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MCP215X Data Logger Demo Board User's Guide

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MCP215X DATA LOGGER DEMO BOARD USER'S GUIDE

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MCP215X DATA LOGGER DEMO BOARD USER'S GUIDE

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

This chapter contains general information that will be useful to know before using the MCP215X Data Logger Demo Board User's Guide. Items discussed in this chapter include:

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

ABOUT THIS GUIDE

Document Layout

This document describes how to use the MCP215X Data Logger Demo Board User's Guide as a development tool to emulate and debug firmware on a target board. The manual layout is as follows:

- **Chapter 1: Product Overview** – Important information about the MCP215X Data Logger Demo Board User's Guide.
- **Chapter 2: MCP215X Data Logger Demo Board User's Guide** – Includes instructions on how to get started with this demo board, with a detailed description of each function.
- **Appendix A: Schematic and Layouts** – Shows the schematic and layout diagrams for the MCP215X Data Logger Demo Board.
- **Appendix B: Bill-of-Materials** – Lists the parts used to build the MCP215X Data Logger Demo Board.
- **Appendix C: Connection Sequence** – Shows the connection sequence between a Primary device and the MCP215X (Secondary device). This connection sequence is shown at an overview level and does not show exact operation.
- **Appendix D: 250 Byte Transmit Table** – Shows the data that is transmitted by the program when in 250-Byte Transmit mode.

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

This user's guide describes how to use MCP215X Data Logger Demo Board User's Guide. Other useful documents are listed below. The following Microchip documents are available and recommended as supplemental reference resources.

MCP2150 Data Sheet (DS21790)

This data sheet provides detailed information regarding the MCP2150 device.

MCP2155 Data Sheet (DS21790)

This data sheet provides detailed information regarding the MCP2155 device.

AN858, "Interfacing the MCP215x to Host Controller" (DS00858)

This application note discusses the interface between a Host Controller and the MCP215X device.

AN888, "Programming the Palm OS® for Embedded IR Applications" (DS00888)

This application note discusses the programming of a Palm™ PDA to interface to an IrDA® standard device using IrCOMM.

AN926, "Programming the Pocket PC OS for Embedded IR Applications" (DS00926)

This application note discusses the programming of a Pocket PC PDA to interface to an IrDA standard device using IrCOMM.

AN941, "Programming Windows® XP for Embedded IR Applications" (DS00941)

This application note discusses the programming of a Windows XP PC to interface to an IrDA standard device using IrCOMM.

THE MICROCHIP WEB SITE

Microchip provides online support via our web 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

NOTES:

Chapter 1. Overview

1.1 INTRODUCTION

This chapter provides an overview of the MCP215X Data Logger Demo Board and covers the following topics:

- What is the MCP215X Data Logger Demo Board?
- What the MCP215X Data Logger Demo Board kit includes

1.2 WHAT IS THE MCP215X DATA LOGGER DEMO BOARD?

The MCP215X IrDA® Standard Protocol Stack Controller device allows the system designer to implement a low-cost, wireless IR port in any application providing support for the IrDA standard protocol stack and IrDA standard bit encoding/decoding.

The MCP215X Data Logger Demo Board is used to evaluate and demonstrate either the MCP2150 or MCP2155 device in a data-logging application. The board will communicate to a Primary device (such as a PDA (e.g., Palm™ or Pocket PC) or laptop computer). It is intended to serve as an example to assist system designers in developing an IrDA standard node using the MCP215X device.

Though the MCP215X Data Logger Demo Board ships with a MCP2150 installed, this device may be interchanged with a MCP2155, allowing the MCP2155 to be evaluated.

Note: If the MCP2150 is replaced by the MCP2155, the MCP2155 device must have the firmware programmed into the device. Ensure that the demo program firmware was assembled for the MCP2155 (the demo program uses conditional assembly to use the same source file for the two devices). The "MCP215X" variable needs to be equated to '55'. The MPASM™ assembler will display a message as to which device the file has assembled for.

1.3 WHAT THE MCP215X DATA LOGGER DEMO BOARD KIT INCLUDES

This MCP215X Data Logger Demo Board Kit includes:

- The MCP215X Data Logger Demo Board (with MCP2150 installed)
- MCP215X Data Logger Demo Board User's Guide (on CD-ROM)
- CD-ROM also includes:
  - Palm PDA Primary device application program (and related Application Note 888)
  - Pocket PC Primary device application program (and related Application Note 926)
  - Windows XP Primary device application program (and related Application Note 941)
  - Demo board firmware that can be conditionally assembled for either the MCP2150 or the MCP2155.

NOTES:

Chapter 2. Installation and Operation

2.1 INTRODUCTION

This chapter discusses the installation and operation of the MCP215X Data Logger Demo Board and a Primary device for data communication. This demonstrates an IrDA standard system and will assist the system designer on how to integrate an IR port into a system.

