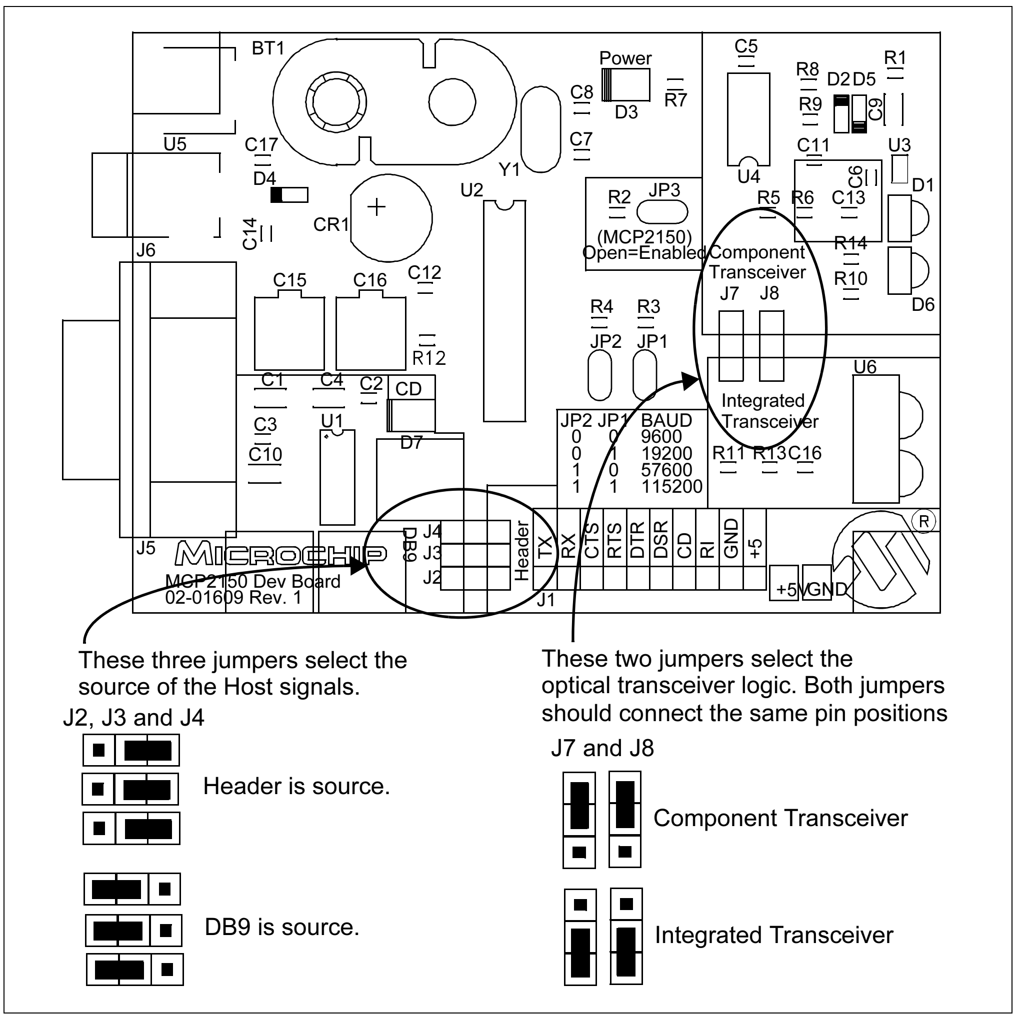
1.3.7 Selecting UART Source and Optical Transceiver Interface

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

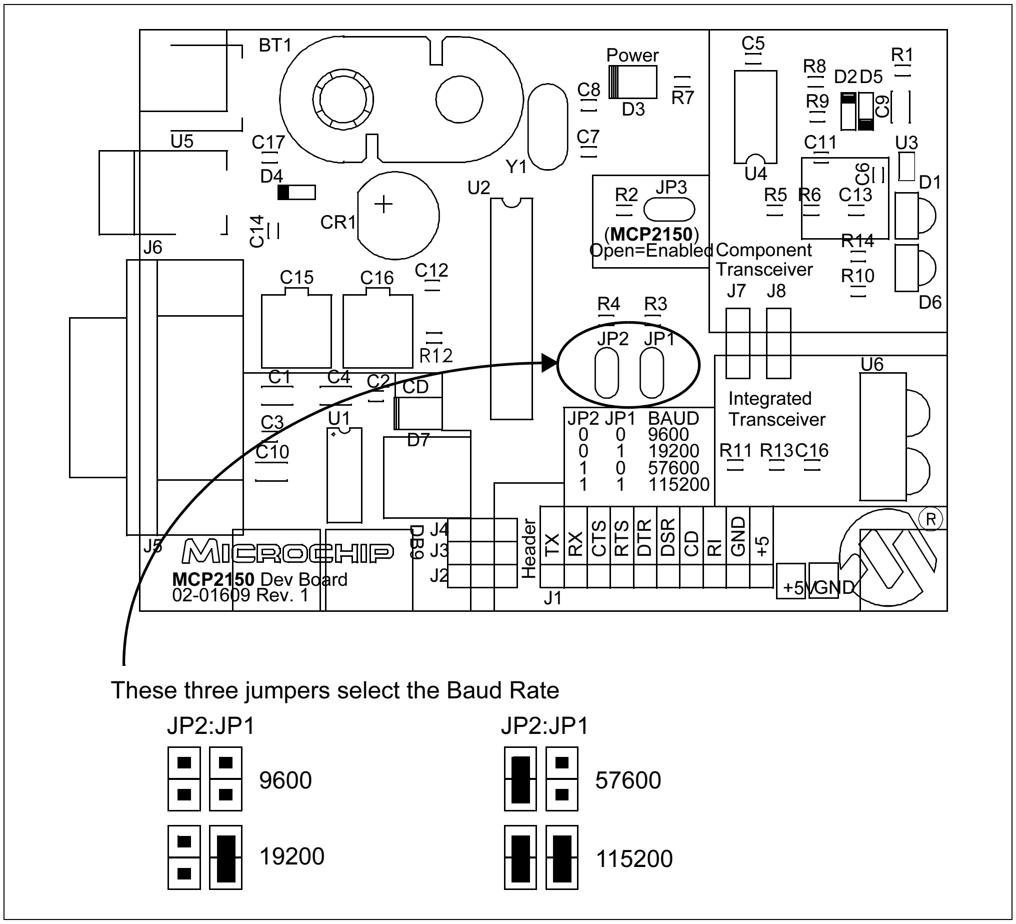


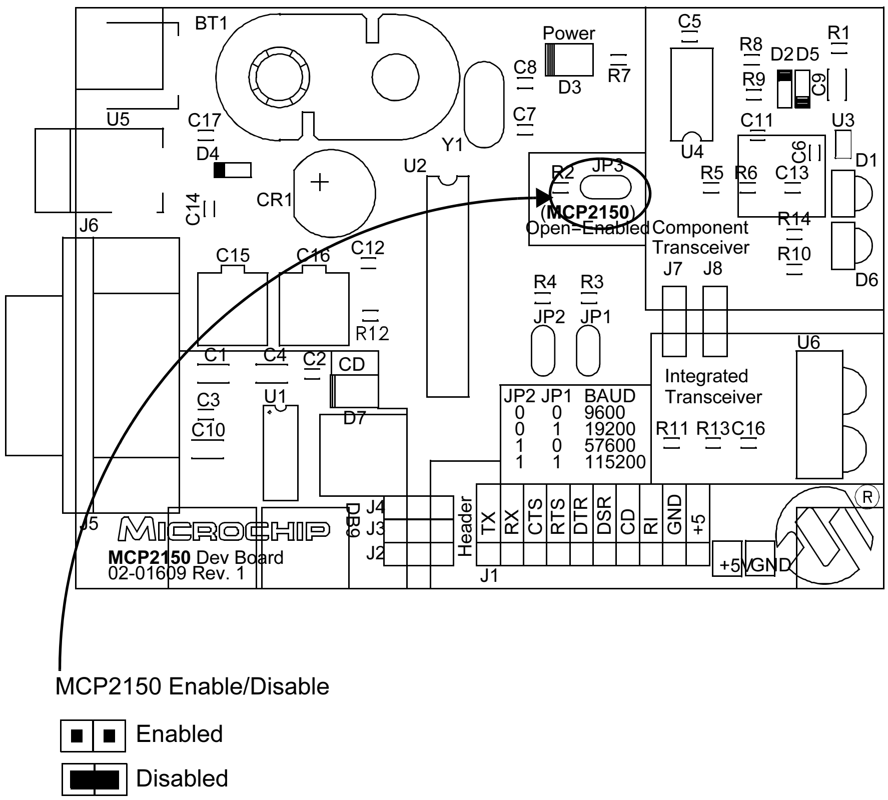
TABLE 1-2: SERIAL BAUD RATE SELECTION VS. FREQUENCY

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

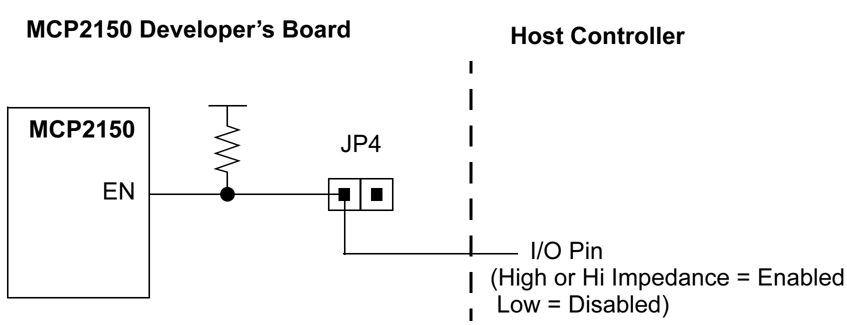
Figure 1-10 shows the jumper (JP3) which will enable or disable the MCP2150 device. When the MCP2150 is disabled, the device will consume less current.

