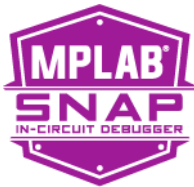# MPLAB® SNAP IN-CIRCUIT DEBUGGER

## MPLAB® Snap In-Circuit Debugger Information Sheet

### INTRODUCTION

The MPLAB® Snap In-Circuit Debugger (PG164100) is an ultra-low priced debugging solution for projects not requiring high-voltage programming or advanced debug features. Therefore, it supports many of Microchip's newer MCU offerings but not some legacy products. With a nominal feature set, the debugger is geared toward developers who don't require advanced features. *It is not intended for production programming*.

> **Note:** Refer to the MPLAB® PICkit™ 4 In-Circuit Debugger and the MPLAB X IDE User's Guides or online help for additional information.

- Description
- Features
- MPLAB Snap In-Circuit Debugger Components
- Additional Items Needed
- MPLAB Snap vs. MPLAB PICkit 4 Comparison
- Pinout Information
- LEDs
- Debugger to Target Communication
- Debugger Options Selection
- Troubleshooting

### DESCRIPTION

The MPLAB Snap In-Circuit Debugger allows fast and easy debugging and programming using the powerful graphical user interface of MPLAB X IDE (Integrated Development Environment) or MPLAB IPE (Integrated Programming Environment). The debugger works with Microchip PIC®, dsPIC® Flash, AVR®, or DSC devices. It will also work with 32-bit based microcontroller, such as SAM, CEC and PIC32 devices.

The MPLAB Snap connects to the computer using a high-speed 2.0 USB interface and connects to the target via a Microchip debug 8-pin Single In-Line (SIL) connector. The SIL connector uses two device I/O pins and the reset line to implement in-circuit debugging and In-Circuit Serial Programming™ (ICSP™).

The MPLAB Snap supports advanced interfaces such as 4-wire JTAG and Serial Wire Debug with streaming Data Gateway, while being backward compatible for demo boards, headers and target systems using 2-wire JTAG and ICSP.

The debugger system executes code like an actual device because it uses the target device's built-in emulation circuitry, instead of a special debugger chip. All available features of a given device are accessible interactively and can be set and modified by the MPLAB X IDE interface.

The MPLAB Snap In-Circuit Debugger is compatible with Microsoft Windows® 7 or later, Linux® and macOS™ platforms.

# MPLAB® Snap In-Circuit Debugger Information Sheet

## FEATURES

### Features/Capabilities:

- Connects to computer via high-speed USB 2.0 (480 Mbits/s) cable
- An 8-pin SIL programming connector and the option to use various interfaces
- Programs devices using MPLAB X IDE or MPLAB IPE
- Works with many Microchip PIC, dsPIC, AVR, or DSC devices, including 32-bit microcontrollers such as SAM, CEC and PIC32 devices (refer to the device support list found on your PC, for example, C:\Program Files (X86)\Microchip\ MPLABX\vx.xx\docs\Device Support.htm, where vx.xx is the version of MPLAB X IDE)
- Supports 4-wire JTAG and Serial Wire Debug
- Backward compatibility for demo boards, headers and target systems using 2-wire JTAG and ICSP (In-Circuit Serial Programming)
- Supports multiple hardware and software breakpoints, stopwatch and source code file debugging
- Debugs your application on your own hardware in real time
- Sets breakpoints based on internal events
- Debugs at full target MCU speed
- Configures pin drivers
- Adds new device support and features by installing the latest version of MPLAB X IDE (available as a free download at http://www.microchip.com/mplabx/)
- Indicates debugger status via the Active and Status LEDs

### Performance/Speed:

- No firmware download delays incurred when switching devices
- 32-bit microcontroller using an Arm® Cortex®-M7 core running at 300 MHz

### Safety:

- RoHS, CE, and China E compliant
- Supports target supply voltages from 1.2V to 5.5V +/-10%

> **Note:** The MPLAB Snap In-Circuit Debugger is powered through its Micro-B USB connector. The target board must be powered from its own power supply.