The MCP215X Data Logger Demo Board demonstrates the implementation of an embedded system with an IrDA standard interface. This system operates as an IrDA standard Secondary device using either the MCP2150 or the MCP2155 device.

The IrDA standard system requires the Primary device to be running an appropriate application program. The MCP215X Data Logger Demo Board interfaces to the Primary device application programs that are currently available from Microchip. The three application programs available for the following Primary device systems are:

- Palm OS®
- Microsoft® Pocket PC 2003
- Microsoft® Windows XP

These application programs are supported by three application notes that discuss the programming of these particular operating systems. These application notes are:

- AN888, "Programming the Palm OS® for Embedded IR Applications", DS00888
- AN926, "Programming the Pocket PC for Embedded IR Applications", DS00926
- AN941, "Programming Windows XP® for Embedded IR Applications", DS00941

Note: References to a MCP215X device in this document can refer to either the MCP2150 or the MCP2155 device.

The host UART interface includes non-data flow control signals. These are the signals between a Host Controller and a MCP215X device. A discussion of the host UART interface is given in the following application note:

- AN858, "Interfacing the MCP215X to a Host Controller", DS00858

2.2 FEATURES

The MCP215X Data Logger Demo Board has the following features:

- Communicates directly to Primary device (PDA or laptop computer) running the supplied Primary device application program or running a terminal emulation program
- LCD display (2 row x 16 character) for display of system information
- Data is transmitted in an easy-to-read format
- Reprogrammable PIC16F877 with MPLAB® In-Circuit Debugger (ICD) interface for user application development
- 18-pin socket for the installation of either a MCP2150 (default device) or a MCP2155 (optional device)
- Header that allows either several board signals to be monitored or allows the MCP215X Data Logger Demo Board to be interfaced to the user's system
- Eight LEDs that indicate MCP215X status (CTS, RTS, DTR, DSR, CD and RI activity)
- Eight LEDs that are connected to PORTD of the PIC16F877
- Battery-operated by a 9V source (can use a 9V battery)
- PICmicro® microcontroller (MCU) RESET switch
- Two switches (SW2 and SW3) to control the PICmicro MCU program operation
- Header and jumpers to allow the electrical removal of the optical transceiver and the installation of an alternate optical transceiver circuit (on a daughter board)
- Variable resistor connected to PICmicro MCU A/D input
- 8-pin DIP socket for the installation of an optional serial EEPROM (24LC256)

2.3 GETTING STARTED

This section presents an overview of the following system blocks:

- The MCP215X Data Logger Demo Board Hardware
- The MCP215X Data Logger Demo Board Firmware
- The Primary device Graphical User Interface (GUI)

This should give you an understanding of what these components do in the complete IrDA standard system.

2.3.1 The MCP215X Data Logger Demo Board Hardware Overview

The major components for the MCP215X Data Logger Demo Board are:

1. MCP215X device (U3)
2. Optical transceiver (U5 - TFDS 4500)
3. PICmicro MCU (U1 - PIC16F877)
4. LCD module
5. Power supply
6. User inputs to PICmicro MCU (SW2, SW3 and variable resistor (VR1))
7. PICmicro MCU RESET
8. PICmicro MCU crystal (Y2)

The MCP215X Data Logger Demo Board is fully assembled and tested for evaluation and demonstration of the MCP2150 or MCP2155 features. A block diagram of the demo board is shown in Figure 2-1. The board has been designed to allow the installation of an optional LCD contrast control (VR2) and serial EEPROM device. These optional components are removed from the MCP215X Data Logger Demo Board block diagrams for readability.

For more detailed circuit information, refer to **Appendix A. "Schematic and Layouts"** and **Appendix B. "Bill-Of-Materials (BOM)"**.