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)	$\leftrightarrow$	MCP2120 Dev Board (ASCII)
2.	MCP2120 Dev Board (IR Driver)	$\rightarrow$	MCP2120 Dev Board (IR Driver)
3.	MCP2150 Dev Board (ASCII)	$\leftrightarrow$	MCP2120 Dev Board (IR Driver)
4.	MCP2120 Dev Board (IR Driver)	$\rightarrow$	IrDA standard port (Palm Pilot, cell phone, ...)
5.	MCP2150 Dev Board (ASCII)	$\rightarrow$	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

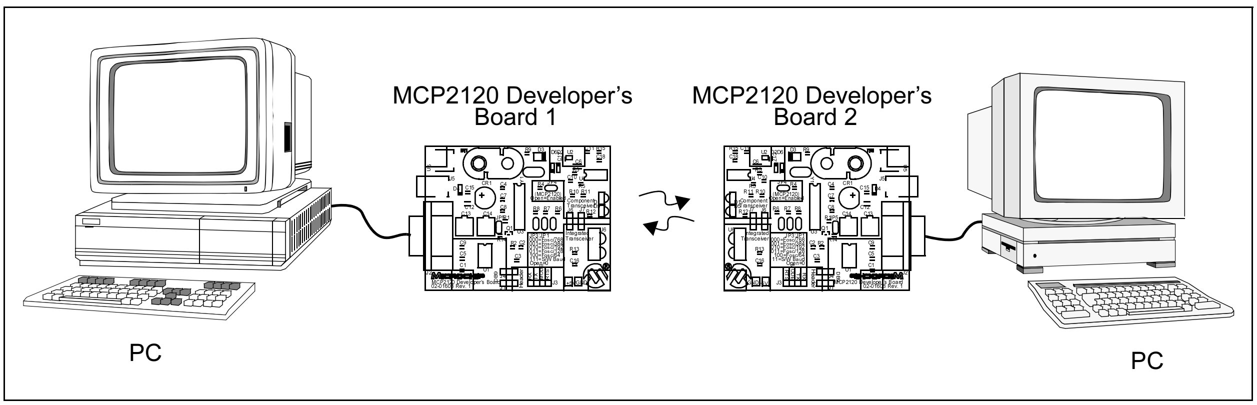
Items discussed in this chapter include:

- 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



2.4 HARDWARE SETUP

2.4.1 Oscillator

The crystal oscillator has pin receptacles to allow the changing of the MCP2120 oscillator frequency. For the tutorial, we will be using a crystal frequency of 7.3728 MHz. This crystal frequency is shipped in the kit.

2.4.2 Board Jumpers

The MCP2120 and MCP2150 Developer's Boards may use one of two host interfaces, the DB-9 interface to connect to a PC, or the header to connect to a controller board.

For the tutorial, the host signal will come from the DB-9 connector and the infrared data signals will interface to the Integrated Optical Transceiver. Figure 2-2 shows how the two 3-pin jumpers need to be connected for this configuration.

FIGURE 2-2: MCP2120 DEVELOPER'S BOARD COMPONENT LAYOUT

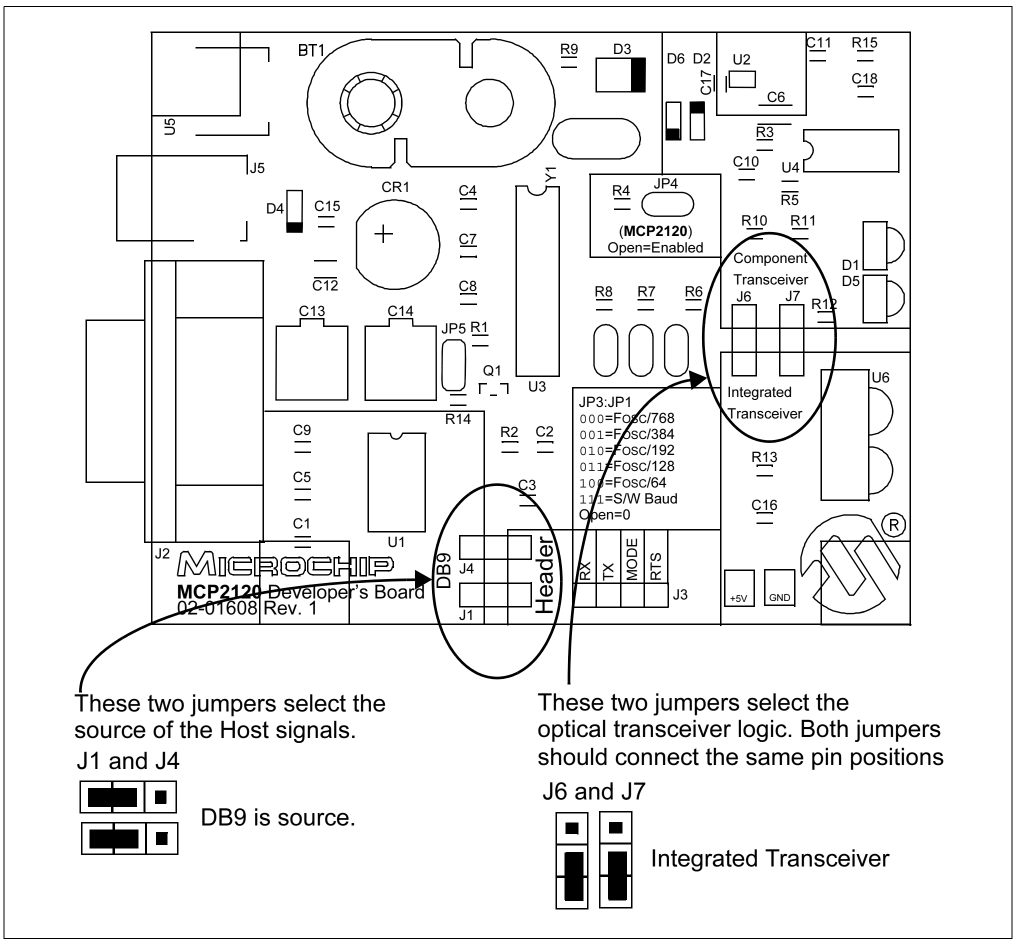


Figure 2-3 shows the three Baud Rate Select jumpers (JP3:JP1) and the baud rate formula that is specified (baud rate dependant on MCP2120 operational frequency). The tutorial requires these jumpers to be open for a baud rate of 9600, when the crystal frequency is 7.3728 MHz.

FIGURE 2-3: MCP2120 BAUD RATE

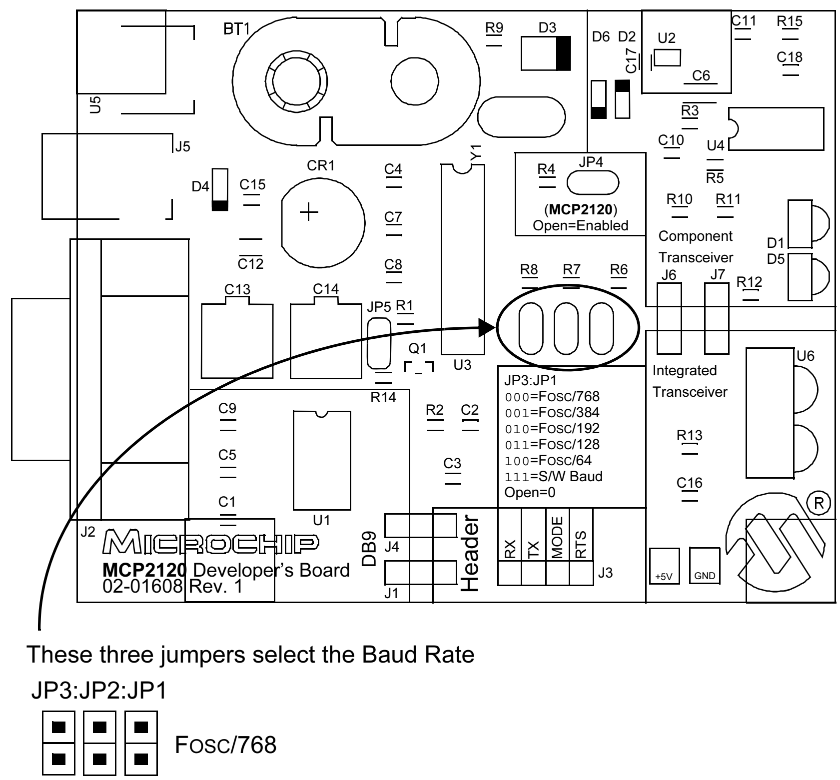
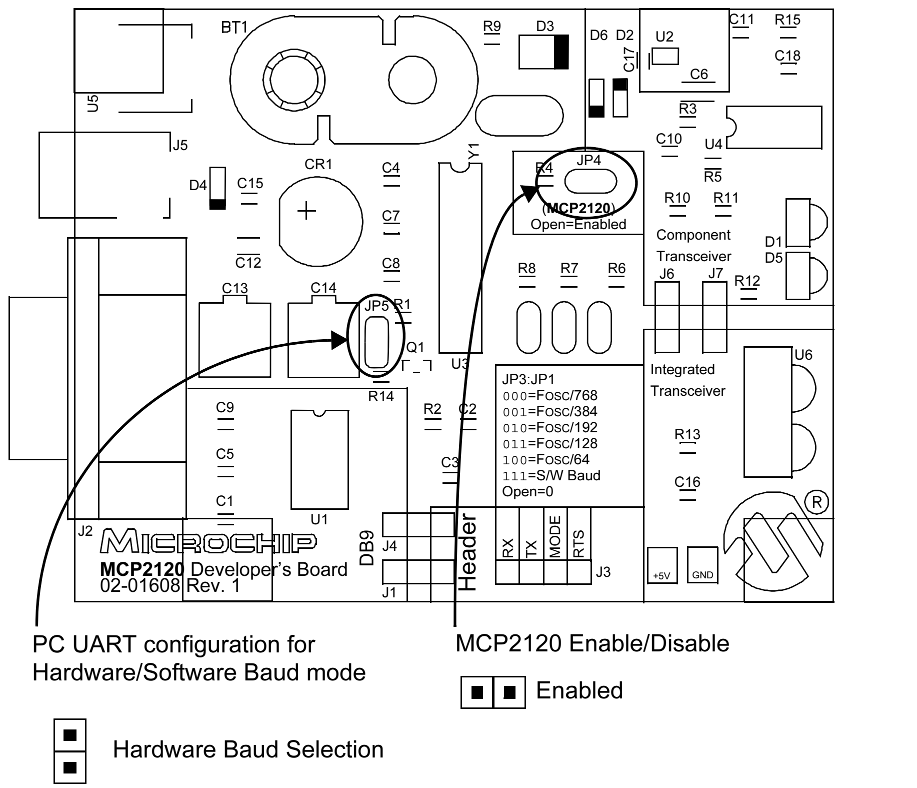


Figure 2-4 shows jumpers JP4 and JP5 and their state. For the tutorial, both of these jumpers are required to be open.