## MPLAB SNAP IN-CIRCUIT DEBUGGER COMPONENTS

The components of the MPLAB Snap In-Circuit Debugger system are:

- an 8-pin SIL connector
- a Micro-B USB connector
- two LEDs
- Emergency Recovery Jumper (not populated)

**FIGURE 1-1:** MPLAB® SNAP IN-CIRCUIT DEBUGGER
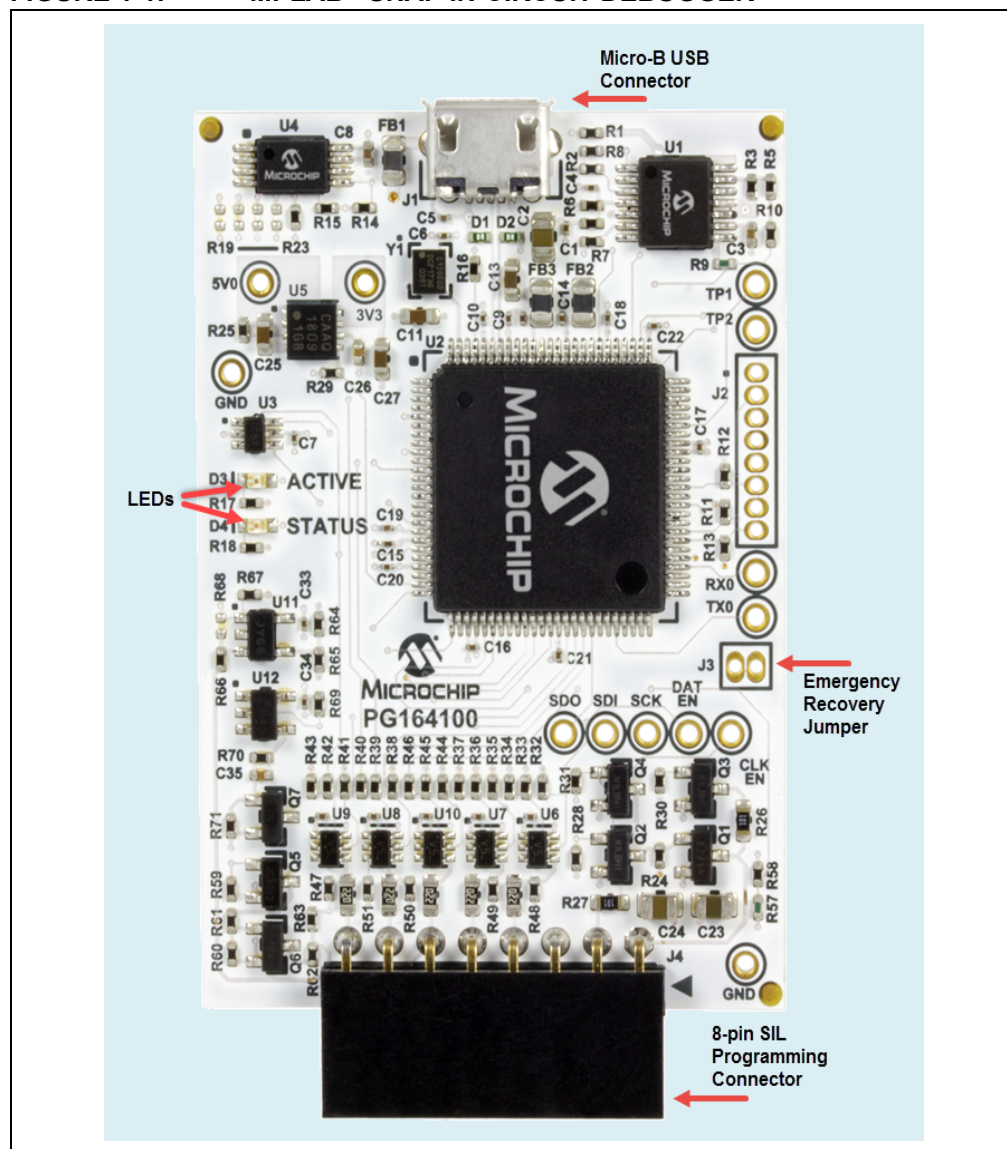
# MPLAB® Snap In-Circuit Debugger Information Sheet

