Firmware Loader user guide

About this document

Version

3.5.0

Scope and purpose

The Firmware Loader (fw-loader) tool is a cross-platform command line utility that simplifies upgrading the KitProg3 firmware on development kits and MiniProg4 stand-alone probes. Also, the fw-loader tool provides various command-line options to be used with KitProg3 firmware.

Intended audience

This document helps you understand fw-loader tool command-line options.

Document conventions

Convention	Explanation
Bold	Emphasizes heading levels, column headings, menus and sub-menus
Italics	Denotes file names and paths.
`Courier New`	Denotes APIs, functions, interrupt handlers, events, data types, error handlers, file/folder names, directories, command line inputs, code snippets
File > New	Indicates that a cascading sub-menu opens when you select a menu item

Acronyms and Abbreviations

Term	Description
KitProg3/2	The communication firmware for programming and debugging. It provides communication between programming tool and a target, such as PSoC™ 6 MCU. KitProg3 supports a variety of development kits and is also found in the MiniProg4 debug probe.
CMSIS	Arm® Cortex® Microcontroller Software Interface Standard
CMSIS-DAP	CMSIS Debug Access Port
DAPLink	The platform-independent firmware that enables programming and debugging applications for Arm Cortex® CPUs. DAPLink provides Drag-and-Drop programming via a Mass Storage Controller, CMSIS-DAP debugging, and a virtual serial port

Reference documents

Refer to the following documents for more information as needed:

- KitProg3 user guide

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1 Introduction

The fw-loader tool can:

- List connected supported KitProg3 development kits or MiniProg4 probes
- Perform firmware update to KitProg3 or KitProg2
- Switch between KitProg3 Bulk/HID/DAPLink/Dual-UART/Bootloader mode
- Configure KitProg3 GPIO pins

1.1 Supported OS

The fw-loader tool supports the following operating systems:

- Windows 7 64-bit, 10 64-bit and newer
- Ubuntu Linux 18.04 LTS and newer
- macOS 10, Big Sur, and newer

Note: *On a Linux machine, run the udev_rules\install_rules.sh script before the first run of the fw-loader tool.*

1.2 Supported hardware

The fw-loader supports the following programming hardware:

- MiniProg4 stand-alone programmer
- KitProg3 onboard programmer
- KitProg2 onboard programmer (in proprietary mode)

1.3 KitProg3 device naming

In this document, the term "KitProg3-based device" refers to any development kit or stand-alone probe that carries the KitProg3/2 communication firmware on it. Therefore, it is used in any description about development kits such as CY8CKIT-062-BLE or MiniProg4 probe. Refer to KitProg3 user guide for a full list of supported kits.

The full KitProg3-based device name is typically displayed as follows:

```
KitProg3 CMSIS-DAP BULK-1014091C02179400
```

It consists of the device type (KitProg3), the mode in which the device operates (CMSIS-DAP BULK), and the serial number (1014091C02179400). Any development kit or MiniProg4 probe can be addressed by the full KitProg3-based device name. The full name should be used in quotes (e.g., "KitProg3 CMSIS-DAP BULK-121902F302098400").

1.3.1 Mode

The same KitProg3-based device can have distinct full names based on different modes. For example:

- `KitProg3 CMSIS-DAP BULK-1014091C02179400` – KitProg3-based device in the **Bulk** mode
- `KitProg3 CMSIS-DAP HID-1014091C02179400` – KitProg3-based device in the **HID** mode

1.3.2 Serial number

Each KitProg3-based device can be identified by the serial number, which is an alpha-numeric value. It is the last part of the full KitProg3-based device name. All fw-loader device-specific commands can take the serial number as their KitProg3-based device name argument. For example:

```
fw-loader --update-kp3 1014091C02179400
```

1.4 Package Contents

The fw-loader tool package contains:

- CyBridge library – The dynamic library providing API for communication with KitProg3-based device.
- Auxiliary libraries – Additional run-time libraries used by the fw-loader tool.
- Firmware folder – This folder contains the KitProg2/3 firmware files.

