How to Restore a chipKIT™ Bootloader

This guide will show you how to restore your chipKIT bootloader, in the event that it has been erased from a chipKIT-compatible board. This operation is required if you have used MPLAB X to program the board in a generic way, causing the bootloader to be over-written.

The steps below will apply to most chipKIT-compatible boards.

What you will need:

- **chipKIT-compatible Board** – Contains a microcontroller referred to as the "target device"
- **Bootloader Hex File** – Downloadable from the web. In general there are two potential places to download bootloaders for your particular board:

  1. **Manufacturer Website:** Production versions of the bootloader are programmed by the manufacturer. Production bootloader hex files are available from the board manufacturer's web site. For example, Digilent's chipKIT Product Pages have a download section where you can find the bootloader hex file that ships with the board. The Production Version is always a safe choice, as the developers of MPIDE are careful to maintain backward compatibility with original production boards.

  2. **GitHub Repo:** Community versions are available at this GitHub repo. These versions of the bootloader are built from the latest sources available. GitHub is a developer's tool, and is particularly useful for tracking changes between multiple versions of source code. However, no special knowledge is required to acquire a bootloader hex file. Simply right-click on the hex file name, and save the file to your local disk. In some cases there will be multiple versions of a bootloader listed for the same chipKIT board, or experimental versions with unfamiliar names. If you are unsure about which version to use, you could post a question to the chipKIT support forum.

- **Device Part Number** – This is particular to your board. Below is a table of some boards:

Board Name	Microcontroller	Manufacturer
chipKIT Pi Development Board	PIC32MX250F128B	element14
chipKIT DP32 Development Board	PIC32MX250F128B	Digilent
chipKIT Fubarino Mini Development Board	PIC32MX250F128D	Microchip
chipKIT Fubarino SD Development Board	PIC32MX795F512H	Microchip
chipKIT Max32 Development Board	PIC32MX795F512L	Digilent
chipKIT (Cerebot) MX3 Development Board	PIC32MX320F128H	Digilent
chipKIT Pro (Cerebot) MX4 Development Board	PIC32MX460F512L	Digilent
chipKIT Pro (Cerebot) MX7 Development Board	PIC32MX795F512L	Digilent
chipKIT uC32 Development Board	PIC32MX340F512H	Digilent
chipKIT Uno32 Development Board	PIC32MX320F128H	Digilent
chipKIT WF32 Development Board	PIC32MX695F512L	Digilent
chipKIT Wi-FIRE Development Board	PIC32MZ2048ECG100 or PIC32MZ2048EFG100[1]	Digilent

[1] The ECG was for pre-production Rev B and earlier boards.

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- **Device programmer and matching USB cable** – From the list below.
  *Note, if you have the chipKIT Pro "Cerebot" MX4 or MX7, these boards have an on-board programmer/debugger, so you don't need an additional programmer from the list below.

  - PICkit 3 Programmer (plus one of the following):
    - PICkit 3 Programming Cable Kit ([Digilent Part# 240-035P](#))
    - Male header, single row, 0.1 inch spacing (2.54mm) either straight or right angle (see examples below)
      - Straight: [Digi-key Part# S1131EC-06-ND](#)
      - Right Angle: [Digi-key Part# S1132E-06-ND](#)
  - chipKIT PGM Programmer
  - MPLAB ICD 3 (including the following):
    - RJ-11 to ICSP Adapter ([Microchip Part# AC164110](#))
  - MPLAB REAL ICE (including the following):
    - RJ-11 to ICSP Adapter ([Microchip Part# AC164110](#))

- **MPLAB IPE** – The "Integrated Programming Environment" Software

  - Note that if you have MPLAB X IDE installed, you may have installed the IPE during the installation. If not, do the following:
    - Go to http://www.microchip.com/mplabx
    - Download MPLAB X IDE and begin the installation
    - From the MPLAB X installer, you can choose to install both MPLAB X IDE and the MPLAB IPE or you can just choose to install the IPE

Preface

Before we get started, please take a moment to understand the following things. We will be using the IPE programming software with a device programmer (such as a PICkit 3) to program a bootloader hex file to the target device on your chipKIT board. It is interesting to note that the device programmer itself contains built-in software (a bootloader and firmware) with details such as memory ranges and programming algorithm. The IPE will update the device programmer software, if necessary, before attempting to program your target device.

If an update to the device programmer software is required, the IPE will perform the update automatically. During the software update, additional messages will appear in the Output window. The screen shot below (in step 5) shows an example of the additional messages. If an update to the device programmer software is not required, the additional messages will not appear.

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How to Restore the chipKIT Bootloader:

