UG0851
User Guide
FlashPro Express
Software v12.3

FlashPro Programmer
FlashPro 3/X, 4, 5, 6

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Introduction to FlashPro Express

About FlashPro Express

FlashPro Express is Microsemi's programming software tool designed from the ground up to address secured programming assurance in production programming house environments. FlashPro Express software supports PolarFire ^{TM}, SmartFusion®2, IGLOO®2, and RTG4^{TM} in the Windows and Linux OS environments, using the FlashPro Programmer hardware.

You can install FlashPro Express two ways:

- **Integrated with Libero** - FlashPro Express is installed automatically when Libero is installed. FlashPro Express is used by Libero to perform the programming tasks for PolarFire, SmartFusion2, IGLOO2, and RTG4, as part of the design flow.
- **Stand-Alone** - FlashPro Express is also available as a standalone installation. This mode is primarily used for production programming or lab programming on machines in which a full version of Libero is not required.

See the Microsemi website for more information on FlashPro Express.

About FlashPro Programmer

The FlashPro series of hardware programmers saves you board space because a single JTAG chain can be used for all JTAG devices. In-system programming using the JTAG port adds the flexibility of field upgrades or post-assembly production-line characterization. Production costs are significantly reduced as a result of elimination of expensive sockets on the board.

See programmer sections and the Microsemi website for details on FlashPro3/X, FlashPro4, FlashPro5 and FlashPro6.

Note: FlashPro 5 and FlashPro 6 support programming though the device SPI Slave port as well.

Secure Job Programming

Job programming is the concept of using a single file to program a Microsemi device or chain of Microsemi devices using encrypted bitstreams.

The single job file contains all of the information necessary to setup FlashPro Express as well as the encrypted bitstream images for the devices in the job. Once a job file is created it can be handed off securely to production programming houses or contract engineering facilities to load the Microsemi images during manufacturing. Job projects can be exported from Libero and imported into stand-alone FlashPro Express providing a clean delineation between design flow and production programming.

Migrating FlashPro Projects to FlashPro Express

Existing FlashPro projects (*.pro) files are now called Job Project files in FlashPro Express. These Job Projects can be opened with FlashPro Express to take advantage of Linux programming support and the simplified tool targeted for operators in a production floor environment.

FlashPro projects that were created in single mode will not be supported with this tool. Microsemi recommends that you convert these projects to chain mode projects. To convert the project to a chain project, do the following steps:

1. Open the FlashPro project (*.pro) in FlashPro.
2. Locate the loaded STAPL file by one of two methods:

   The log will print "STAPL file '<stapl_path>' has been loaded successfully." <stapl_path> is the location of the STAPL file loaded.

Within the Single Device Configuration Window there is a field STAPL_FILE_NAME, which displays the location of the STAPL file loaded.
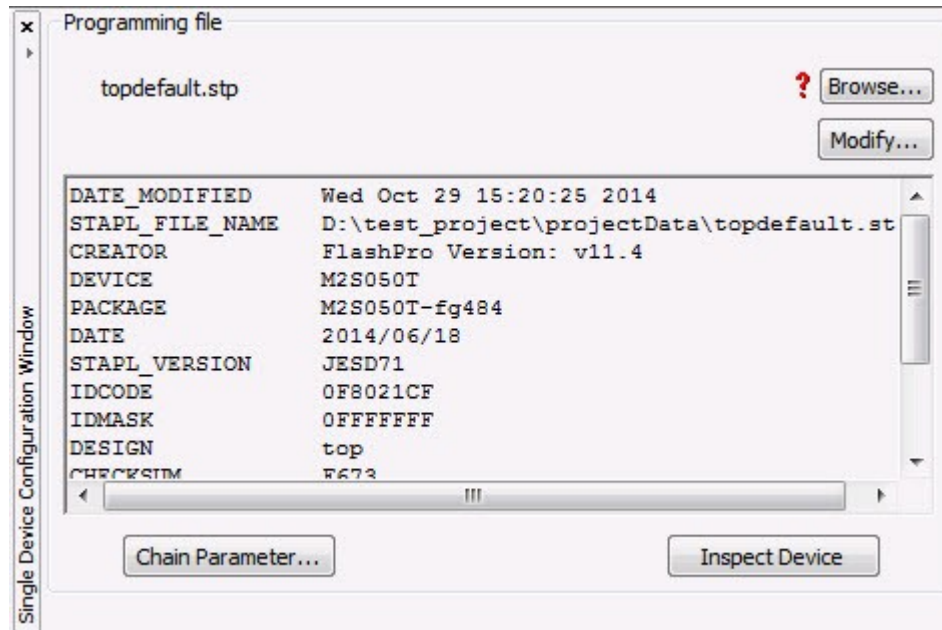
3. Switch the project to chain mode by one of the two methods:

    a. Press the chain button from the toolbar.

    b. From the Tools menu, select **Mode->Chain Programming**.

4. Load the STAPL file in chain mode by adding a Microsemi device in the chain.

    a. From the File menu, select **Configuration->Add Microsemi Devices from Files**.

    b. Browse to the location of the STAPL file and click **Open**.

5. To save the project, from the File menu, select **Save Project**.

6. You may now open the project using FlashPro Express.

When moving FlashPro project (*.pro) files to another machine, Microsemi recommends that you archive the entire project folder, copy it to the new machine, extract it locally, then load the job project within FlashPro Express. FlashPro Express will only open a job project if a programmer is connected to the machine, at least one Microsemi device has programmed enabled, and all enabled Microsemi devices have a bitstream file loaded.