FIGURE 2-4: MCP2120 UART MODE AND ENABLE MODE

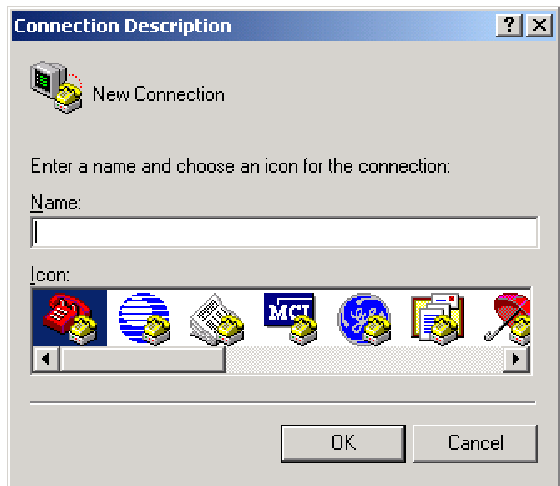


2.5 SETTING UP THE TERMINAL PROGRAM

Windows 95 Operating System (OS) comes with a Terminal Emulation program called Hyperterminal. This tutorial uses this program to demonstrate the operation of the MPLAB C30 Developer's Kit boards.

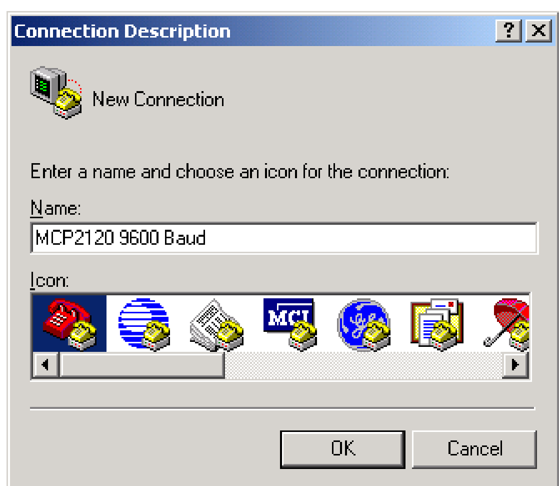
To open Hyperterminal, select *Start > Programs > Accessories* and select the Hyperterminal folder. Then double click the program file Hypertrm.exe. to start Hyperterminal. Figure 2-5 shows the initial screen once the Hyperterminal program is open. You will then need to select a name for this configuration.

FIGURE 2-5: HYPERTERMINAL® OPENING SCREEN



For the initial test, we will set up the system to operate at 9600 baud. Type the name as shown in Figure 2-6 and select any icon. Click **OK**.

FIGURE 2-6: CHOOSING NAME AND ICON

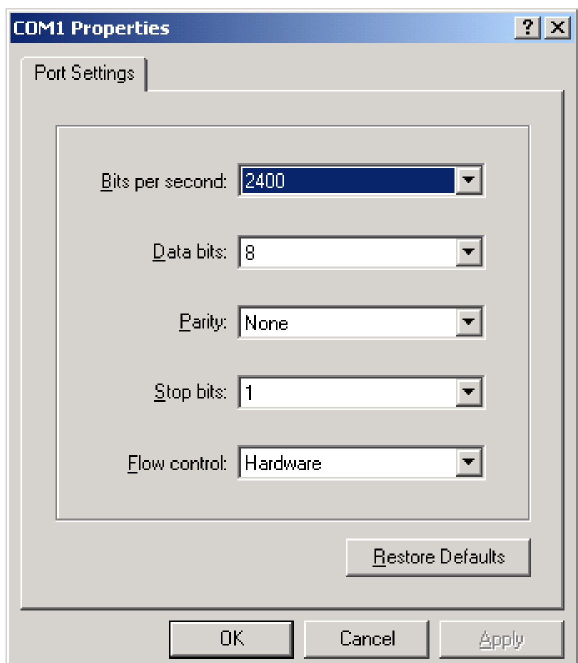


The menu in Figure 2-7 appears. You will need to select the port your serial port is on (Connect using). In our case, we are using COM1. Click **OK**.

FIGURE 2-7: SELECTING COMMUNICATIONS (COM) PORT

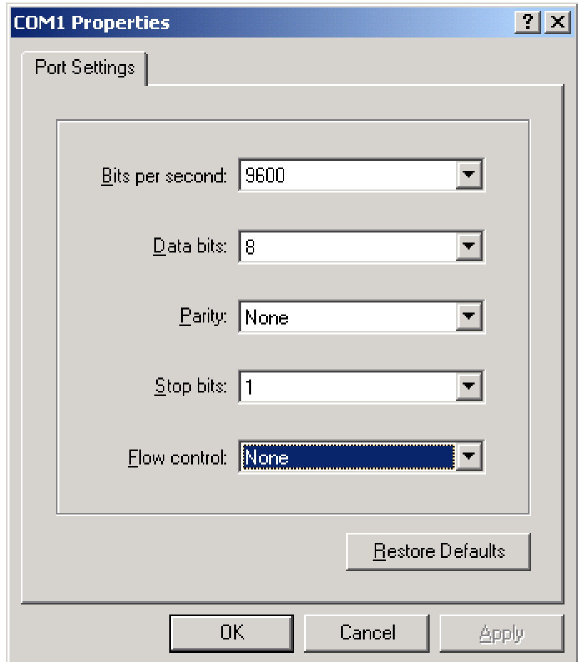
The Default settings for COM1 are displayed in Figure 2-8.

FIGURE 2-8: HYPERTERMINAL® DEFAULT COM PORT SETTINGS



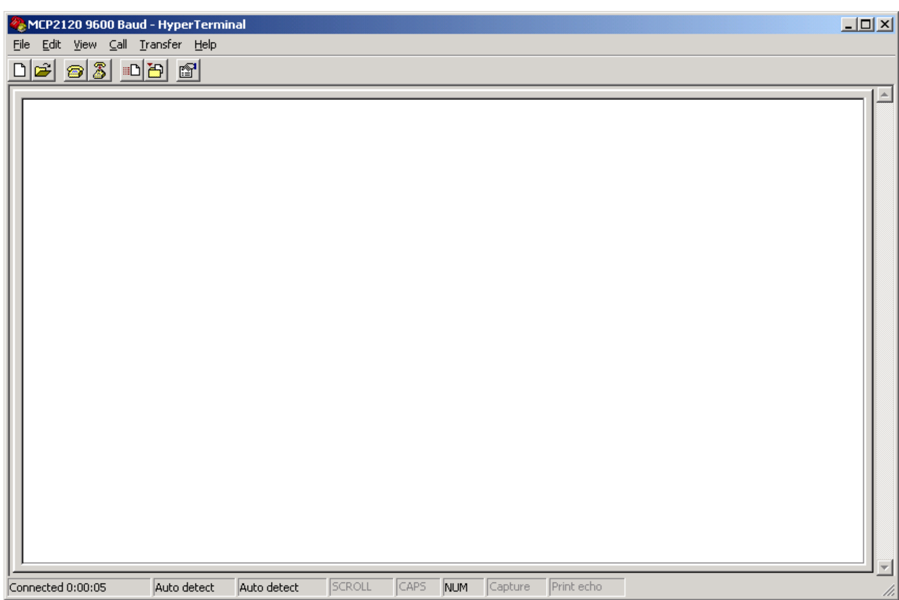
The COM port settings need to be modified so the **Bits per second** is "9600" and the **Flow Control** is "None", as shown in Figure 2-9. Click **OK** when done.

FIGURE 2-9: DESIRED HYPERTERMINAL® COM PORT SETTINGS



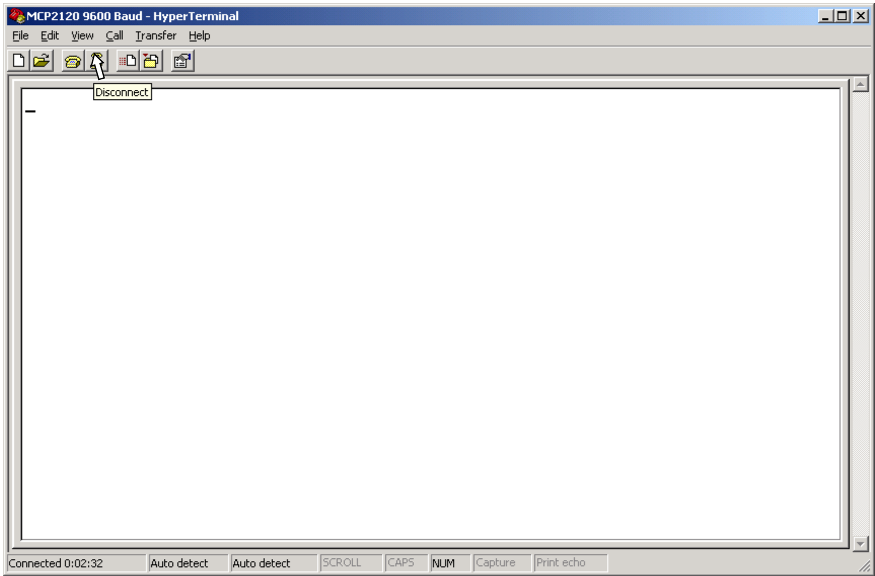
The terminal window opens connected to the serial port as shown in Figure 2-10.