FIGURE 2-1: MCP215X DATA LOGGER DEMO BOARD BLOCK DIAGRAM

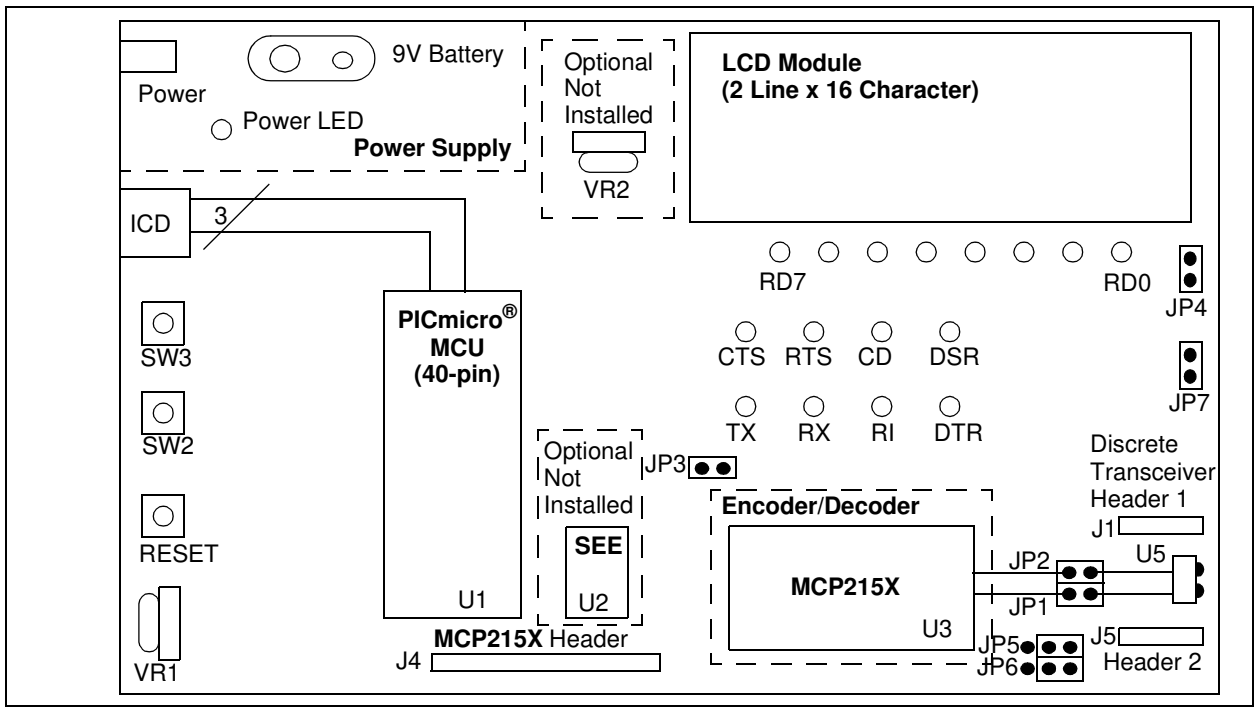


Figure 2-2 shows the layout of the MCP215X Data Logger Demo Board with indication to points of interest.