1. Open MPLAB IPE
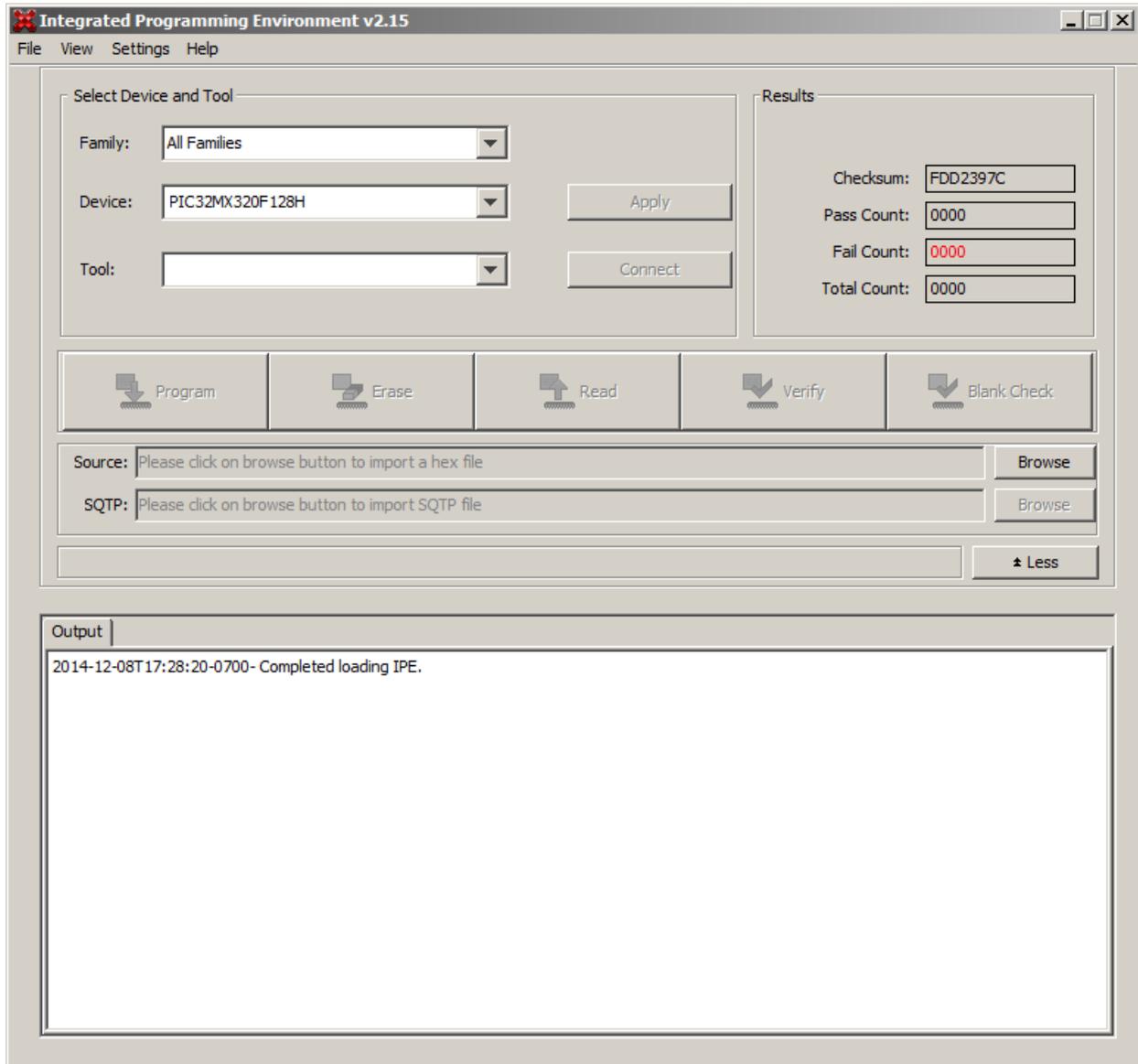
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2. In the Device drop-down menu, either choose, type, or paste the device part number (from your target board) into the field. Then click the "Apply" button if needed.
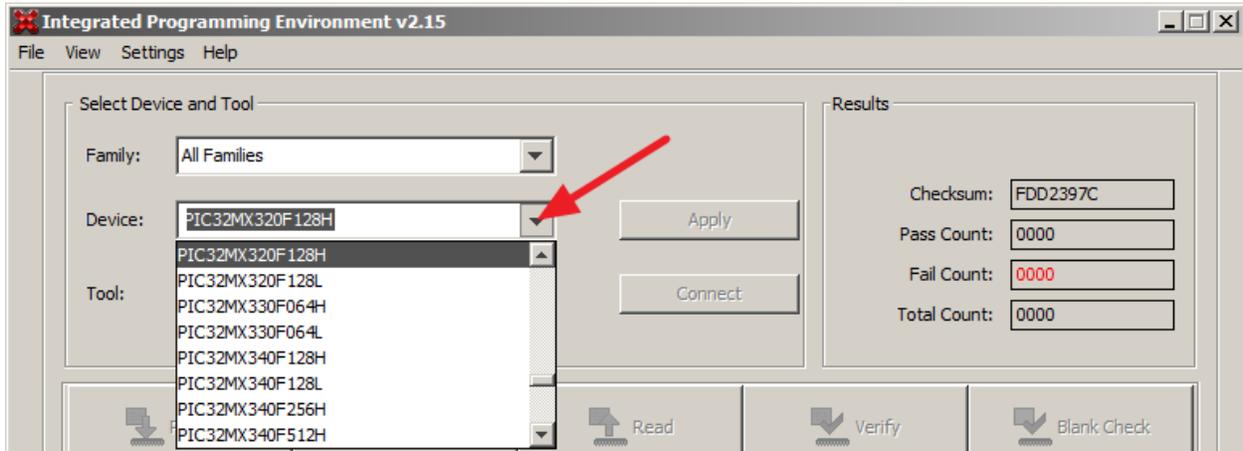
3. With the USB cable appropriate for your programmer, connect the programmer into the USB port on your computer. If you have the chipKIT Pro "Cerebot" MX4 or MX7, just plug the board in directly, as the programmer is built-in on this board.

4. In the IPE, after a few seconds, your programmer should appear in the Tool drop-down menu. Select the programmer you want to use, if it's not already selected.
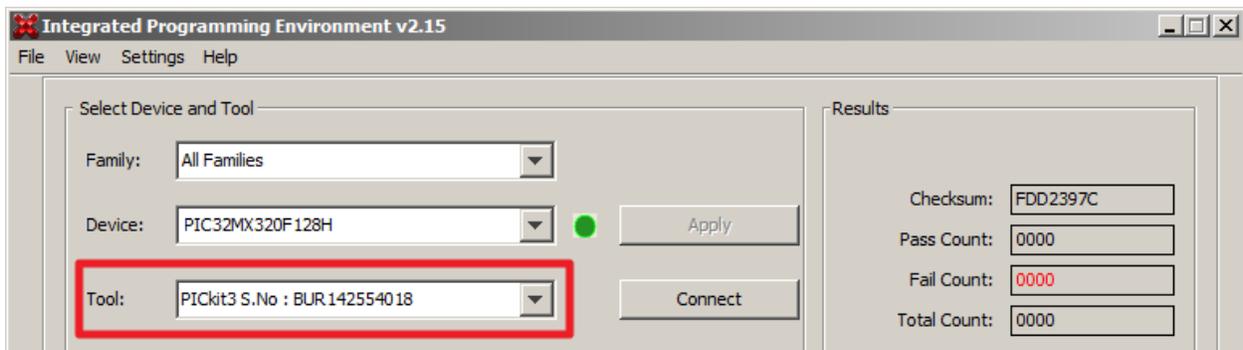
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5. Click the connect button (see screenshot above).

   When first connected, the IPE may attempt to update the device programmer's firmware and bootloader, and/or the firmware for the type of device selected. This may take a minute or two, with progress reported in the Output window. The device programmer updates will depend upon which version of the IPE is currently running, and which version was used previously.