1.5 Launch fw-loader tool

1.5.1 As a stand-alone tool:

The latest stand-alone version of the fw-loader tool can be found in our GitHub repository. Download the appropriate zip archive and unzip it to any convenient location.

Run the fw-loader tool from the installation directory. For example:

<install-dir>/fw-loader/bin/

Note: *On Windows 7, ensure KB2999226 (Update for Universal C Runtime in Windows) is installed. You can download it from https://support.microsoft.com/en-us/topic/update-for-universal-c-runtime-in-windows-c0514201-7fe6-95a3-b0a5-287930f3560c.*

1.5.2 From ModusToolbox™ tools package:

The fw-loader tool is installed as part of the ModusToolbox™ tool package. The following is the default path to fw-loader tool:

<install-dir>/ModusToolbox/tools_x.x/fw-loader/bin/

For Windows, you can use the *fw-loader.bat* file provided with the ModusToolbox™ tools package in the *tools_x.x* folder.

2 Command-line options

This section lists and describes the commands that can be used with the fw-loader tool.

Command-line option	Description
--help	Displays the list of supported commands with their descriptions
--device-list	Displays the list of connected supported KitProg3-based devices
--update-kp2	Updates the Firmware of the KitProg-based device to KitProg2
--update-kp3	Updates the Firmware of the KitProg-based device to KitProg3
--mode	Switches the mode of the KitProg3-based device
--info	Returns the KitProg3-based device info based on Unique ID Record
--set-kp3-gpio-pin	Sets desired operational mode and state on GPIO pin of KitProg3-based device
--read-kp3-gpio-pin	Displays the current state of GPIO pin of KitProg3-based device
--set-kp3-flow-control	Sets requested UART flow control mode for a requested KitProg3 UART
--get-kp3-flow-control	Retrieved the UART flow control mode set doe a requested KitProg3 UART

2.1 --help

This command displays the list of supported commands with their descriptions. Running the fw-loader tool without arguments returns the same information.

Examples:

```
fw-loader
fw-loader --help
```

Return

Status return code – 0.

2.2 --device-list

This command lists the connected KitProg2-based and KitProg3-based devices in the following format:

```
KitProg<X> <mode>-<serial-num> firmware version <firmware-version> [outdated]
```

- `X` – generation of KitProg firmware, e.g., 2, 3
- `mode` - Bootloader, CMSIS-DAP HID, CMSIS-DAP BULK, DAPLink CMSIS-DAP. For KitProg2, only one mode is supported
- `serial-num` - serial number of KitProg2-based/KitProg3-based device
- `Firmware-version` - the version of the KitProgX being run
- `[outdated]` – displayed only if the KitProg3 firmware is not up-to-date

Note: *For KitProg3-based devices in dual-UART operational mode (refer to the KitProg3 User Guide), the mode will be displayed as in bulk – "CMSIS-DAP BULK".*

Example:

```
fw-loader --device-list
```

Return

Expected output if no supported KitProg3-based devices are connected: `"No connected devices"` message

In other cases, the list of devices displays.

2.3 --update-kp2 [full-device-name | serial-num | all]

This command downgrades a KitProg3-based device to KitProg2 firmware. Specify the full device name or serial number if multiple supported KitProg3-based devices are connected, or use the option "all" to update all connected KitProg3-based devices.

MiniProg4 probe does not support KitProg2 firmware. See Troubleshooting section to retrieve MiniProg4 from KitProg2.

KitProg2 supports two modes: CMSIS-DAP and Proprietary. Only the Proprietary mode supports the bootloader and therefore only in this mode is KitProg2 visible to the fw-loader tool. Use the **Mode Switch** button to switch KitProg2 to Proprietary mode.