FIGURE 2-10: HYPERTERMINAL® SCREEN AFTER INITIAL SETUP



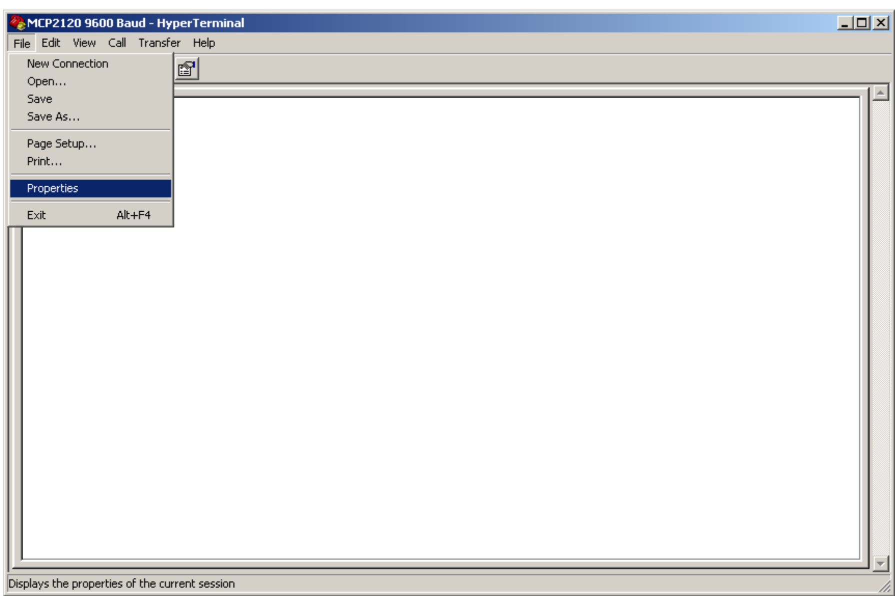
When the characteristics of the Hyperterminal session need to be modified, the program should be disconnected from the port. To disconnect, click on the icon with the handset with the down arrow onto the phone base as shown in Figure 2-11.

FIGURE 2-11: DISCONNECTING HYPERTERMINAL®



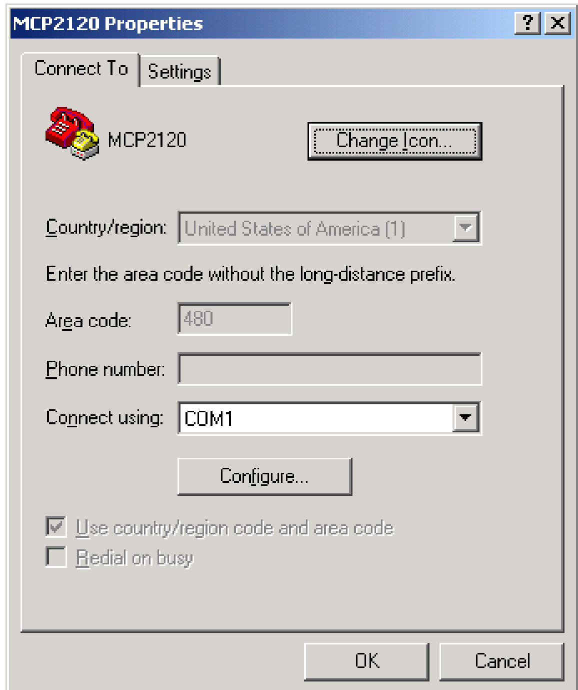
To modify the properties of this Hyperterminal session, select *File > Properties* as shown in Figure 2-12.

FIGURE 2-12: SELECTING HYPERTERMINAL® PROPERTIES MENU



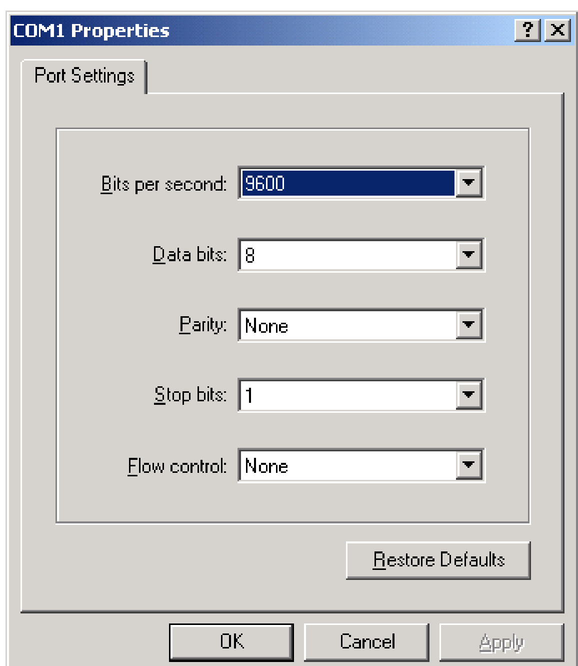
The Hyperterminal Properties window will appear as shown in Figure 2-13. Clicking the "**Configure**..." button will open the COM Properties window shown in Figure 2-14.

FIGURE 2-13: HYPERTERMINAL® PROPERTIES MENU (CONNECT TO)



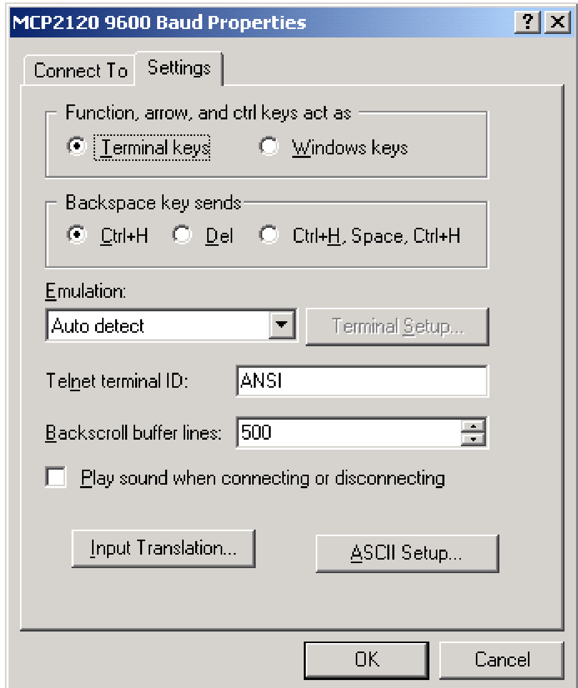
Verify the settings are as desired. If not, change the settings to match the settings in Figure 2-14. Click the **OK** button and you will return to the window shown in Figure 2-13.

FIGURE 2-14: CONFIGURE CONNECTION MENU



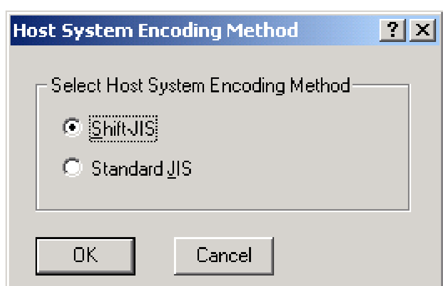
Click on the **Settings** tab. Figure 2-15 shows the default settings. The "**Backscroll buffer lines**" setting can be modified to **0**, if desired. This will make viewing information in the Hyperterminal window more convenient.

FIGURE 2-15: HYPERTERMINAL® PROPERTIES MENU (SETTINGS)



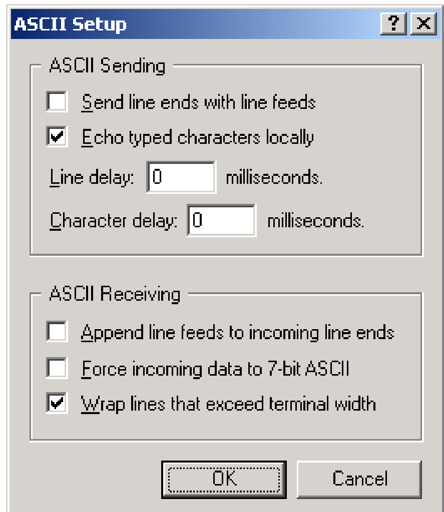
Clicking on the "**Input Translation...**" button will bring up the following window. Click **Cancel** to close this window.

FIGURE 2-16: INPUT TRANSLATION MENU



Clicking on the "**ASCII Setup...**" button will bring up the ASCII Setup window. Make the changes as shown in Figure 2-17 by checking the "**Echo typed characters locally**" setting. Click **OK** to apply these changes and close the window.

FIGURE 2-17: ASCII SETUP MENU



2.6 TRANSMITTING/RECEIVING DATA

Now both PCs should have their Hyperterminal program running in the connected mode with the same COM port settings. See Figure 2-9.

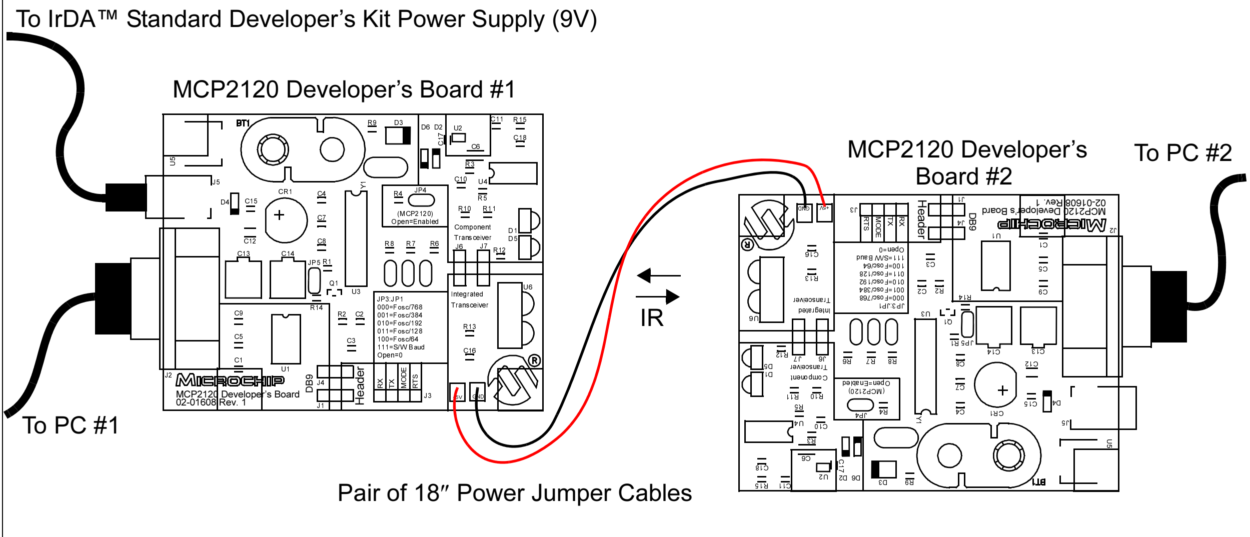
Each MCP2120 Developer's Board should be powered. Use the pair of 18″ (45 cm) power jumper cables to power MCP2120 Developer's Board #2 from MCP2120 Developer's Board #1. Optionally, MCP2120 Developer's Board #2 could be powered from a 9V battery. When the MCP2120 Developer's Board is powered, the green LED (labeled D3) will be on.