## ADDITIONAL ITEMS NEEDED

To use the MPLAB Snap In-Circuit Debugger, you will need to supply:

- a full-featured Micro-B USB cable (data and power), no longer than 1.5 meter, to connect to a computer (for example, the Microchip Part Number ATUSBMICROCABLE-XPRO)
- target board
- power supply for target board
- any wiring interfaces or cables needed for your application, some available adapters and cables include:
  - AC164110 - RJ-11 to ICSP Adapter
  - AC002021 PM3 ICSP cable
- jumper, wire or tweezers for emergency recovery, if needed

## MPLAB SNAP VS. MPLAB PICKIT 4 COMPARISON

The following table compares the MPLAB Snap to the PICkit 4.

TABLE 1-1:     FEATURES COMPARISON

| Feature | MPLAB Snap | MPLAB PICkit 4 |
|---|---|---|
| Enclosure | No, exposed PCB | Yes |
| USB Powered | Yes | Yes |
| USB Speed | High | High |
| USB Cable supplied | No | Yes |
| Programmable $V_{PP}$ | No | Yes |
| Programmable $V_{DD}$ | No | Yes |
| Emulator Power | No | Yes |
| Power to Target | No | Yes - 50 mA |
| Voltage Monitoring | No | Yes |
| Current Sensing | No | Yes |
| Target Power | Yes | Yes |
| Target Voltage Boost | No | Yes |
| RGB Indicators | LED | Yes |
| Software Breakpoints | Yes | Yes |
| Breakpoints | Complex | Complex |
| Buffered Pin Drivers | Yes | Yes |
| Configurable pull-ups | No | Yes |
| Drag and Drop Programming | Yes | Yes |
| Programmer to Go | No | Yes |
| Production Programmer | No | Yes |
| Products Supported | Most Flash MCUs | All Flash MCUs |
| Pay-Per-Feature | No | Yes |
| CDC UART | Yes | Yes |
| SEE configuration (boot) | Yes | Yes |
| USB Serialization | Yes | Yes |
| Recovery Method | PCB pads | Pushbutton |

.

**TABLE 1-2:    INTERFACES COMPARISON**

| Interface | MPLAB Snap | MPLAB PICkit 4 |
|---|---|---|
| ICSP | Yes | Yes |
| MIPS EJTAG 2wire | Yes | Yes |
| MIPS EJTAG 4wire | Yes | Yes |
| ARM SWD | Yes | Yes |
| AVR32 JTAG 4wire | Yes | Yes |
| PDI | Yes, low voltage only | Yes |
| UPDI | Yes, low voltage only | Yes |
| UPDI/HV | No | Yes |
| TPI | Yes | Yes |
| ISP Programming | Yes | Yes |
| DEBUGWIRE | Yes | Yes |
| AWIRE | Yes | Yes |

## PINOUT INFORMATION

**Note:**   The pinouts for the MPLAB Snap are the same as the MPLAB PICkit 4 In-Circuit Debugger. Refer to the MPLAB PICkit 4 online help in MPLAB X IDE (Help>Tool Help Contents>PICkit 4 Help) for more information.

## LEDS

The MPLAB Snap has two fixed color LEDs. The Active LED is green and the Status LED is yellow. The expected start-up LED sequence for the MPLAB Snap debugger is:

Green - steady on, yellow off. The debugger is ready.

The LEDs have the following significance.

**TABLE 1-3:    NORMAL MODES LED DESCRIPTIONS**

| LED | Color | Description |
|---|---|---|
| Active, on | Green | Power is connected; debugger in standby. |
| Status, on (or pulsing activity) | Yellow | Debugger is busy; activity during an operation. |

The following table provides LED descriptions for errors.

**TABLE 1-4:    ERROR LED DESCRIPTIONS**

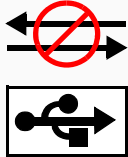| Errors | Description |
|---|---|
| Status, on 3 seconds | Bootloader problem accessing the serial EEPROM. |
| Status, on 10 seconds | API commands cannot be processed by the Bootloader. |
| Active and Status, fast blink (alternating) | A runtime exception occurred in the tool firmware. |
| Active and Status, fast blink (in tandem) | A runtime exception occurred in the Bootloader. |

# MPLAB® Snap In-Circuit Debugger Information Sheet

## DEBUGGER TO TARGET COMMUNICATION

> **Note:** The MPLAB X IDE software must be installed prior to connecting the MPLAB Snap In-Circuit Debugger.