   Note: If you see a message in red that your target device was not found, this is only a warning to remind you that the programmer is not physically connected to your target device/board. When you are ready to program the hex file, you can then connect your programmer to the target board. We'll do that in the next step.
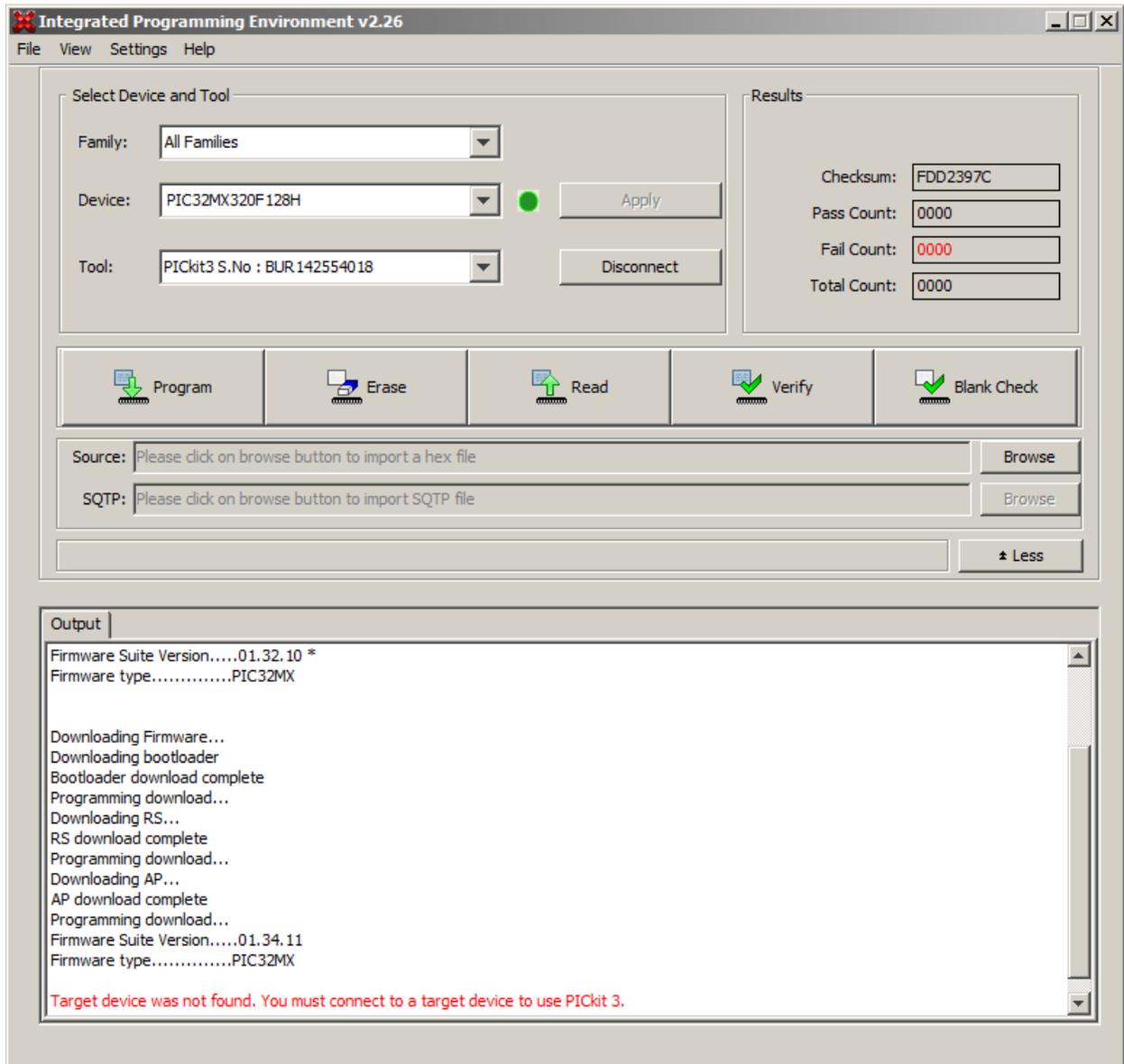
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6. Connect the Programmer to the In-Circuit Serial Programming (ICSP) footprint on the target board (see the Appendix for examples and some notes for connecting certain boards). For chipKIT Pro "Cerebot" MX4 and MX7 boards, there is no need to do this because the programmer is built into the board.

    The ICSP footprint on the target board is essentially a strip of 5 or 6 thru-holes (as seen in the example to the right). Each board will have the ICSP footprint in a different place. The size and dimensions of the thru-holes accommodate the header or right-angle connector used to connect the programmer. Notice that the pins in this example are offset, so that when you connect the header or right-angle connector, it makes a more tight and solid connection.

    When you connect the programmer to the ICSP footprint, ensure that you connect the programmer's Pin 1 (usually indicated by an arrow) with the ICSP footprint Pin 1 (usually indicated by a "1" on the silkscreen, or a square outline on the pin 1 hole on the ICSP footprint, as shown in this photo.)
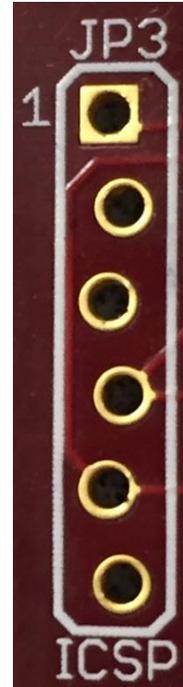
    Note: You could have connected the programmer to the target board in Step 3 above. We prefer to connect the board in this step, to ensure that all firmware updates to the programmer have been completed. Otherwise, connection errors may be reported, depending upon how the target board is powered.

7. If you want to power your target board from the programmer (which will make it easier to connect the chipKIT PGM and PICkit 3) please do the following:

    a. For chipKIT PGM Programmer, this product powers the target board by default. However, the voltage regulator on the chipKIT PGM can provide only about 100mA at 3.3V. Some chipKIT boards require a larger supply, so it is advisable to power the target via USB or the Power Jack connector.
    b. For PICkit 3 and MPLAB ICD 3, you will need to use the Advanced Mode settings to ensure that the Power Target Circuit option is turned on. See the steps below.
    c. For MPLAB REAL ICE, you will have to power your target via USB or the Power Jack connector, as the option to power the target board is not available. Skip ahead to step 8.