FIGURE 2-2: MCP215X DATA LOGGER DEMO BOARD

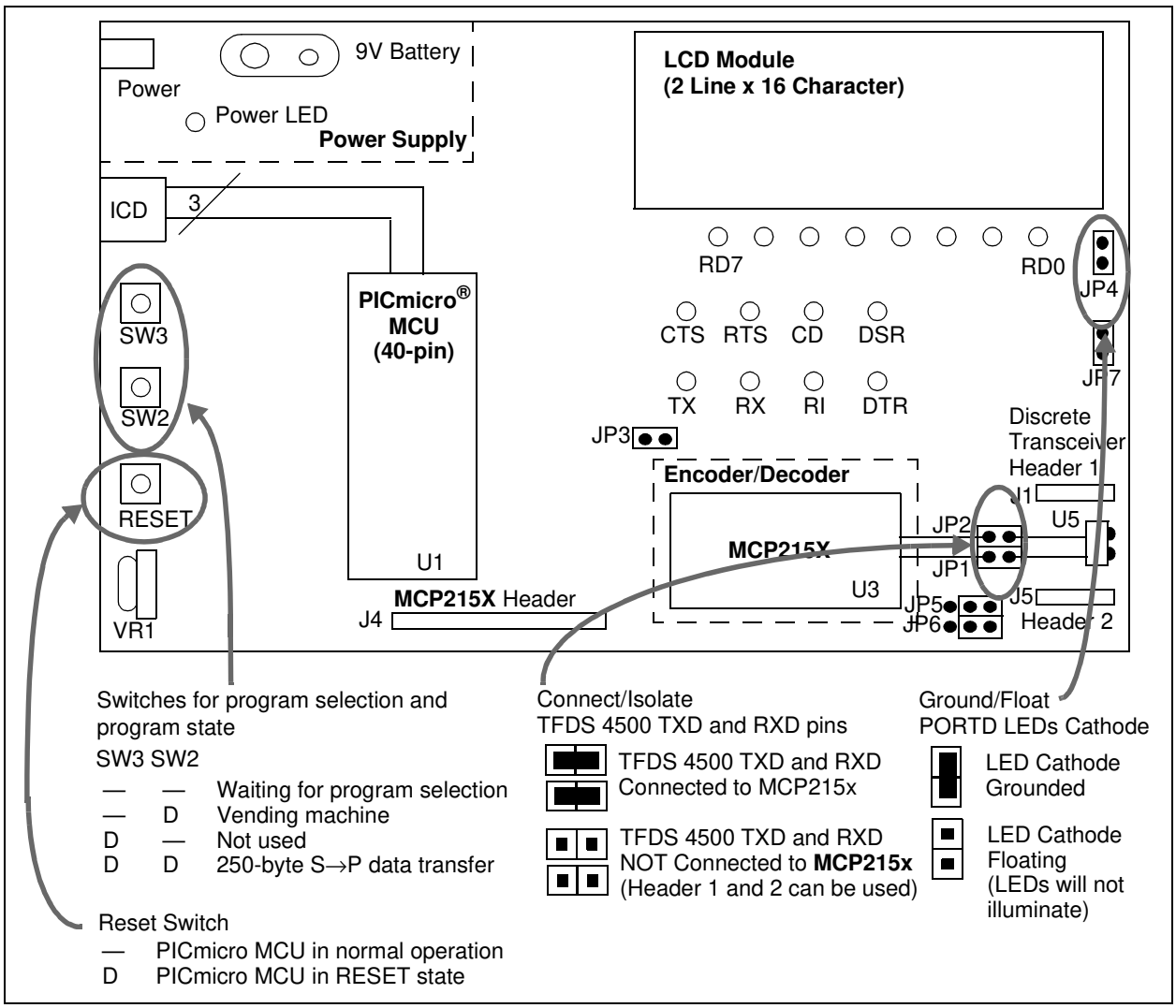


Figure 2-3 shows the switches used to reset the MCP2150 and select one of two demo programs. Switch **RESET** resets the MCP2150 and switch **S2** is used for program selection.