Each MCP2120 Developer's Board should be connected to their respective PC serial port, so that Hyperterminal can communicate to the board.

The MCP2120 Developer's Board should be oriented so that the integrated optical transceivers are aligned with each other (as shown in Figure 2-18). For the initial communication between the two boards, the MCP2120 Developer's Boards should be approximately 6" (15 cm) apart.

Type a string of characters in the Hyperterminal window on PC #1. This same character sting should appear in the Hyperterminal window of PC #2. Typing a string of characters in the Hyperterminal window on PC #2 should have the same character string appear in the Hyperterminal window of PC #1. Congratulations! You may now start modifying the system to evaluate/test the operation of the MCP2120 and MCP2120 Developer's Board.

FIGURE 2-18: MCP2120 TUTORIAL SYSTEM



2.6.1 System Debug Tips

If you are not getting communications between the two boards, some debugging is in order. Here are some suggested steps:

- Verify that the Hyperterminal programs are set up correctly
- Verify that both Hyperterminal sessions are "connected"
- Verify that the MCP2120 Developer's Boards are powered
- Verify that the MCP2120 Developer's Boards are set up correctly

If that review does not locate the issue, then more in depth debugging is required. These steps require an oscilloscope. A digital 4-channel oscilloscope is recommended. By typing a data byte into Hyperterminal on the PC, the oscilloscope can be used to determine where in the system the data byte was "lost".

Figure 2-19 and Figure 2-20 shows a debug flow to help troubleshoot the communications between the two MCP2120 Developer's Boards. Figure 2-19 shows the steps for the transmit side of System #1 (PC #1 and MCP2120 Developer's Board #1). If it appears that the TXIR signal is correct, then the receive side needs to be validated. Figure 2-20 shows the steps for the receive side of System #2 (PC #2 and MCP2120 Developer's Board #2).

These steps can then be used to debug the transmit side of System #2 and the receive side of System #1.

FIGURE 2-19: DEBUG FLOWCHART – MCP2120 DEVELOPER'S BOARD #1 SIDE

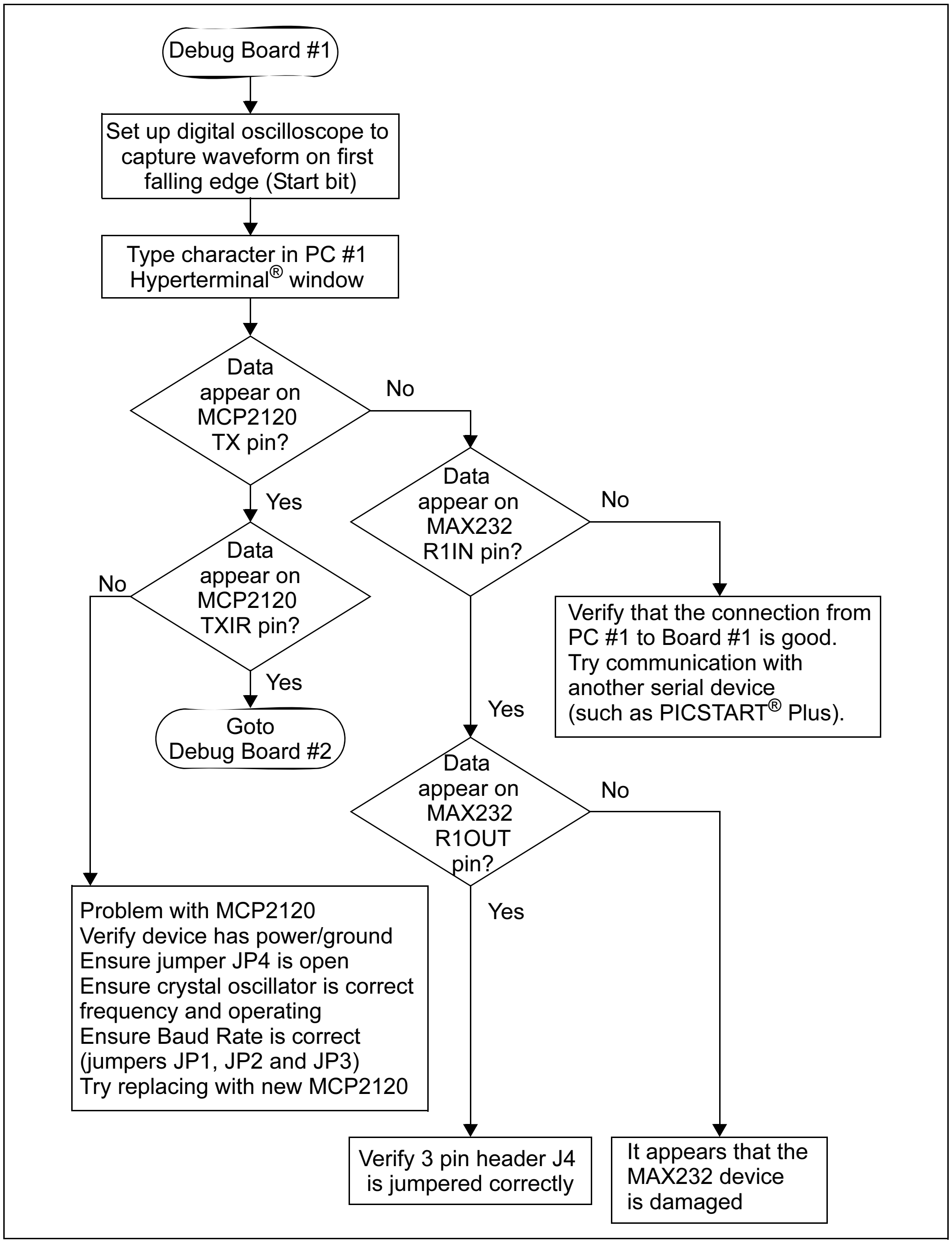
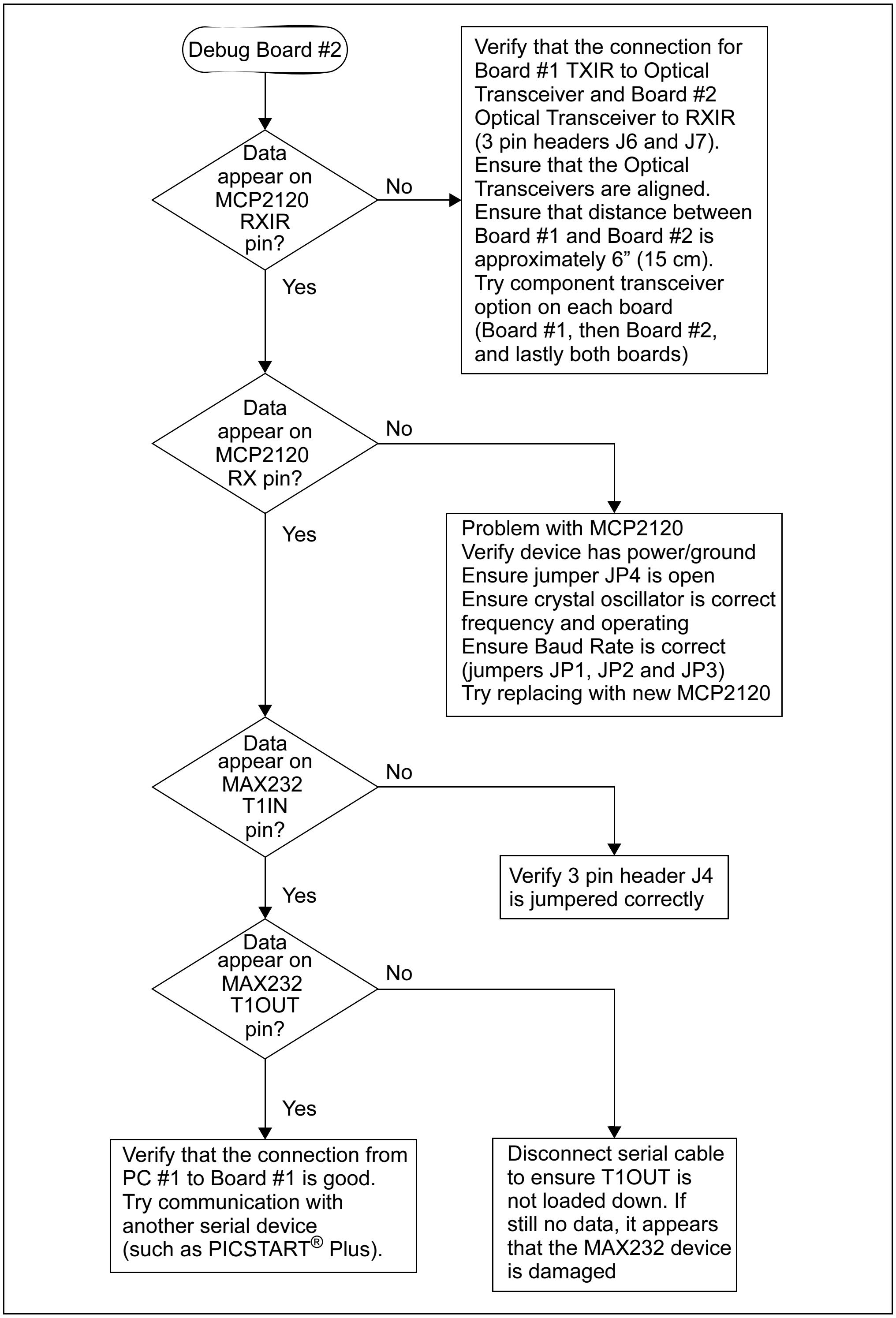


FIGURE 2-20: DEBUG FLOWCHART – MCP2120 DEVELOPER'S BOARD #2 SIDE



Chapter 3. MCP2150 Tutorial

3.1 INTRODUCTION

This chapter covers a tutorial for using the MCP2150 Developer's Board.