    To Enable the **Power Target Circuit** option (which is turned off by default):

    In the IPE Menu, select "Settings > Advanced Mode"
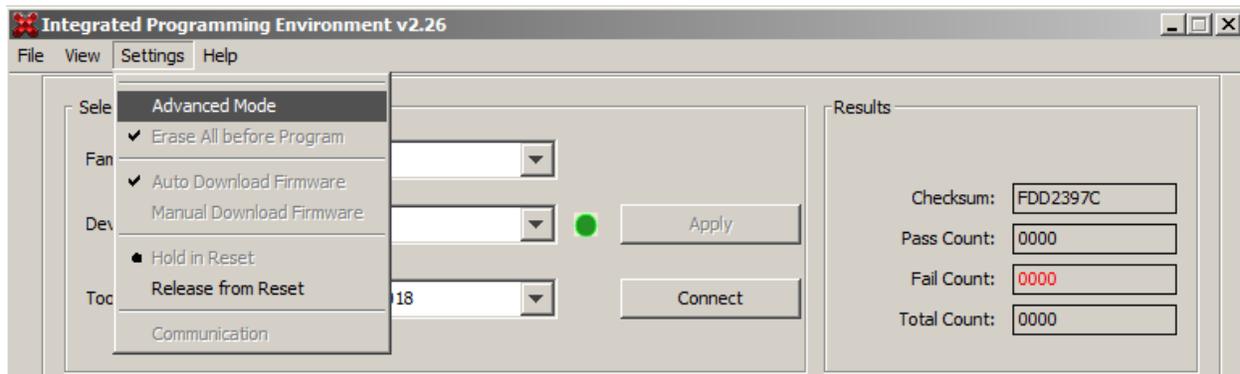
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In the window that appears, type in the IPE password and click "Log on" (you can select to "Remember Password" if you'd like)
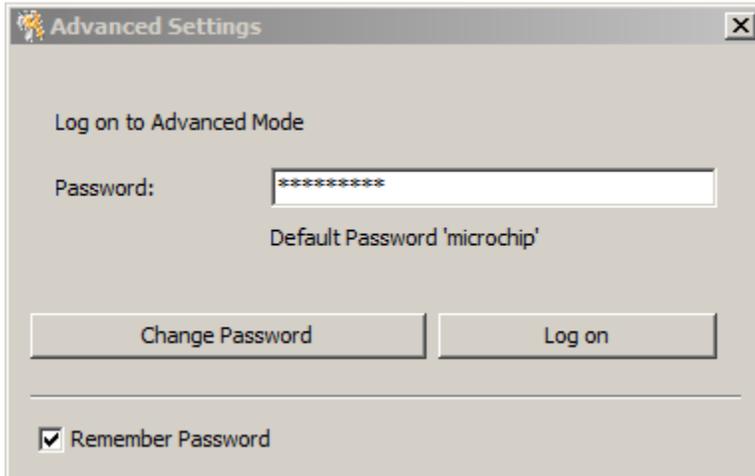
With the new options that appear on the left side of the window, choose "Power" and enable the "Power Target Circuit from Tool" option. Note that you can also change the VDD as needed.
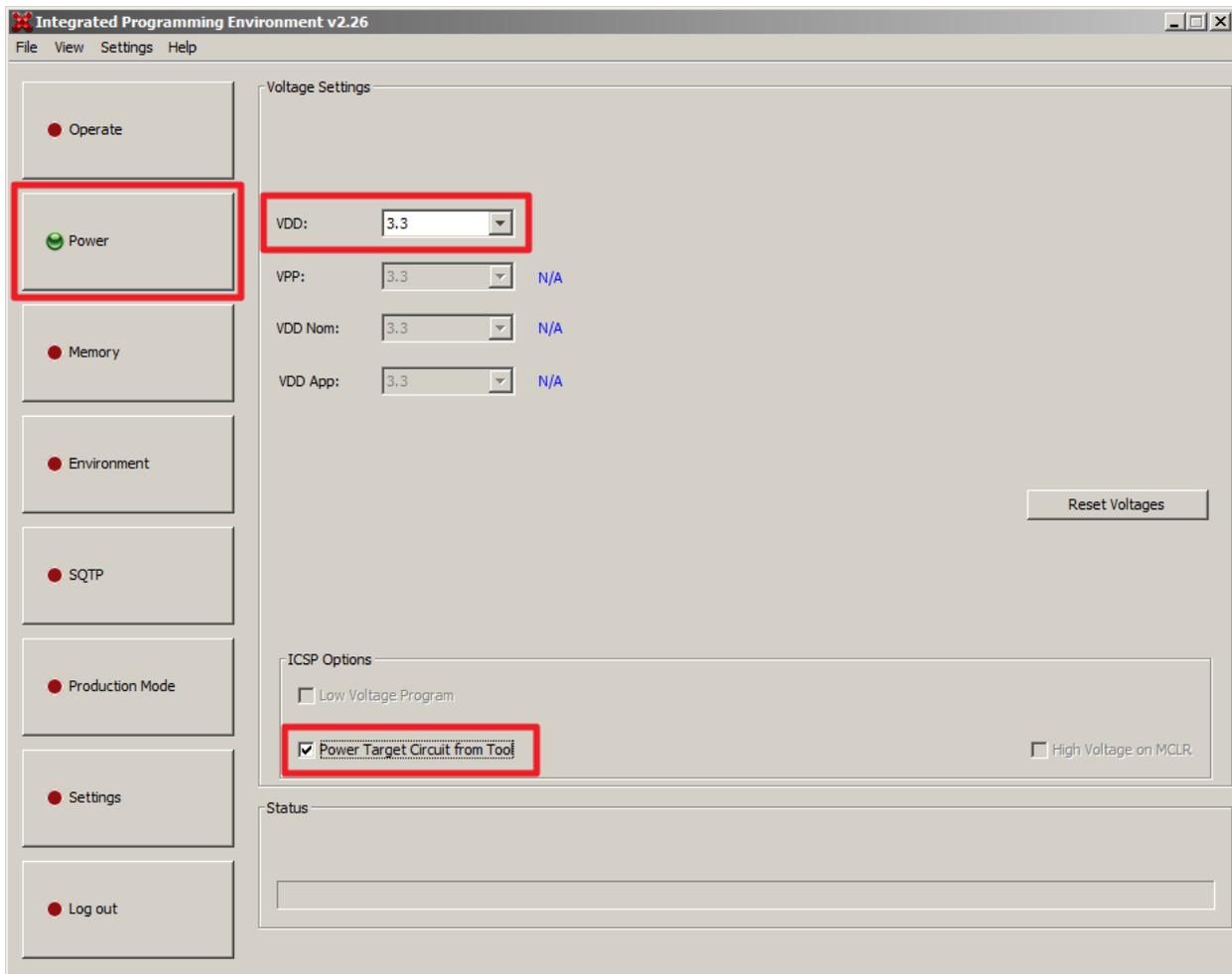
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Click the "Operate" button and the Main Screen will re-appear.
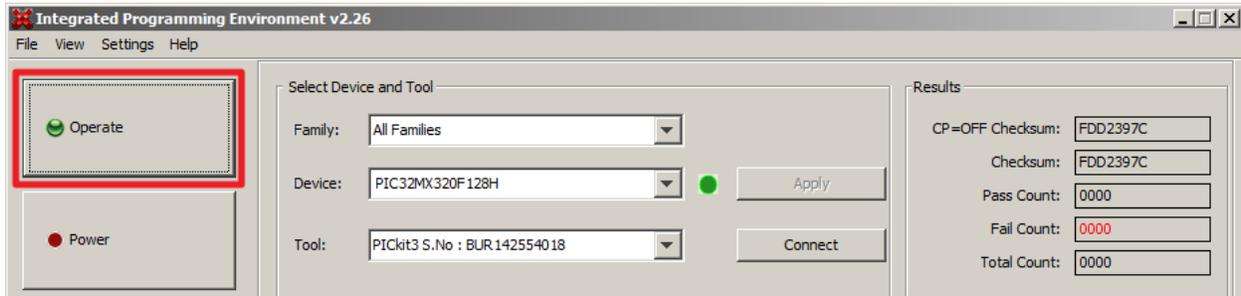
8. In the Main Screen, click "Connect" (or "Disconnect" and then "Connect" again)