FIGURE 2-3: MCP215X DATA LOGGER DEMO BOARD

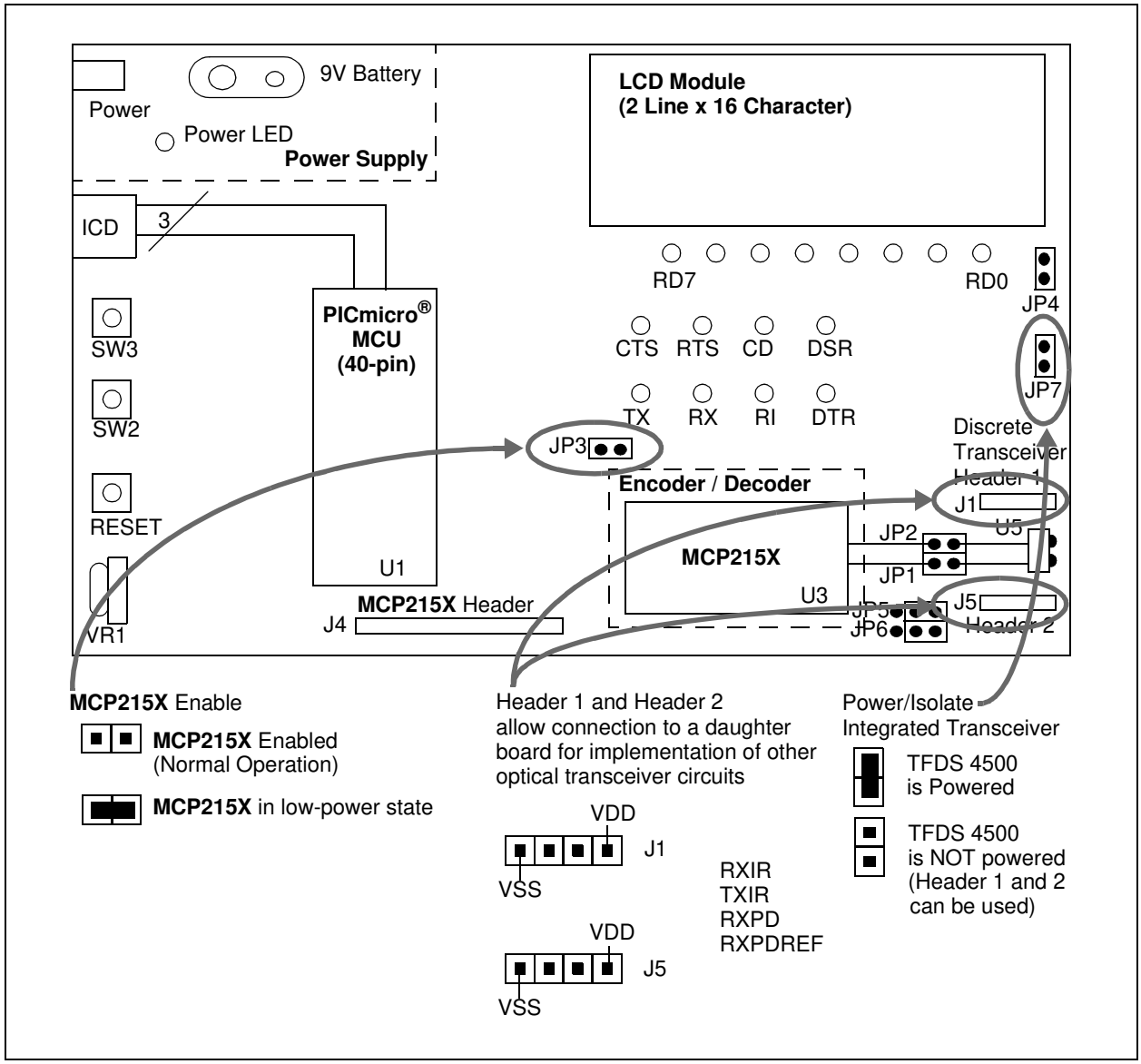
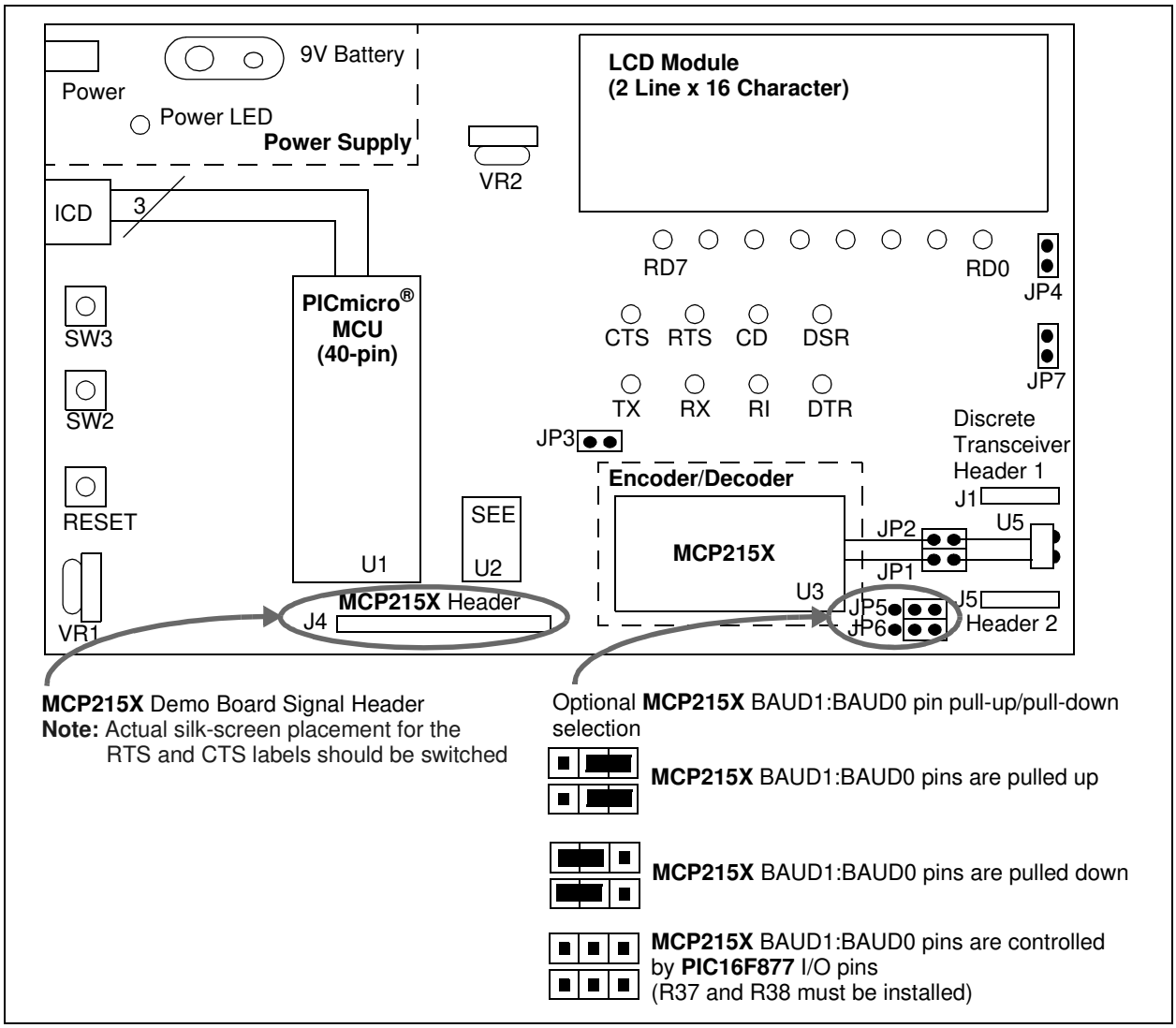


FIGURE 2-4: MCP215X DATA LOGGER DEMO BOARD



A description of the MCP215X Data Logger Demo Board jumpers is given in Table 2-1.