The debugger is connected to the computer via a USB cable for communication and debugger power.

The debugger is connected to the target application for communication and data collection and optional debugger power.

| | **CAUTION** |
|---|---|
| 🚫 USB | **Communication Failure.** **Do not connect the hardware before installing the software and USB drivers.** |

| | **CAUTION** |
|---|---|
| ⚡ | **Debugger or Target Damage.** **Do not change hardware connections while the debugger or target is powered.** |

> **Note:** Refer to the MPLAB PICkit 4 In-Circuit Debugger online help or user's guide for information on target communication connections, debugging, requirements for debugging, programming, troubleshooting, etc.

The following figure shows a typical connection for the MPLAB Snap debugger.

**FIGURE 1-2:** MPLAB SNAP CONNECTIONS
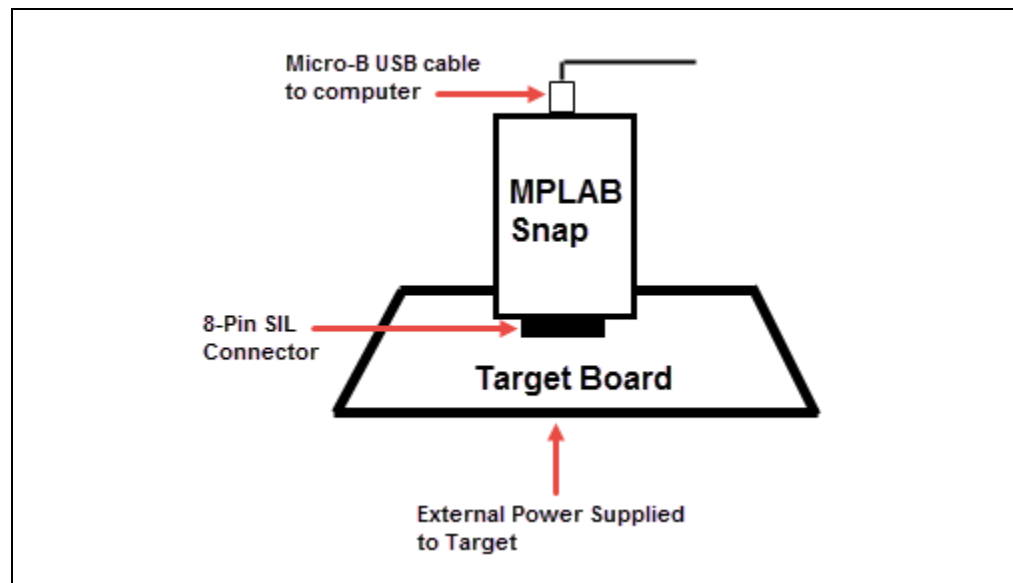
## DEBUGGER OPTIONS SELECTION

The MPLAB Snap project properties available in MPLAB X IDE are a subset of the MPLAB PICkit 4 options.

Debugger options are set in the Project Properties dialog of MPLAB X IDE. Click on **Snap** under "Categories" to display the "Options for Snap" (see Figure 1-3). Use the "Options categories" drop-down list to select various options. Click on an option name to see its description in the Option Description box below. Click to the right of an option name to select or change it.

> **Note:** The available option categories and the options within those categories are dependent on the device you have selected.