In this step, if you see errors such as "Unable to connect to target device" it means your target board is intermittently powered or not getting power at all. Ensure that you have a solid connection from the programmer connector/header to the target ICSP footprint. See the Appendix below for examples of how to connect. Note that you can usually tell the board is being powered if you see an LED turned on (on the target board). Most boards have a red Power LED near the power jack connector. Once your connection is solid, you can proceed to the next step.
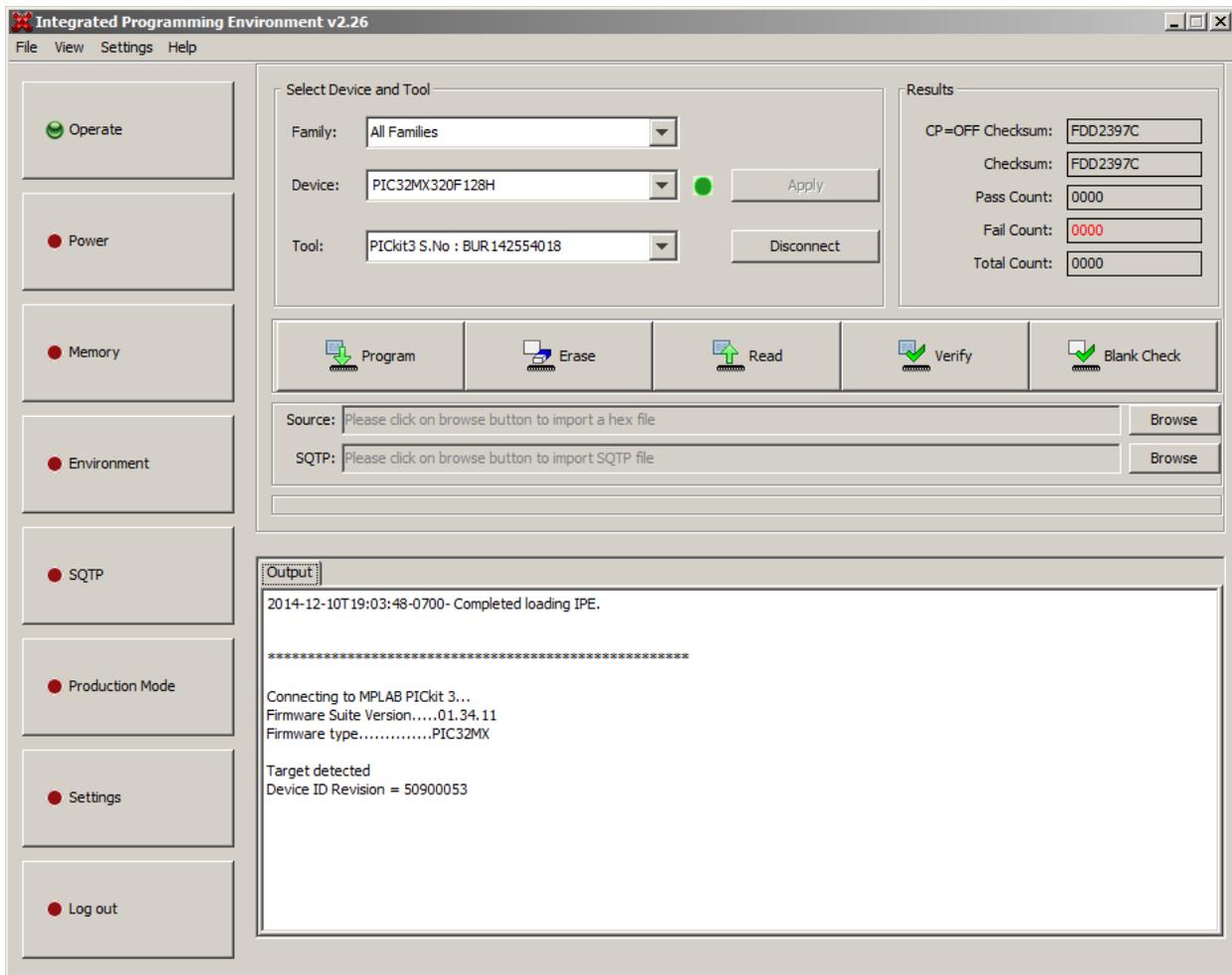
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9. Click the Browse button to locate and select your bootloader hex file. The IPE will then load and prepare the file to be programmed.
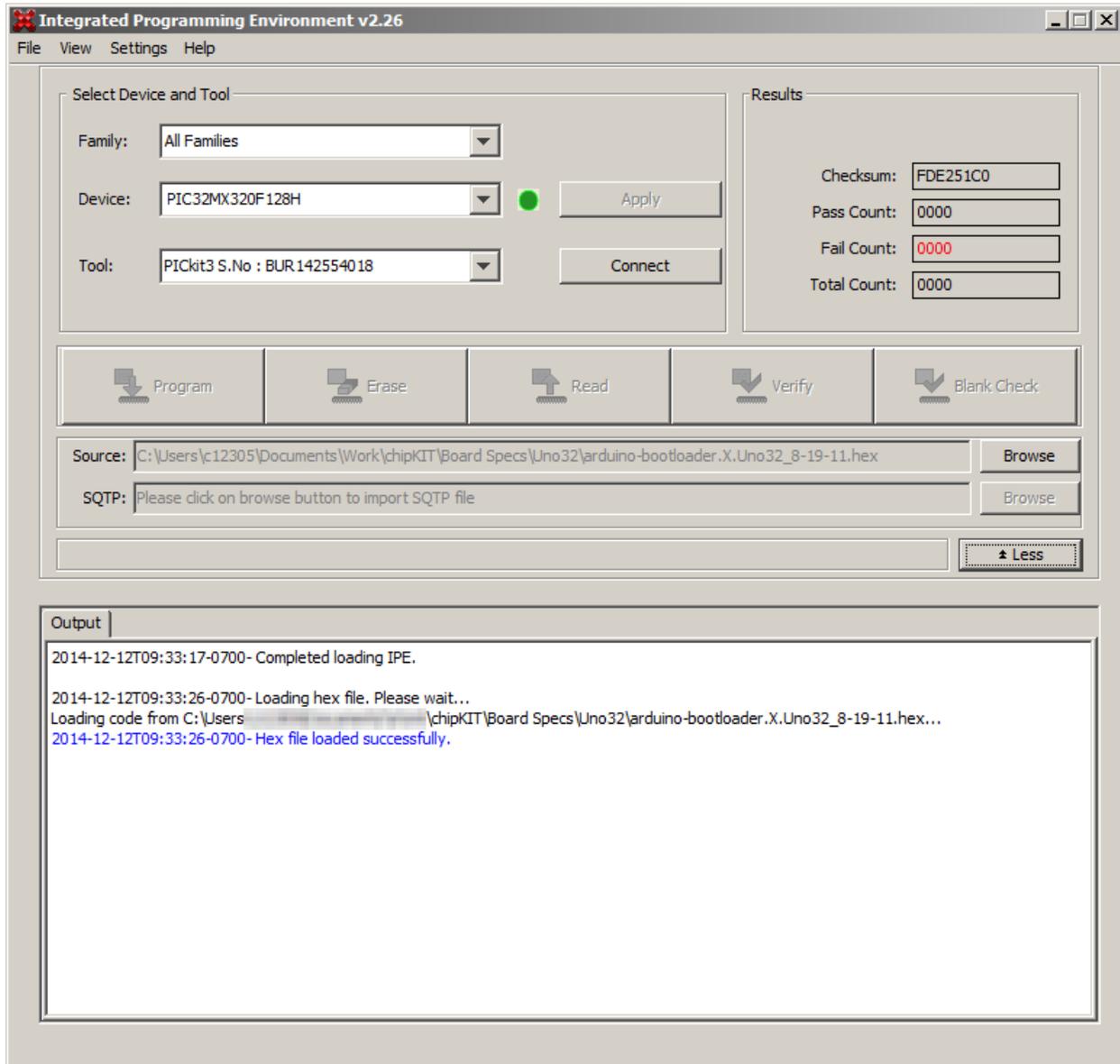
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10. Click the Program button.
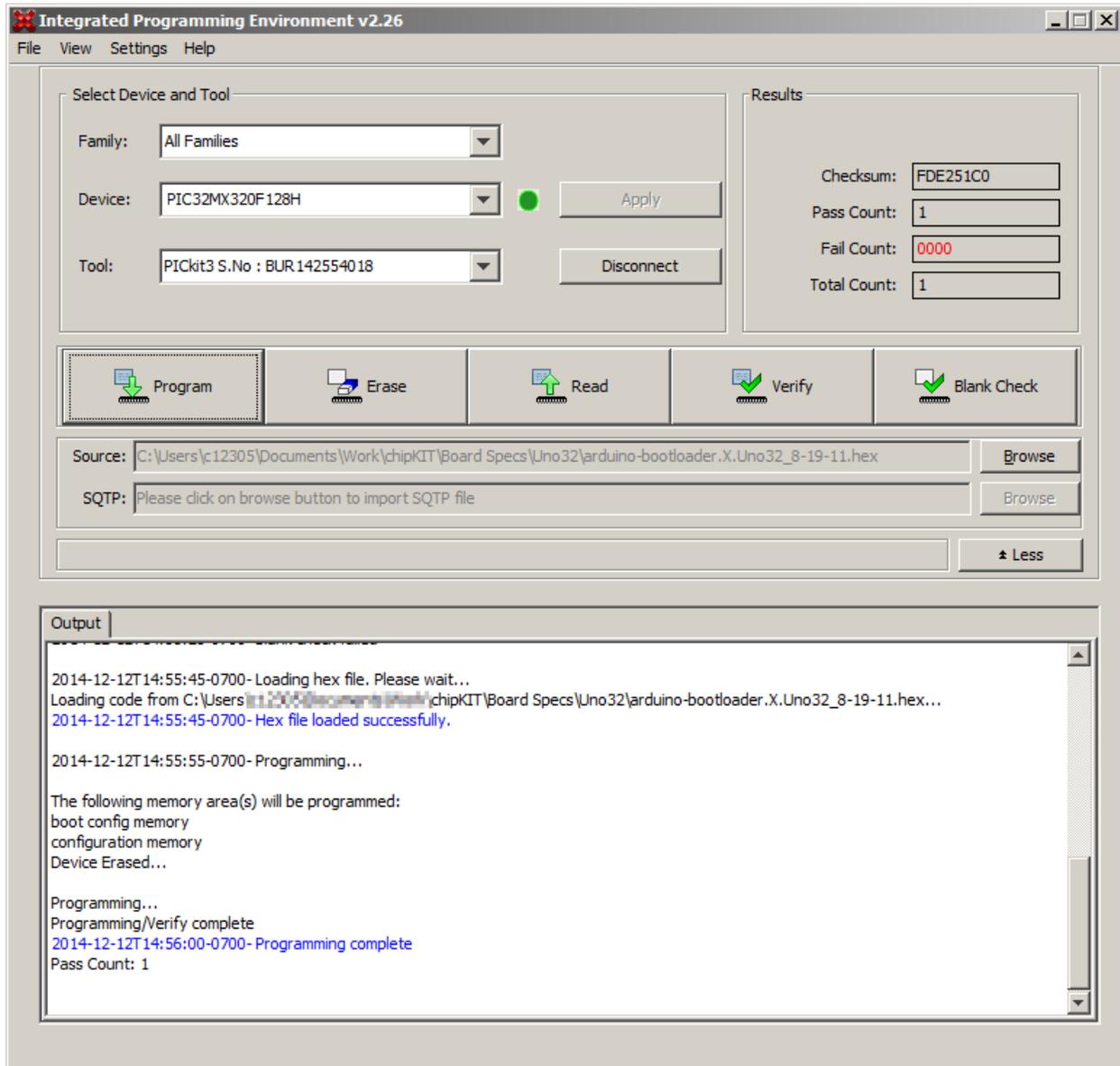
That covers it! ☺