TABLE 2-1: JUMPER DESCRIPTIONS AND SETTINGS

Jumper #	Typical Settings (1)	Description	Comment
JP1	S	To connect TXIR of MCP2150 to TXD of U5 (TFDS 4500) S = TXIR connected to TXD O = TXIR Not connected to TXD	When Open, the signal can come from the daughter board connected to Header J1/J5.
JP2	S	To connect RXIR of MCP2150 to RXD of U5 (TFDS 4500) S = RXIR connected to RXD O = RXIR Not connected to RXD	When Open, the signal can come from the daughter board connected to Header J1/J5.
JP3	O	To connect EN of MCP2150 to VSS S = MCP2150 in Low-power mode O = MCP2150 during normal operation	
JP4	S	To connect cathode of LEDs (RD7:RD0) to VSS S = Cathode of LEDs to VSS O = Cathode of LEDs floating	The PCB default state is shorted between jumper. No jumper is required.
JP5	N/A	To control source of MCP2150 BAUD1 pin	
JP6	N/A	To control source of MCP2150 BAUD0 pin	
JP7	S	To connect VDD to integrated optical transceiver (U5) - TFDS 4500	

Legend: S = Jumper is shorted (Closed) O = Jumper is Open

Note 1: This is the jumper settings for using the integrated transceiver where the PIC16F877 controls the baud rate and the PORTD LEDs are used.

2.3.2 The Embedded System Firmware Overview

There are two PIC16F877 firmware programs that can be demonstrated on the demo board. These are:

- A vending machine that allows the uploading of data and responds to the commands of the Primary device
- A 250-byte secondary device (S) to primary device (P) data transfer. This demonstrates the S → P data throughput

The 250-byte Secondary device (S) to Primary device (P) data transfer program has two options. These are:

1. Transfer data from the Host Controller (PIC16F877) to the MCP2150 while the CTS signal is low.
2. Transfer 64 bytes of data from the Host Controller (PIC16F877) to the MCP2150 after CTS signal falling edge.

Option 2 will demonstrate higher S → P data throughput.

Typical Primary devices include Palm or Pocket PC PDAs and laptop PCs with an IrDA standard infrared port. The embedded system acts as an IrDA standard Secondary device.

The PIC16F877 firmware follows the flow control of the host UART interface. These are the signals between a Host Controller and a MCP2150 device.

The details of the vending machine firmware operation are discussed in **Section 2.3.2.1 "Vending Machine Program Description"**.

The details of the "250 byte Secondary Device (S) to Primary Device (P) Data Transfer" firmware operation are discussed in **Section 2.3.2.2 "250-byte Secondary Device (S) to Primary Device Data Transfer Program Description"**.

Figure 2-5 shows the program flow that occurs to select between these two programs. The MCP215X Data Logger Demo Board LCD module will display information on the state of the firmware execution. This information includes queries for user input.

The selection of the program is dependant on the switches (SW2 and SW3) that are depressed (see Figure 2-4).