**FIGURE 1-3: MPLAB X IDE OPTIONS FOR MPLAB SNAP**
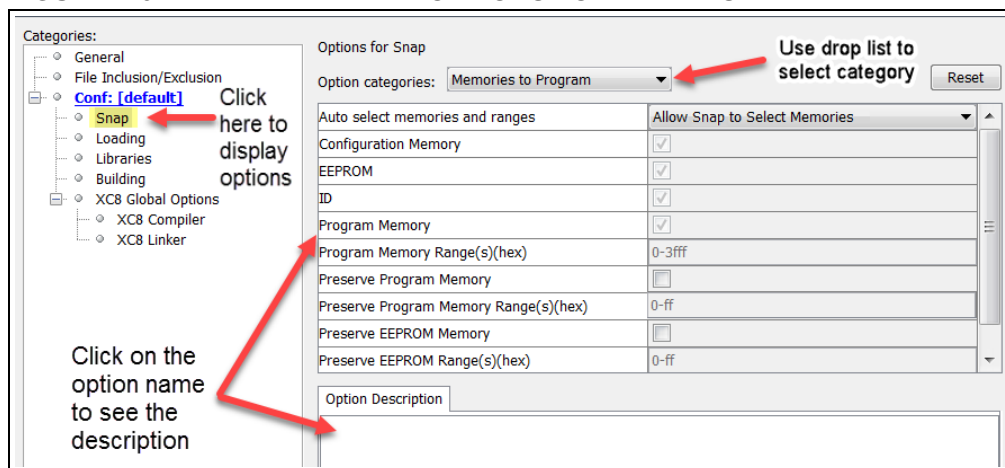


After setting the options, click **Apply** or **OK**. Also click the Refresh Debug Tool status icon 🔁 in the MPLAB X IDE dashboard display to update any changes made.

For the MPLAB IPE, the options for MPLAB Snap are located in *Settings>Advance Mode>Settings*. Refer to MPLAB IPE online help for more information.

The possible option categories may include:

• Memories to Program
• Debug Options
• Program Options
• Freeze Peripherals
• Power
• Firmware

# MPLAB® Snap In-Circuit Debugger Information Sheet

## TROUBLESHOOTING

If you are having problems with MPLAB Snap In-Circuit Debugger operation, start here.

Refer to the "MPLAB PICkit 4" online help section on *Troubleshooting First Steps*. From there you can navigate to "Some Questions to Answer First" and "Top Reasons Why You Can't Debug." For general issues, invoking the bootloader mode and the emergency boot firmware recovery, see the following sections.

If you are having problems with programming and debugging with AVR microcontroller devices that use the UPDI/PDI/TPI interfaces, the MPLAB Snap may require an external pull-up resistor. Refer to the MPLAB Snap web page for the **"ETN36_MPLAB Snap AVR Interface Modification PDF."**

### General

1. It is possible the error was a one-time event. Try the operation again.
2. There may be a programming problem in general. As a test, switch to Run mode in MPLAB X IDE using the ▷ icon and program the target with the simplest application possible (e.g., a program to blink an LED). If the program will not run, then you know that something is wrong with the target setup.
3. It is possible that the target device has been damaged in some way (e.g., over current). Development environments are notoriously hostile to components. Consider trying another target board.
4. Microchip Technology Inc. offers demonstration boards to support most of its microcontrollers. Consider using one of these applications, which are known to work, to verify correct MPLAB Snap In-Circuit Debugger functionality.
5. Review debugger setup to ensure proper application setup. For more information, see the "Operation" section of the MPLAB PICkit 4 online help or PDF.
6. Your program speed may be set too high for your circuit. In MPLAB X IDE, go to *File>Project Properties*, select **Snap** in Categories, then **Program Options** in Option categories, **Program Speed** and select a slower speed from the drop-down menu. The default is Normal. In MPLAB IPE, the Program Speed option can be found in the Advanced Mode, Settings tab.
7. There may be certain situations where the debugger is not operating properly and needs to be reprogrammed. See the following section.

**The Hardware Tool Emergency Boot Firmware Recovery Utility**

| WARNING |
| --- |
| Only use this utility to restore hardware tool boot firmware to its factory state.<br>Use only if your hardware tool no longer functions on any machine. |

The debugger may need to be forced into recovery boot mode (reprogrammed) in rare situations. For example, if none of the LEDs are lit when the debugger is connected to the computer.

**YOU MUST USE MPLAB X IDE V5.05 OR GREATER TO USE THE EMERGENCY RECOVERY UTILITY FOR THE MPLAB SNAP.**

**Carefully follow the instructions found in MPLAB X IDE** under the main menu option *Debug>Hardware Tool Emergency Boot Firmware Recovery*. After the Warning screen, select **MPLAB Snap**.