3.2 HIGHLIGHTS

Items discussed in this chapter include:

- MCP2150 Tutorial

3.3 MCP2150 TUTORIAL

This tutorial was not available for this revision of the MCP2120/MCP2150 Developer's Kit User's Guide. Please check in the Development Tools section of the Microchip web site (**www.microchip.com**) for revision D of the User's Guide. Revision D is planned to include the tutorial on using the MCP2150 Developer's Board with an MCP2120 Developer's Board.

Information on Microchip Development Tools can be located on the web site by using the Navigate window and selecting *Developer's Tool Box > Development Tools*.

NOTES:

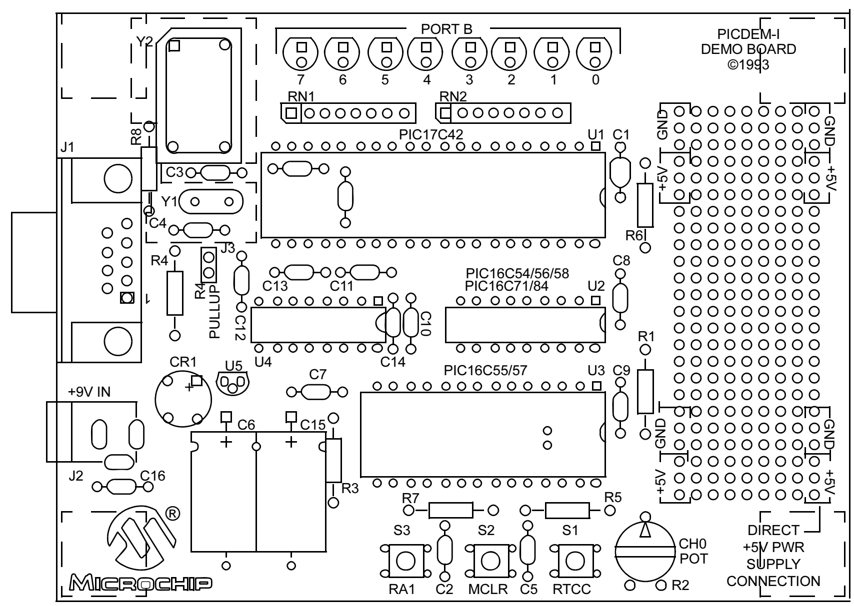
Chapter 4. Using a PICDEM™ 1 or PICDEM 2 Board as Host

4.1 USING THE PICDEM 1 BOARD

The PICDEM 1 board may be used as the host controller in an IrDA standard compatible system. PortB can be used to display received characters, while any of the other ports would be used for the UART and control signals. A PICmicro® microcontroller may be selected that has a hardware UART, or the UART functionality may be implemented in software.

Figure 4-1 shows the parts layout (silk-screen) for the PICDEM 1 board.

FIGURE 4-1: PICDEM™ 1 PARTS LAYOUT



Note 1: U1 is for use with any 40-pin PIC17C4X device.

2: U2 is for use with any 18-pin PIC16C5X, PIC16CXXX device.

3: U3 is for use with any 28-pin PIC16C5X, PIC16CXXX device.

4.2 APPLICATION NOTES

There are two Application Notes that show how to use the PICDEM 1 Board as a Host controller.

AN756, "*Using the MCP2120 for Infrared Communication*", DS00756, uses the MCP2120 Developer's Board and has two code examples. The first is using a PIC16F84 with the MCP2120 Developer's Board in Hardware Baud mode. In this mode, only two signals need to be interfaced. The RX and TX signal. The second code example is also using a PIC16F84 with the MCP2120 Developer's Board in Software Baud mode. In this mode, four signals need to be interfaced; RX, TX, MODE and RTS (used to reset the MCP2120).

AN758, "*Using the MCP2150 to Add IrDA™ Standard Wireless Connectivity*", DS00758, uses the MCP2150 Developer's Board and has one code example. For this application, seven signals need to be interfaced; RX, TX, DSR, DTR, CTS, RTS and CD.

4.2.1 For Additional PICDEM 1 Information

Additional information can located on the Microchip web site (www.microchip.com). Information on Microchip Development Tools can be located by using the Navigate window and selecting *Developer's Tool Box > Development Tools*.

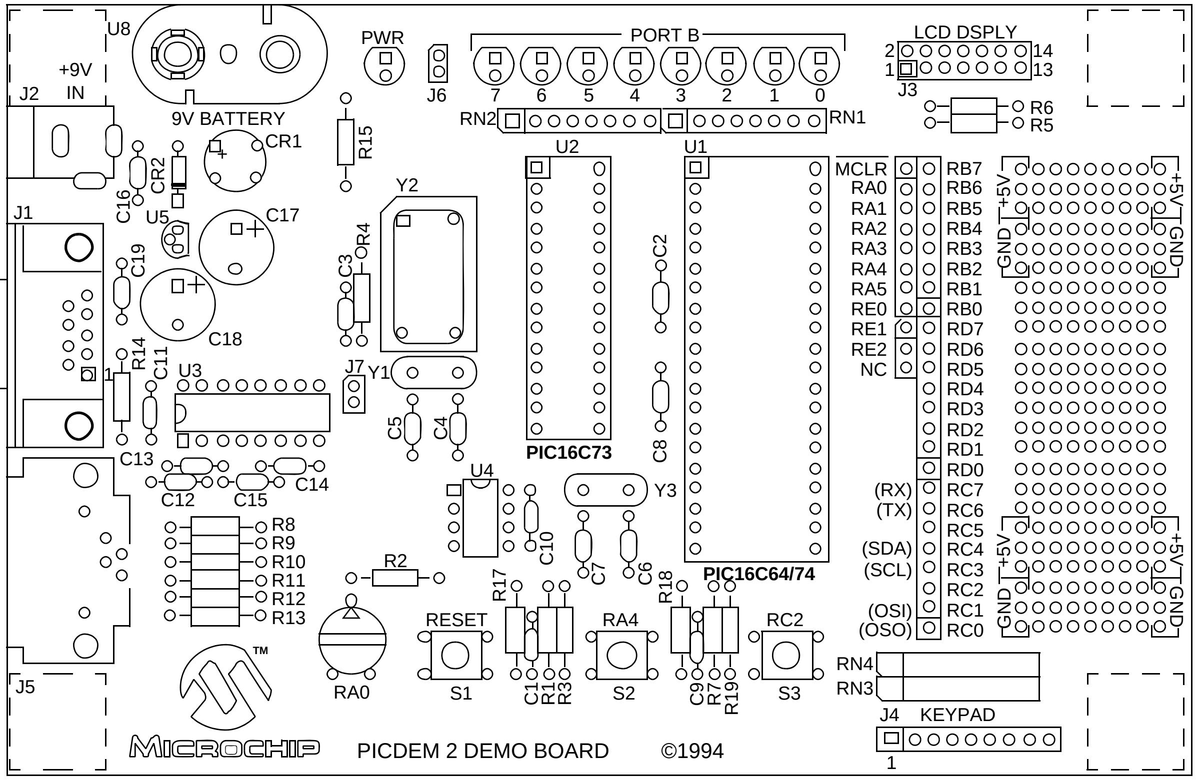
The PICDEM 1 User's Guide literature number is DS33015, and the PICDEM 1 kit can be ordered with part number DM163001.

4.3 USING THE PICDEM 2 BOARD

The PICDEM 2 board may be used as the host controller in an IrDA standard compatible system. PortB can be used to display received characters, while any of the other ports would be used for the UART and control signals. A PICmicro microcontroller may be selected that has a hardware UART, or the UART functionality may be implemented in software.

Figure 4-2 shows the parts layout (silk-screen) for the PICDEM 2 board.

FIGURE 4-2: PICDEM™ 2 PARTS LAYOUT



Note 1: U2 is for use with any 28-pin PIC16CXXX or PIC18CXXX device.

2: U1 is for use with any 40-pin PIC16CXXX or PIC18CXXX device.

4.3.1 Application Notes

Currently there are no Application Notes that use the PICDEM 2 Board as a Host controller. The examples shown for the PICDEM 1 board can be easily modified to have the PICDEM 2 board operate as the Host controller.

4.3.2 For Additional PICDEM 2 Information

Additional information can located on the Microchip web site (www.microchip.com). Information on Microchip Development Tools can be located by using the Navigate window and selecting *Developer's Tool Box* > *Development Tools*.

The PICDEM 2 User's Guide literature number is DS30374, and the PICDEM 2 kit can be ordered with part number DM163002.

NOTES:

Appendix A. Hardware Detail

A.1 INTRODUCTION

The MCP2120/MCP2150 Developer's Board hardware is intended to illustrate the ease of use of Microchip's infrared data communication solutions. The Developer's Board features the following hardware elements.

A.2 POWER SUPPLY

There are three ways to supply power to the MCP2120/MCP2150 Developer's Board:

- A 9V battery can be plugged into BT1.
- A 9V, 750 mA unregulated AC or DC supply can be plugged into J5.
- A +5V, 750 mA regulated DC supply can be connected to the two pins provided, labled +5V and GND. A pair of 18″ (45 cm) cables are provided to allow one board to power another.

A.3 POWER INDICATOR

One green LED indicates whether there is power applied to the MCP2120 and MCP2150 Developer Boards (LED lit) or not (LED off).

A.4 RS-232 SERIAL PORT

A.4.1 MCP2120 Developer's Board

A MAX232 compatible level shifting IC has been provided with all necessary hardware to support connection of an RS-232 host through the DB-9 connector. The port can be connected to a PC using a straight through cable. Refer to the *MCP2120 Data Sheet* (DS21618) for more information.

A.4.2 MCP2150 Developer's Board

A MAX3238E compatible level shifting IC has been provided with all necessary hardware to support connection of a RS-232 host through the DB-9 connector. The port can be connected to a PC using a straight through cable. Refer to the *MCP2120 Data Sheet* for more information.