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Appendix

For additional notes about how to connect your programmer to your target board, see the following:

Digilent boards:
* Most ICSP footprints look like the example in Step 6.
* For chipKIT Pro (Cerebot) MX4 and MX7, these boards already have a PICkit on-board (PKOB) so you don't need to use the ICSP circuitry.

Fubarino boards:

> The Fubarino boards, SD and Mini, have the ICSP pins sectioned off with the silkscreen. Note that they use only the first 5 pins of the ICSP. This is ok; just make sure you line up Pin 1 on the programmer connector to Pin 1 (the pin that is squared off) on the Fubarino. (See below for examples)
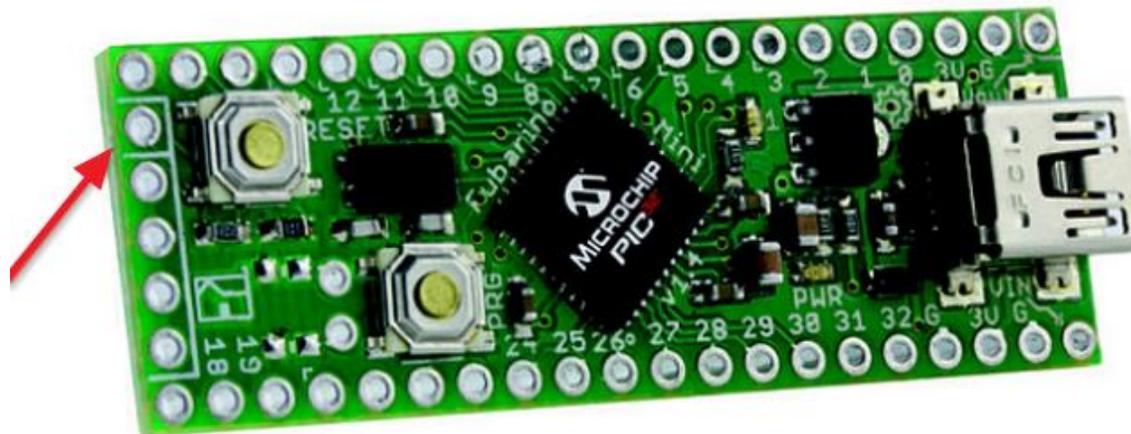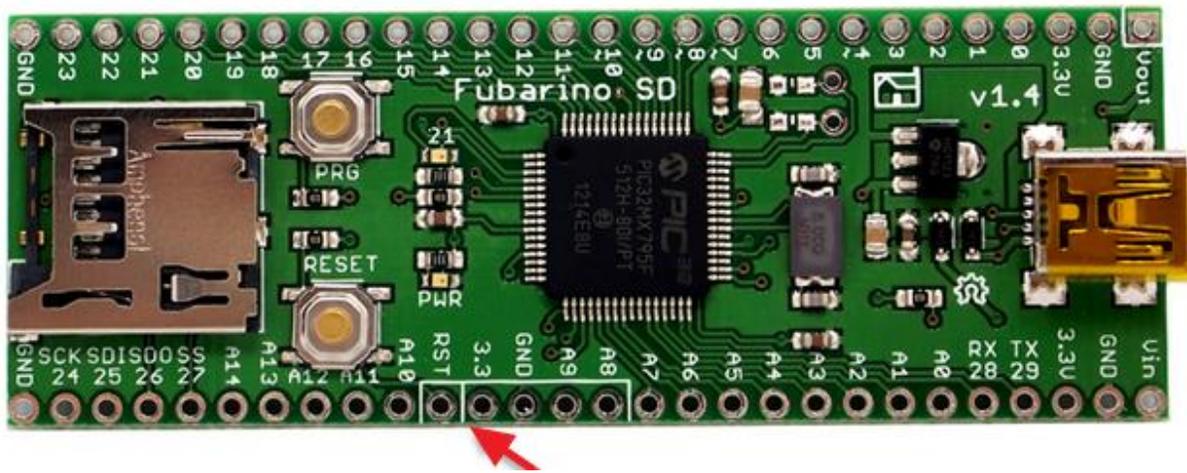
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How to connect your programmer to your target board (Examples)