Note: *Downgrade to KitProg2 firmware is allowed only for these development kits: CY8CKIT-062-BLE, CY8CKIT-062-WIfi-BT, CY8CPROTO-063-BLE, CY8CKIT-041-40XX, CY8CKIT-041-41XX, CY8CKIT-048, CY8CKIT-145-40XX, CY8CKIT-146, CY8CKIT-147, and CY8CKIT-149, CY8CKIT-148.*

Examples:

```
fw-loader --update-kp2
fw-loader --update-kp2 all
```

If option "all" was chosen and any error has occurred – upcoming updates will be skipped.

2.4 --update-kp3 [full-device-name | serial-num | all]

This command upgrades a KitProg2-based/KitProg3-based device to KitProg3 firmware. Specify the full device name or serial number if multiple KitProg3-based devices are connected or use the option "all" to update all connected supported devices.

Examples:

```
fw-loader --update-kp3
fw-loader --update-kp3 all
fw-loader --update-kp3 121902F302098400
fw-loader --update-kp3 "KitProg3 CMSIS-DAP BULK-121902F302098400"
```

If you specified option "all" and any error occurred, the upcoming updates will be skipped.

2.5 --mode <mode> [full-device-name | serial-num]

This command switches the KitProg3-based device operational mode. Specify the KitProg3-based device name or serial number if multiple supported development kits or probes are connected.

Note: This command is not supported for KitProg2 devices.

Supported modes include:

- `kp3-hid`
- `kp3-bulk`
- `kp3-bootloader`
- `kp3-daplink`
- `kp3-dualuart`

On Windows hosts, the `kp3-bulk` mode cannot support simultaneous I²C/SPI bridging (e.g. for CAPSENSE™ tuning). Switch to `kp3-hid` mode instead.

Examples:

```
fw-loader --mode kp3-hid
fw-loader --mode kp3-daplink
fw-loader --mode kp3-bootloader 121902F302098400
fw-loader --mode kp3-bootloader "KitProg3 CMSIS-DAP BULK-121902F302098400"
```

2.6 --info [full-device-name | serial-num]

Displays the parsed KitProg3 Unique ID Record information. Supported on KitProg3-based devices only with KitProg3 Unique ID set; otherwise, the fw-loader tool will return "<full-device-name> has no valid info available" error. The full device name or serial number should be specified if multiple KitProg3-based devices are connected.

Examples:

```
fw-loader --info
fw-loader --info 121902F302098400
fw-loader --info "KitProg3 CMSIS-DAP BULK-121902F302098400"
```

2.7 --set-kp3-gpio-pin <pin_number> <pin_mode> <state> [full-device-name | serial-num]

Sets the desired operational mode and state on the KitProg3 GPIO pin. This is supported on KitProg3 devices with GPIO Bridging feature. For the list of devices with GPIO bridging feature, refer to the KitProg3 user guide.

- The `<pin_number>` consists of two numbers XY, where X is the port number and Y is the pin number on the dedicated port. Supported port and pin combinations are listed in the KitProg3 user guide.
- Supported operational modes `<pin_mode>` are:
  - HiZ (High-Impedance Digital)
  - ResUp (Resistive Pull Up)
  - ResDown (Resistive Pull Down)
  - OdLow (Open Drain, Drives Low)
  - OdHigh (Open Drain, Drives High)
  - DmStr (Strong Drive)
  - ResUpDwn (Resistive Pull Up & Pull Down)
- Supported states `<state>` are 0 and 1.

*Note: Trying to set an invalid combination of **<pin_mode>** and **<state>**, such as HiZ and 0 or HiZ and 1, will result in an error due to undefined behavior.*

Examples:

```
fw-loader --set-kp3-gpio-pin 35 ResUp 0
fw-loader --set-kp3-gpio-pin 35 ResUp 0 121902F302098400
fw-loader --set-kp3-gpio-pin 35 ResDown 1 "KitProg3 CMSIS-DAP BULK-
121902F302098400"
```

2.8 --read-kp3-gpio-pin <pin_number> [full-device-name | serial-num]

Reads the current state on the GPIO pin. This is supported on KitProg3 devices with the GPIO Bridging feature. For a list of devices with GPIO bridging feature, refer to the KitProg3 user guide.

