
Modifying the PICDEM™ USB Board for PIC18 Full-Speed USB Microcontrollers

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INTRODUCTION

Microchip Technology's PICDEM™ USB Demonstration Board (DM163010) was designed as a development platform for PIC16C745/765 USB microcontrollers, prior to the introduction of the PIC184550 family of full-speed USB devices. This document describes how to modify the demo board to work with the PIC18 devices.

HARDWARE MODIFICATIONS

The PIC16 and PIC18 USB microcontrollers differ in their clock structure, as well as the use of internal pull-up resistors. The changes needed to adapt the demo board to PIC18 USB devices are relatively minor and easy to make. They are shown in the layout in Figure 1, with locations corresponding to the steps listed below.

1. Modify the external clock source:
 - a) Remove the existing 6 MHz oscillator (Y4), along with capacitors C2 and C3.
 - b) Populate the socket Y3 with a canned 20 MHz oscillator (such as DigiKey part number X119-ND or equivalent).

Note: The example firmware for the PIC18 USB devices provided by Microchip assumes that the external clock source is 20 MHz.

2. Remove resistor R1 to permit the use of the on-chip USB pull-up resistor. R2 should be left unpopulated.
3. To use the MPLAB® ICD 2 In-Circuit Debugger/Programmer with PIC18 devices:
 - a) Populate the pad J6 with a 6-wire RJ-11 jack (the standard MPLAB ICD 2 connector), such as DigiKey part number A9031-ND or equivalent.
 - b) Remove LEDs D6 and D10.
 - c) Run a jumper wire between the bottom vias (closer to the board center) of D6 and D10.
4. Populate either U3 (28-pin) or U5 (40-pin) with the appropriate PIC18 USB microcontroller.

FIRMWARE MODIFICATIONS

The example firmware for the PIC18 USB family is written with the assumption that the PICDEM FS USB Demonstration Board (DM163025) is the target platform. The PICDEM USB and PICDEM FS USB boards, however, have different board components and layouts. This requires a few basic changes to PIC18 USB firmware in order to make it run.

To show these changes, we will look at the PIC18F4550 mouse demonstration program, available on the Microchip web site (www.microchip.com/usb). When executed, it causes the screen cursor on the connected host computer to rotate in a circle.

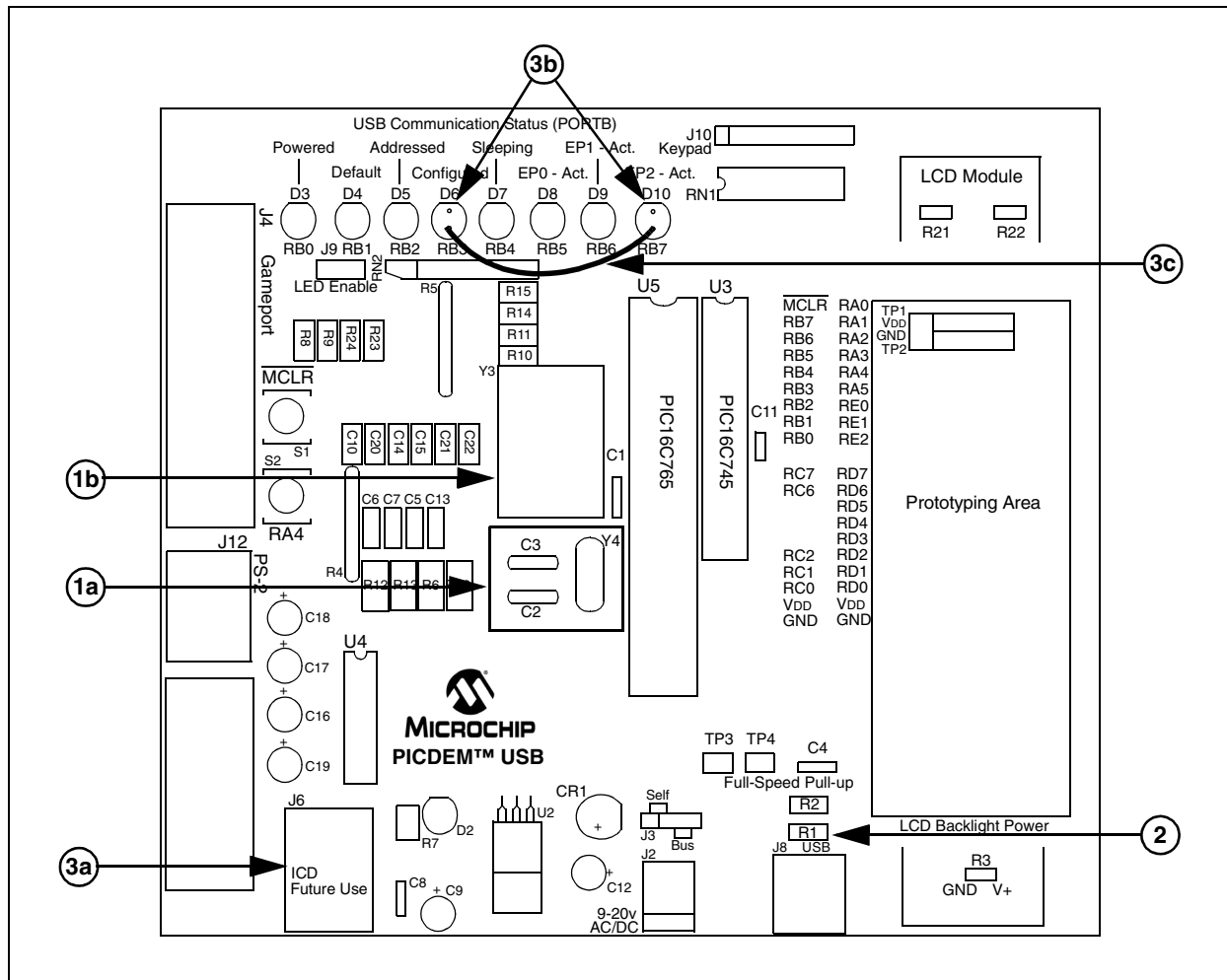
To alter this demonstration program for use with the PICDEM USB board, it must first be installed on the host computer. This is done by downloading and executing the file, `HID_setup.exe`. Once it is installed:

1. In the directory, `C:\MCHPFSUSB\fw\Hid\Mouse`, open the MPLAB ICD 2 workspace file, `MCHPUSB.mcw`.
2. From the MPLAB ICD 2 toolbar, select Configure > Configuration Bits.... Change the oscillator configuration from "HS: HS+PLL, USB-HS" to "EC: EC+PLL, EC+PLL+RA6, USB-EC".
3. Open the header file, `usbcfg.h`, and comment out `#define USE_USB_BUS_SENSE_IO`.

Now you can build the project and program the microcontroller.

Note that these changes represent the bare minimum needed to make the demo application work. Should further modifications be required, or to troubleshoot other firmware issues, the user should refer to Chapter 4 of the "PICDEM™ FS USB Demonstration Board User's Guide" (DS51526) for detailed information on the Microchip USB firmware.

FIGURE 1: PICDEM™ USB BOARD LAYOUT WITH LOCATIONS OF REQUIRED HARDWARE CHANGES



COMPATIBILITY CONSIDERATIONS

It is important to note that the changes described previously represent the minimum that is required to make the demonstration work. When moving any application for PIC18F USB devices to the PICDEM USB board, certain items should always be checked.

It is very important to verify I/O assignments. For example, the status LEDs are mapped differently on the two boards: they are driven from PORTB on the PICDEM USB board, and PORTD on the PICDEM FS USB board. Also, the SPI™ module is multiplexed to different pins on the PIC16 and PIC18 USB devices. To change these items, users will need to change the `io_cfg.h` header file. Some I/O changes may require additional hardware modifications.

When using the bootloader application provided with the PICDEM FS USB application, the firmware uses a hardware signal to initiate operation. On the original PICDEM FS USB board, this operation is implemented

with a push button connected to RB4; this is not available on the PICDEM USB board. For the bootloader to work correctly, either modify the firmware to look for another hardware trigger, or add a push button switch between RB4 and ground.

The PICDEM USB board was not designed for automatic power switching. Therefore, it is always necessary to verify that jumper J3 is configured correctly for the actual power source being used.

The PICDEM USB board does not support the automatic detection of bus attachment, while the PICDEM FS USB board and PIC18 USB firmware does. Users will need to disable this feature by commenting out the `#define USE_USB_BUSSENSE_IO` statement in the `usbcfg.h` header file (for the mouse application located in the path, `C:\MCHPFSUSB\fw\Hid\Mouse\autofiles`).

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