One of the easiest ways to connect the PICkit 3 when you don't have "Power to Target" enabled is to use a right angle connector and point the pins upward so that when the PICkit is connected to the board, there is still room to power the board via the USB or Power Jack connector.
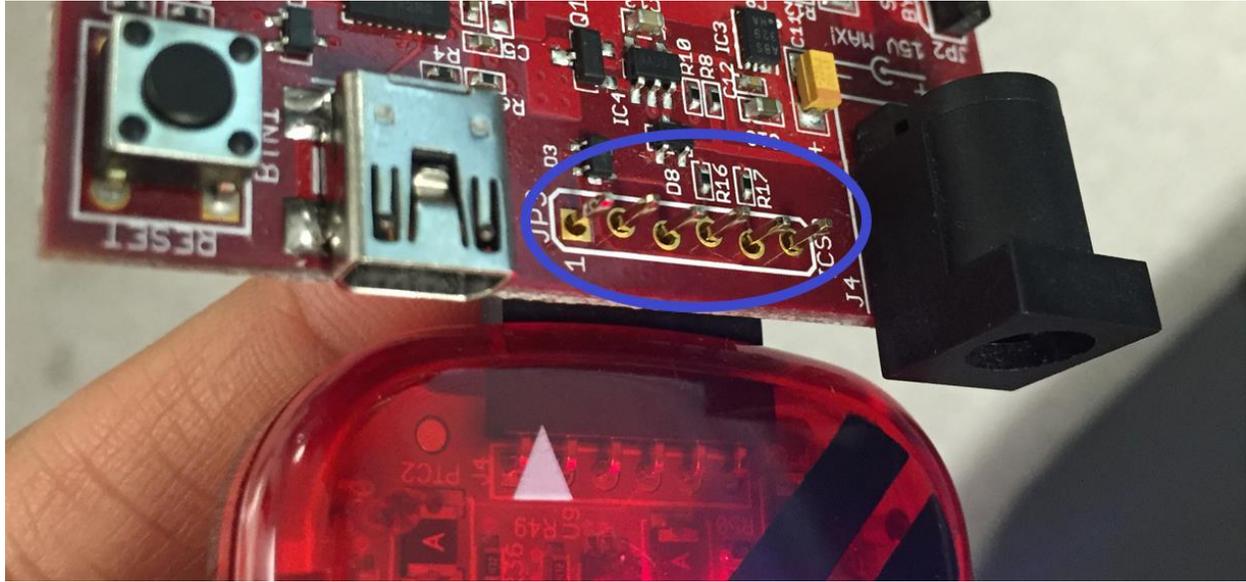
In the image below, the PICkit 3 is connected to the target board (chipKIT Uno32) using the Digilent "PICkit 3 Programming Cable Kit." Note that chipKIT Uno32 is also being powered by the red USB cable, which is not necessary if you have enabled "Power to Target" in the Advanced settings in the IPE.
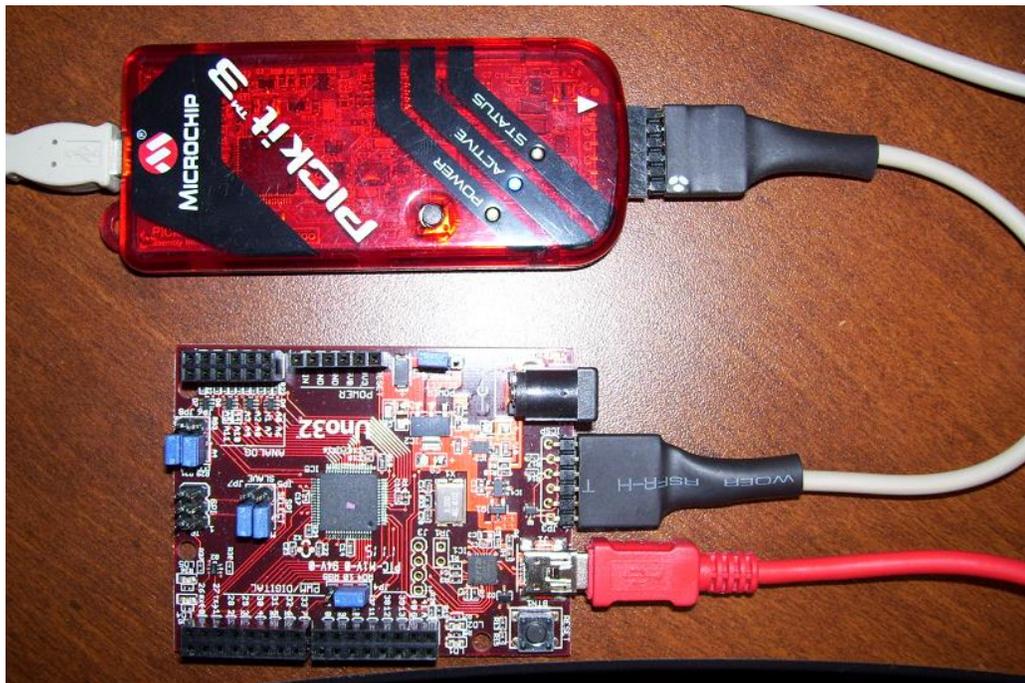
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In the image below, the MPLAB REAL ICE is connected to the target board using the RJ-11 cable down to an RJ-11 socket to ICSP adapter (as seen in the image that follows this one).

In the image below, you can see the RJ-11 socket to ICSP adapter. The RJ-11 cable can be coming from either the MPLAB REAL ICE or the MPLAB ICD 3.
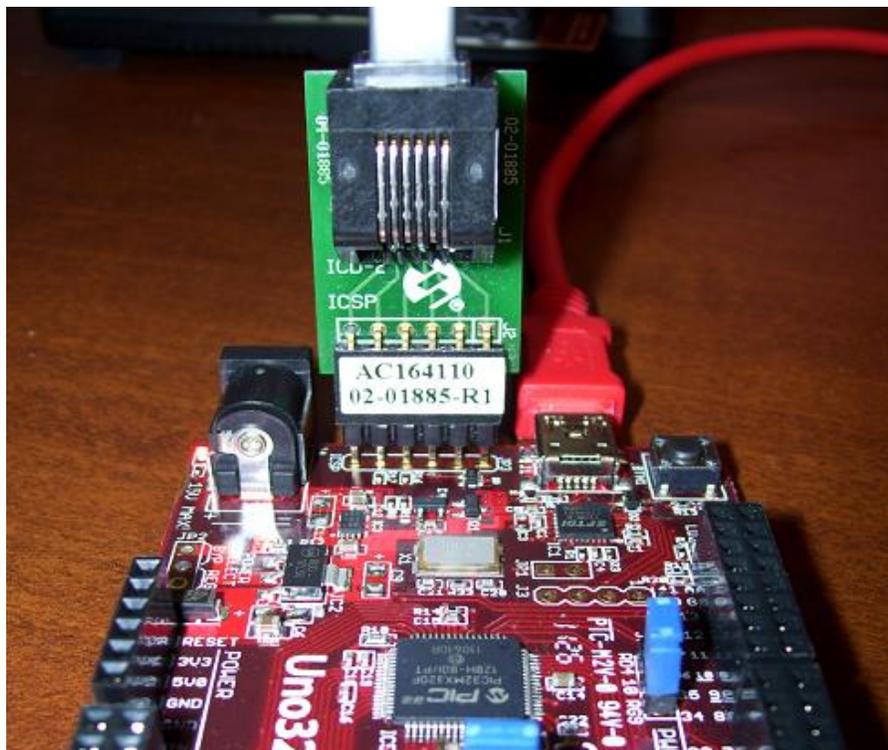
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In the image below, the MPLAB ICD 3 is connected to the target board using the RJ-11 socket to ICSP adapter (see photo above for a better view of this adapter).