- `<pin_number>` consists of two numbers XY, where X is the port number and Y is the pin number on the dedicated port. Supported port and pin combinations are listed in the KitProg3 user guide.

Examples:

```
fw-loader --read-kp3-gpio-pin 36
fw-loader --read-kp3-gpio-pin 36 121902F302098400
fw-loader --read-kp3-gpio-pin 35 "KitProg3 CMSIS-DAP BULK-121902F302098400"
```

2.9 --set-kp3-flow-control <port_number> <mode> [full-device-name|serial-num]

Configures the UART flow control mode of the KitProg3 UART for a KitProg3-based device. If multiple supported KitProg3-based devices are connected, specify the full device name or serial number. This is applicable only for KitProg3-based devices where UART HW flow control is supported. These can be found in the KitProg3 User Guide.

- `<port_number>` is the requested KitProg3 UART port.
- `<mode>` is the requested UART flow control mode; none/hardware values are supported.

Examples:

```
fw-loader --set-kp3-flow-control 0 none
fw-loader --set-kp3-flow-control 0 hardware 121902F302098400
fw-loader --set-kp3-flow-control 1 none
"KitProg3 CMSIS-DAP BULK-121902F302098400"
```

2.10 --get-kp3-flow-control <port_number> [full-device-name|serial-num]

Retrieves the UART flow control mode of the KitProg3 UART for a KitProg3-based device. If multiple supported KitProg3-based devices are connected, specify the full device name or serial number. This is applicable only for KitProg3-based devices where UART HW flow control is supported. These can be found in the KitProg3 User Guide.

- `<port_number>` is the requested KitProg3 UART port.

Examples:

```
fw-loader --get-kp3-flow-control 0
fw-loader --get-kp3-flow-control 1 121902F302098400
```

3 Troubleshooting

Problem

Errors are observed while performing the `--device-list` command with MiniProg4 probe connected:

```
Error =  The HID read has timed out. Cannot open the 'MiniProg4 CMSIS-DAP HID-
<serial-number> device.
```

Root cause

KitProg2 firmware is installed on MiniProg4.

Solution

Update KitProg-based device from Bootloader mode:

1. Switch the KitProg3-based device to Bootloader mode.
   a. Unplug device while pressing the **Mode Select** button.
   b. Plug in device back.
   c. Release the **Mode Select** button.
2. Perform firmware update using the `--update-kp3` command.

Problem

The supported KitProg3-based device is connected and can be seen in the system, but it cannot be detected by the fw-loader tool.

Root cause

The device is currently accessed by another process (such as PSoC™ Programmer, etc.), or the fw-loader tool version is not up to date with the KitProg3 Firmware on the connected device.

Solution

Close any other application that might use the connected KitProg3-based device and retry the operation. If the issue persists, make sure to use the latest version of the fw-loader tool, or downgrade the KitProg3 FW to the older supported version via firmware update from Bootloader mode (see steps above).

Revision history

Date	Revision	Description
2021-08-09	**	New document.
2022-04-25	*A	• Added description of set-kp3-gpio-pin (Section 2.7) and read-kp3-gpio-pin (Section 2.8) commands • Updated Command-line options table • Added section 1.3 – KitProg Device naming • Corrected the "device" term across the document
2022-08-19	*B	• Updated descriptions of commands in sections 2.2 and 2.4 • Updated Introduction section 1 with info GPIO Bridging feature • Updated Troubleshooting section 3
2023-04-20	*C	• Updated list of supported OS in section 1.1 • Updated section 1.5 – Launch fw-loader toolUpdated Command-line options table • Added description of set-kp3-flow-control (Section 2.9) and get-kp3-flow-control (Section 2.10) commands • Updated Troubleshooting section 3

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