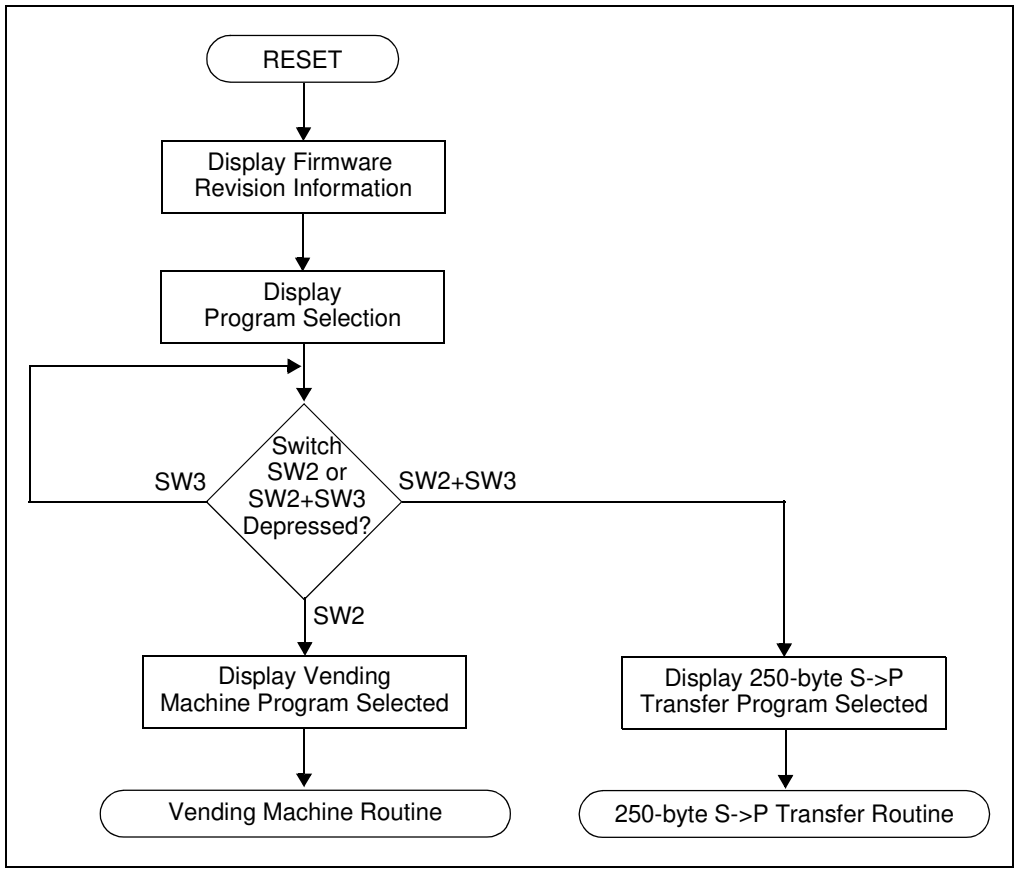
TABLE 2-2: DEMO PROGRAM SELECTION

SW3	SW2	Demo Program
—	—	N/A (waiting for a switch to be depressed)
—	D	Vending machine
D	—	Not implemented
D	D	S→P Transfer 250-bytes from demo board to Primary device (PDA)

Note: D = Depressed — = Not depressed

The MCP2150/MCP2155 source code of the MCP215X Data Logger Demo Board is available for download from the Microchip web site at www.microchip.com. This board also supports the MCP2155 device with only a change of the PIC16F877 firmware. The MCP2140 can be supported with some hardware modifications and changes to the PIC16F877 firmware.

FIGURE 2-5: PIC16F877 FIRMWARE FLOW - MAIN



2.3.2.1 VENDING MACHINE PROGRAM DESCRIPTION

This demo emulates a vending machine by counting the number of each item (soda and candy) dispensed.

Once the MCP215X Data Logger Demo Board has completed reset and the LCD module indicates which switches to depress to select a program, depress switch **S2**. The LCD module will indicate that the vending machine program is selected.

The LCD module will then indicate the values of the soda and candy counters. Depressing the **S2** switch will increment the soda counter, while depressing the **S3** switch will increment the candy counter. Once either switch is depressed, the LCD module displays the new counter values. Each counter is an 8-bit value and can display a value from 0 to 255 (decimal).

When the PIC16F877 receives a data byte, the value is checked to determine the operation to perform. The vending machine program understands two commands:

1. Transmit the counter values.
2. Clear the counter values.

Table 2-3 shows the two commands that the vending machine program accepts. All other data values that are received are ignored. Once the program has received the "Transmit the current counter values" command, the PIC16F877 will transmit the data on two lines, in the following easy-to-read format:

```
Soda = xxx
Candy = xxx
```

where `xxx` is the counter value

TABLE 2-3: VENDING MACHINE COMMANDS

Description	Command	
	ASCII Code	Hex Code
Transmit the current soda and candy counter values to the Primary device	5	0x35
Clear the current soda and candy counters	6	0x36

Note: All other received data values are ignored.

The host UART interface is operating at 115,200 baud.

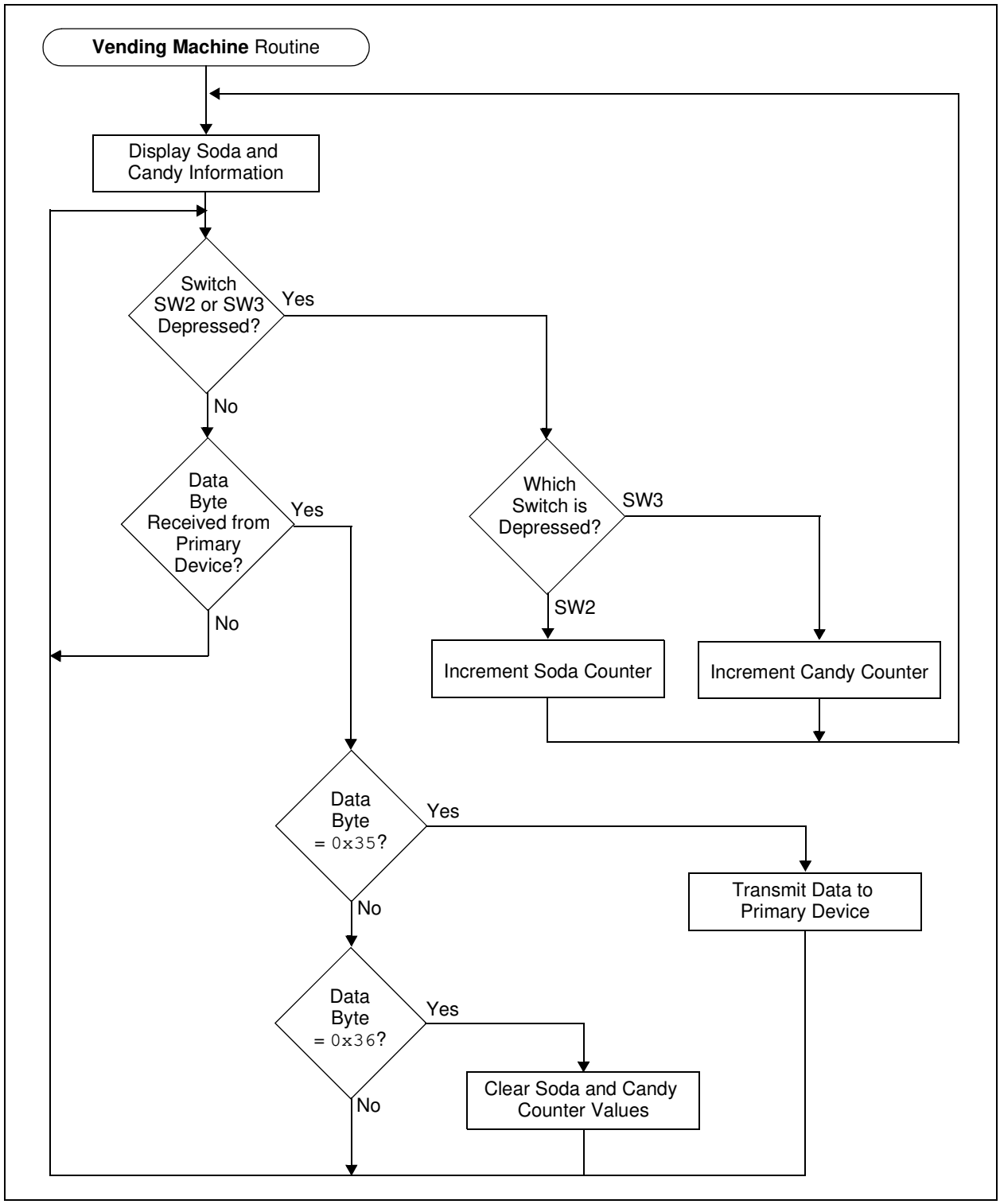
The transfer will not commence until the PIC16F877 has received a data byte from the Primary device.