A.5 JUMPERS

Jumpers are used to allow the Developer's Board to be configured into the different modes that are possible. These modes include:

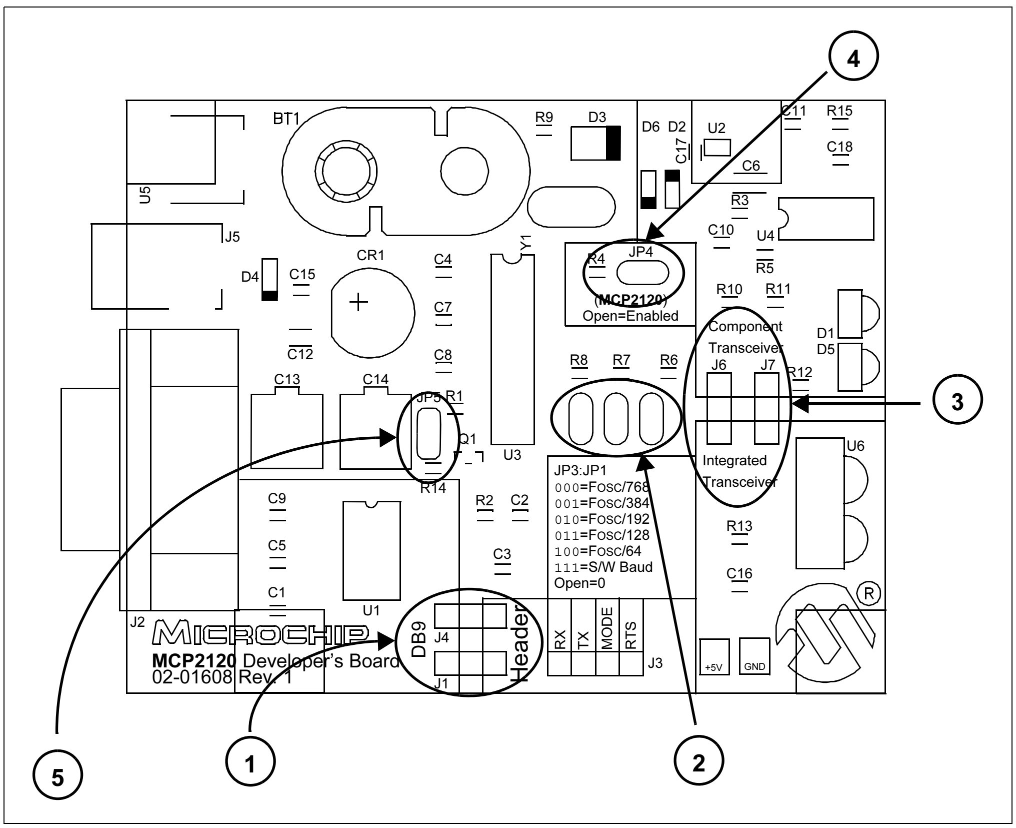
- Selection of baud rate
- Source of host signals
- Source of optical transceiver signals
- Device enable signal for power down operation

A.5.1 MCP2120 Developer's Board

The MCP2120 Developer's Board has the following jumpers:

1. Two jumpers to select source of UART signals. Either RS-232C socket or the four-pin header.
2. Three jumpers to select desired baud rate.
3. Two jumpers to select IR Transceiver options.
4. Jumper to disable device operation.
5. Jumper for Software Baud control when using RS-232C interface.

FIGURE A-1: MCP2120 DEVELOPER'S BOARD HARDWARE

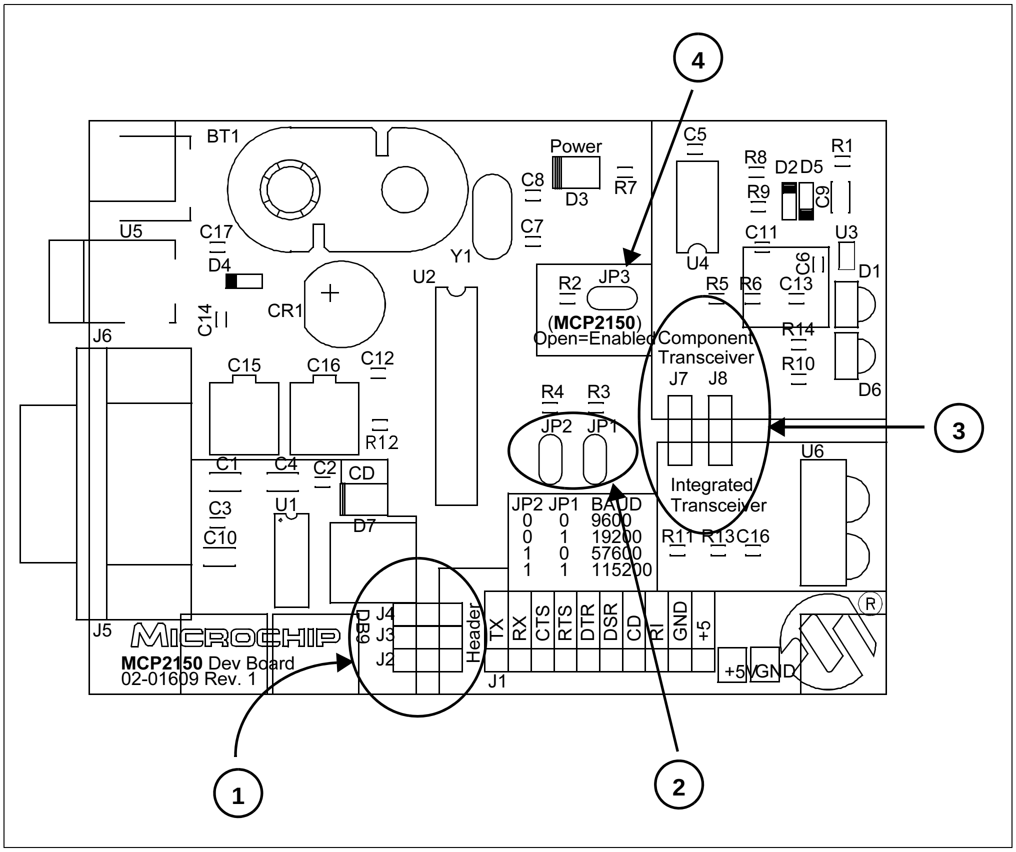


A.5.2 MCP2150 Developer's Board

The MCP2150 Developer's Board has the following jumpers:

1. Three jumpers to select source of UART signals. Either RS-232C socket or the eight-pin header.
2. Two jumpers to select desired baud rate.
3. Two jumpers to select IR Transceiver options.
4. Jumper to disable device operation.

FIGURE A-2: MCP2150 DEVELOPER'S BOARD HARDWARE



A.6 OSCILLATOR OPTIONS

The MCP2120 can be operated at different frequencies, while the MCP2150 only operates at a single fixed frequency.

A.6.1 MCP2120 Developer's Board

The MCP2120 Developer's Board crystal has pin receptacles so that crystal frequencies can easily be changed. Table A-1 shows the baud rates for a given crystal frequency, based on the state of the BAUD2:BAUD0 pins.

TABLE A-1: CRYSTAL FREQUENCY / BAUD RATE

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

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 µs in the IrDA standard specification.

A.6.2 MCP2150 Developer's Board

The MCP2150 Developer's Board requires a fixed frequency crystal (11.0592 MHz).

TABLE A-2: CRYSTAL FREQUENCY / BAUD RATE

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

A.7 BOARD LAYOUT

Figure A-3 shows the component layout (silkscreen) for the MCP2120 Board.

FIGURE A-3: MCP2120 DEVELOPER'S BOARD COMPONENT LAYOUT

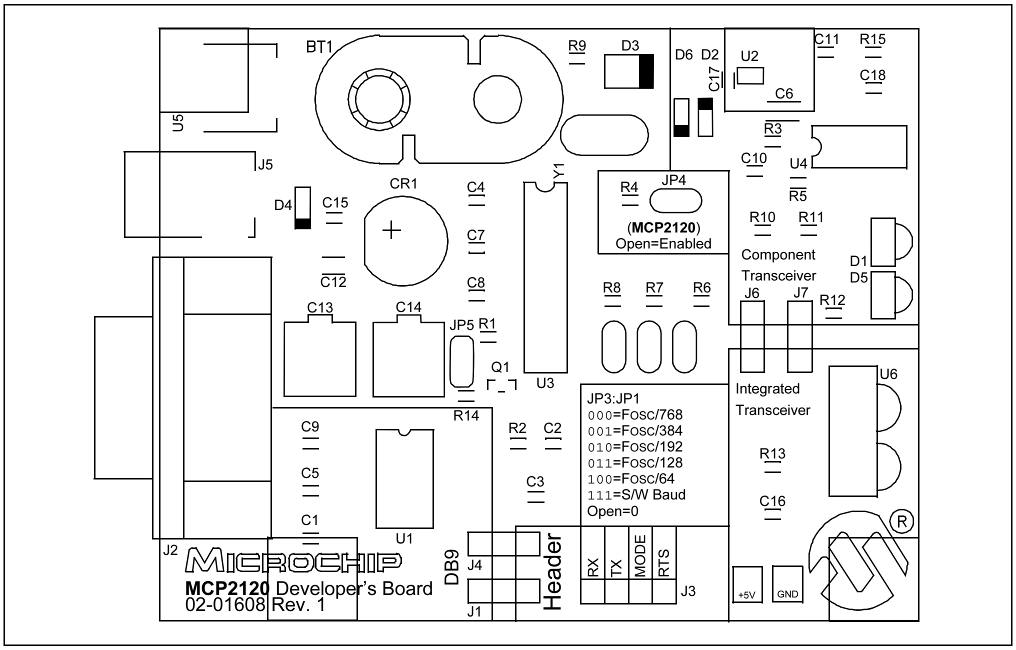
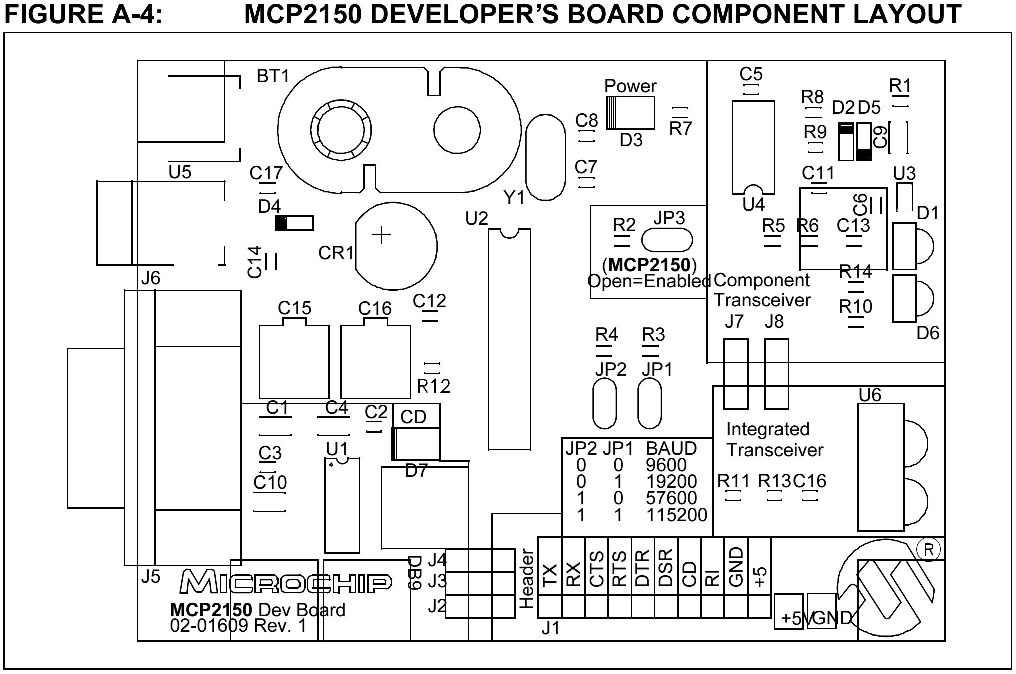