**FIGURE 1-4:        SELECTING EMERGENCY UTILITY**
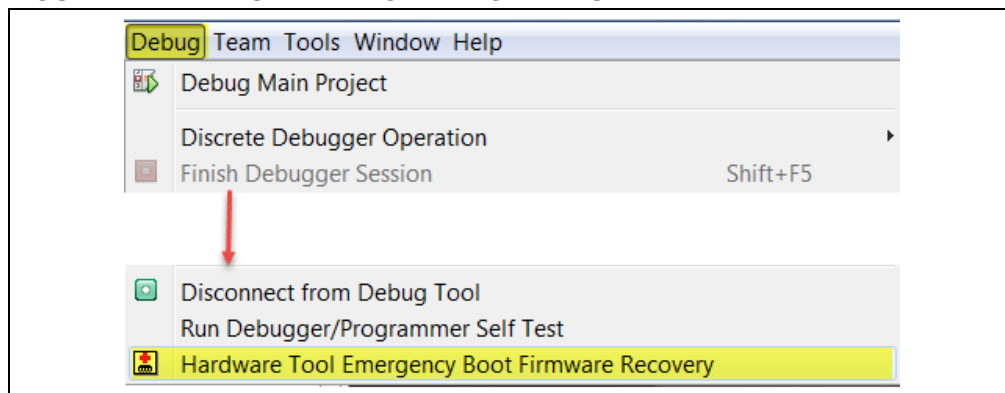


Figure 1-5 shows where the emergency recovery jumper is located on the board.

**FIGURE 1-5:        EMERGENCY RECOVERY JUMPER**
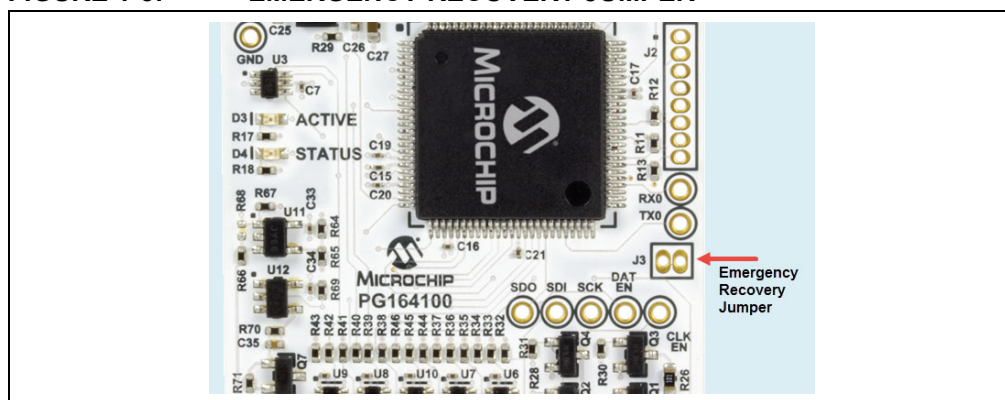


If the procedure was successful, the recovery wizard displays a success screen. The MPLAB Snap will now be operational and able to communicate with the MPLAB X IDE. If the procedure fails, try it again. If it fails a second time, contact Microchip Support at http://support.microchip.com.

**NOTES:**

**Note the following details of the code protection feature on Microchip devices:**

• Microchip products meet the specification contained in their particular Microchip Data Sheet.

• Microchip believes that its family of products is one of the most secure families of its kind on the market today, when used in the intended manner and under normal conditions.

• There are dishonest and possibly illegal methods used to breach the code protection feature. All of these methods, to our knowledge, require using the Microchip products in a manner outside the operating specifications contained in Microchip's Data Sheets. Most likely, the person doing so is engaged in theft of intellectual property.

• Microchip is willing to work with the customer who is concerned about the integrity of their code.

• Neither Microchip nor any other semiconductor manufacturer can guarantee the security of their code. Code protection does not mean that we are guaranteeing the product as "unbreakable."

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