The PIC16F877 follows the flow control of the MCP2150 to ensure that data is not lost. The MCP2150 handles all the IrCOMM protocol for the data packets that it receives from the PIC16F877.

Once the command has been processed, the PIC16F877 waits for the next command to be received.

The program flow for the vending machine demo is shown in Figure 2-6.

FIGURE 2-6: PIC16F877 FIRMWARE FLOW - VENDING MACHINE



2.3.2.2 250-BYTE SECONDARY DEVICE (S) TO PRIMARY DEVICE DATA TRANSFER PROGRAM DESCRIPTION

After the MCP215X Data Logger Demo Board has completed reset and the LCD module indicates which switches to depress to select a program, depress switches **S2** and **S3** simultaneously. The LCD module will indicate that the 250-byte S→P program is selected.

You then need to specify the data transfer method. The host UART interface is operating at 115,200 baud. There are two methods by which to accomplish this.

In the first method, the PIC16F877 will transfer data to the MCP2150 while the CTS signal is low. This is the easiest method to implement. To select this method, depress switch **S2**. After depressing **S2**, the LCD will indicate the mode of data transfer and that it is waiting. The transfer will not commence until the PIC16F877 has received a data byte from the Primary device.

In the second method, the PIC16F877 will transfer 64 bytes of the data table to the MCP2150 after the falling edge of the CTS signal. This method gives the best data throughput. To select this method, depress switch **S3**. After depressing **S3**, the LCD will indicate the mode of data transfer and that it is waiting. The transfer will not commence until the PIC16F877 has received a data byte from the Primary device.

The PIC16F877 follows the flow control of the MCP2150 to ensure that data is not lost. The MCP2150 handles all the IrCOMM protocol for the data packets that it receives from the PIC16F877.

After the table has completed transmission, the PIC16F877 returns to the routine that asks for the data transfer method.

The program flow for the "250 Byte Secondary Device (S) to Primary Device (P) Data Transfer" demo is shown in Figure 2-7.

The 250-byte data table transmitted from the MCP215X Data Logger Demo Board to the Primary device is shown in **Appendix D. "MCP215X 250-Byte Data Transmit Table"**. These values will be displayed in the Primary device's terminal emulation program window.

Note:	The byte sent by the Primary device is expected since most PDAs will not establish a link until data is sent. Depending on the PDA application program used (Palm™ or Pocket PC), the operation of the **Connect** button varies.

The PIC16F877 receives a single byte from the IrDA standard Primary device and then a 250-byte table is transmitted back to the Primary device.

If you desire more than 250 bytes to be transferred, the source code is written to allow this 250-byte table to be transmitted multiple times. At the beginning of the S→P Data Transfer routine (routine has label `S2Pxfer`), there is a `#define` for the `TableCNTR`. This is set to '1', but can be changed to allow the data table to be transmitted "`TableCNTR`" time. `TableCNTR` should not be greater than D'255' (8-bit value)

FIGURE 2-7: PIC16F877 FIRMWARE FLOW - 250-BYTE S->P TRANSFER