Figure A-4 shows the component layout (silkscreen) for the MCP2150 Board.

FIGURE A-4: MCP2150 DEVELOPER'S BOARD COMPONENT LAYOUT



A.8 SCHEMATICS

Figure A-5 shows the schematic for the MCP2120 Developer's Board. Figure A-6 shows the schematic for the MCP2150 Developer's Board.

FIGURE A-5: MCP2120 DEVELOPER'S BOARD SCHEMATIC

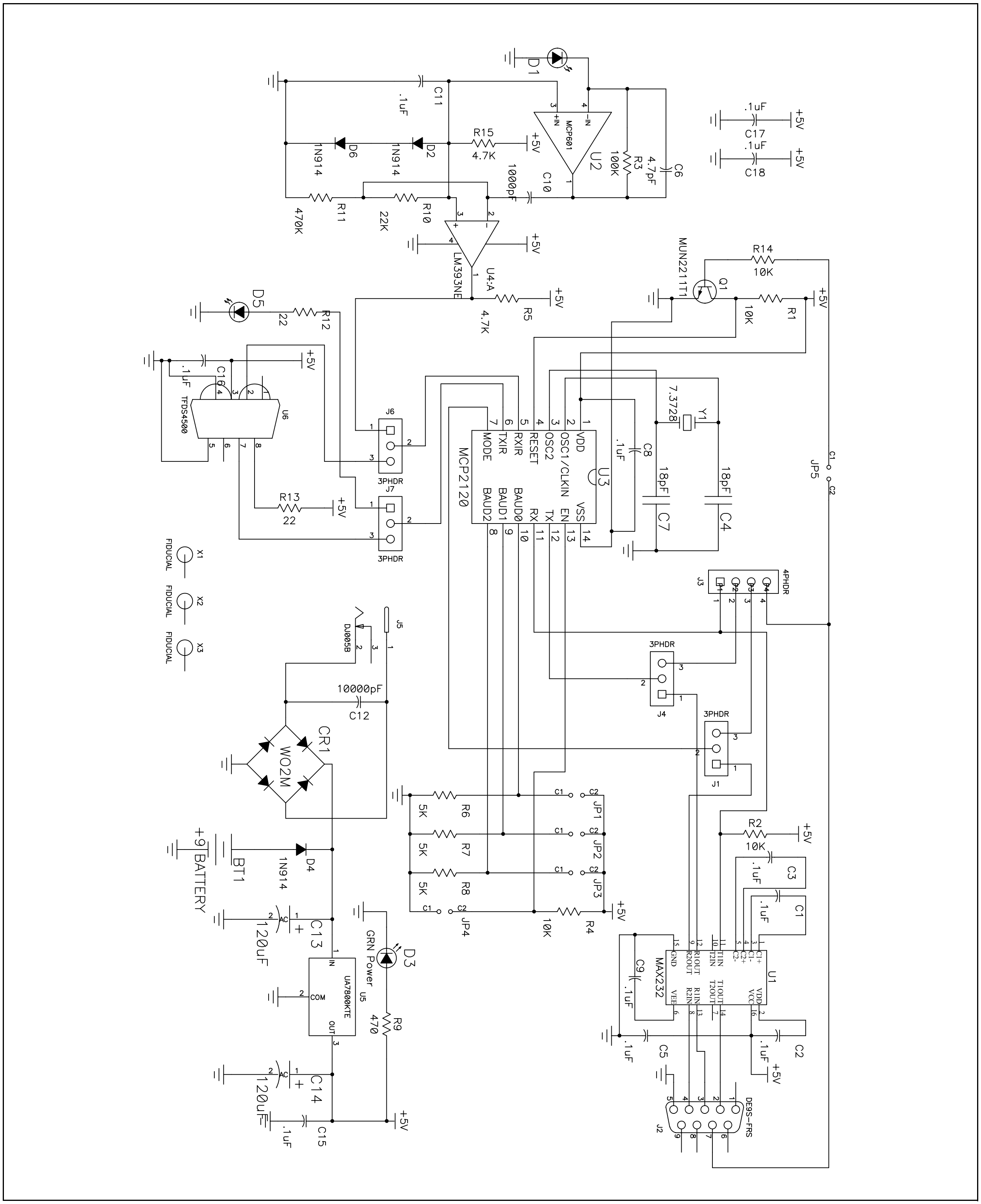
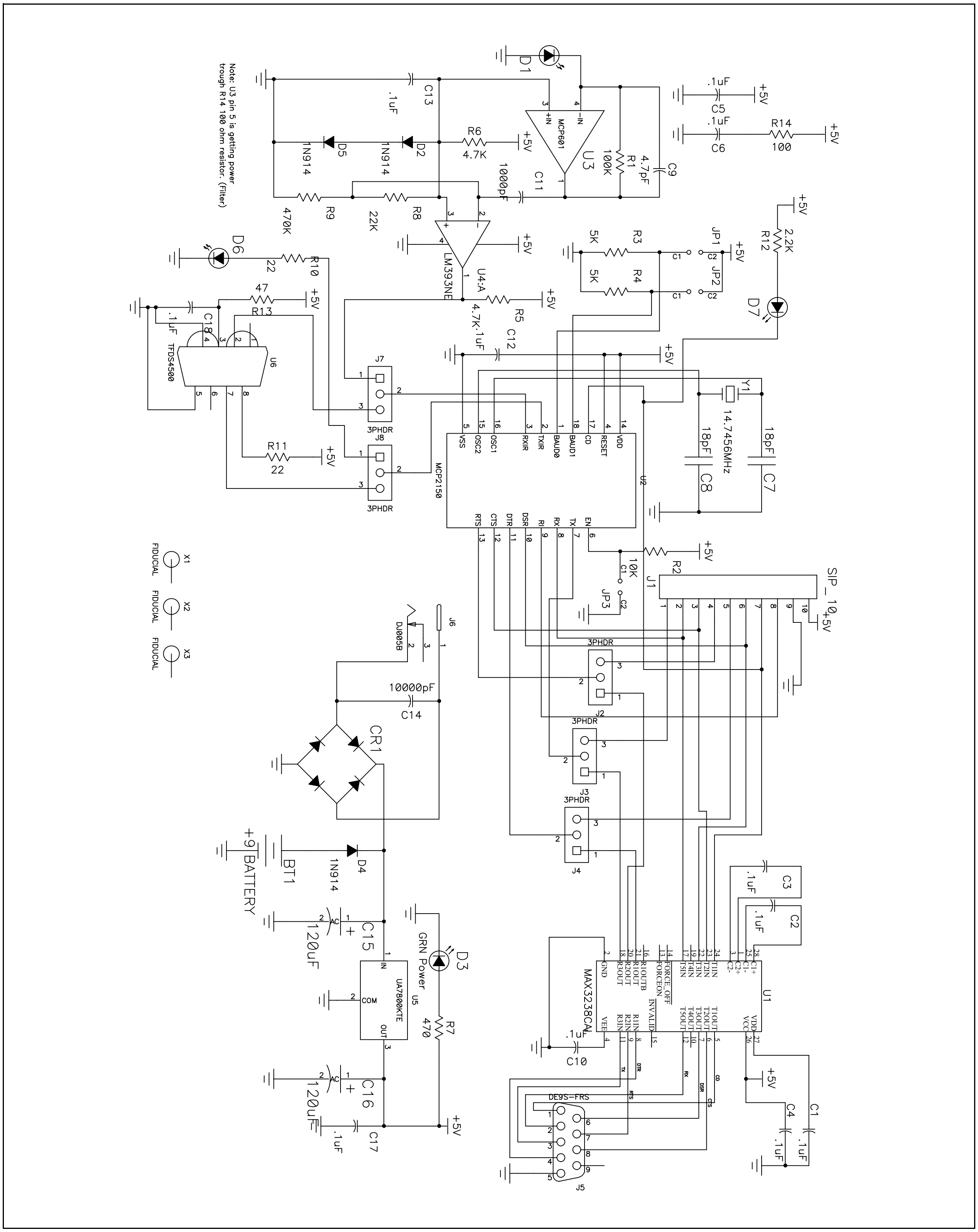


FIGURE A-6: MCP2150 DEVELOPER'S BOARD SCHEMATIC



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