Supported Families - FlashPro Express

The table below lists the device families and their derivatives that FlashPro Express can program directly through Libero or by exporting a FlashPro Express job:

Table 1 · Product Families and Derivatives Directly Supported by FlashPro Express

Device Family	Family Derivatives	Description
PolarFire	N/A	Lowest power, cost optimized, mid-range solution
SmartFusion2	N/A	Address fundamental requirements for advanced security, high reliability and low power in critical industrial, military, aviation, communications and medical applications.
IGLOO2	N/A	Low-power mixed-signal programmable solution
RTG4	N/A	Radiation-tolerant programmable solution

Installing FlashPro Express Software and Hardware

See the Microsemi Website for more information about FlashPro Express.

Getting Started

Starting FlashPro Express

Start FlashPro Express by running the program at [installation folder] > bin > FPExpress.

FlashPro Express Interface

The main FlashPro Express UI consists of a list of programmers and a chain table, as shown in the figure below. This view displays the programmers connected to the machine, and the devices within the JTAG chain specified in the job project file (PRO) file, as shown in the figure below.

Note: For SmartFusion2 and IGLOO2 devices, you have the option to select JTAG or SPI Slave in the Select Programming Interface dialog box. See the Select Programming Interface help topic in the online help for more information.

- Hover over the programmer Info icon to display more information about a programmer.
- Click the Name field to change a programmer name.
- Click the checkbox to enable or disable a programmer.
- Right-click a programmer to Ping, Self-Test, Scan, Check Chain or Remove it from the list.
- Additional information about a device and programming file, if loaded, can be viewed by hovering over the info icon of that device.
- Devices specified as disabled in the job project (*.pro) file are shown disabled and their HighZ value is displayed in the column header.
- Device/Programmer States:
    - **IDLE**: The devices/programmers are idle and not executing any programming action.
    - **DISABLED**: Devices that are not enabled for programming
    - **PASSED**: The last programming operation passed
    - **FAILED**: The last programming operation failed
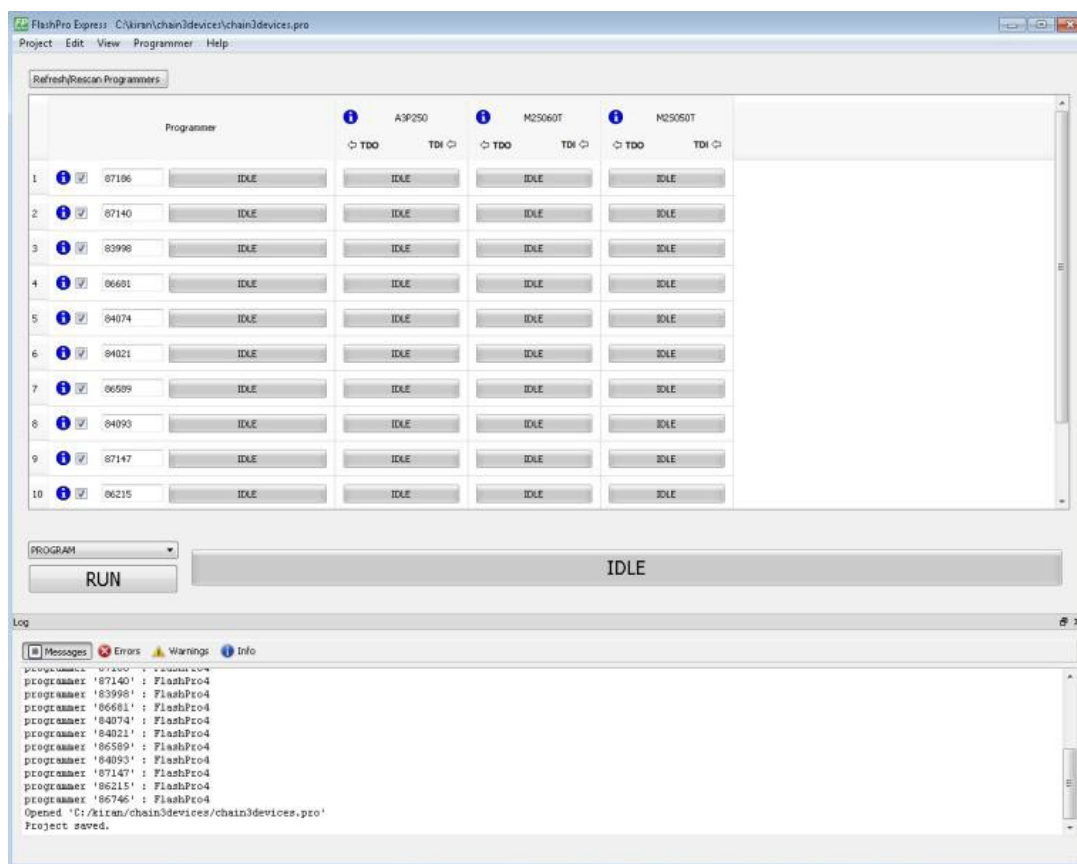
Figure 1 · FlashPro Express Programmers and Chain Table (JTAG example)

Note: SPI Slave mode is supported by FlashPro5 for SmartFusion2 and IGLOO2 devices, and by FlashPro6 for SmartFusion2, IGLOO2, and PolarFire devices. JTAG is the default interface.
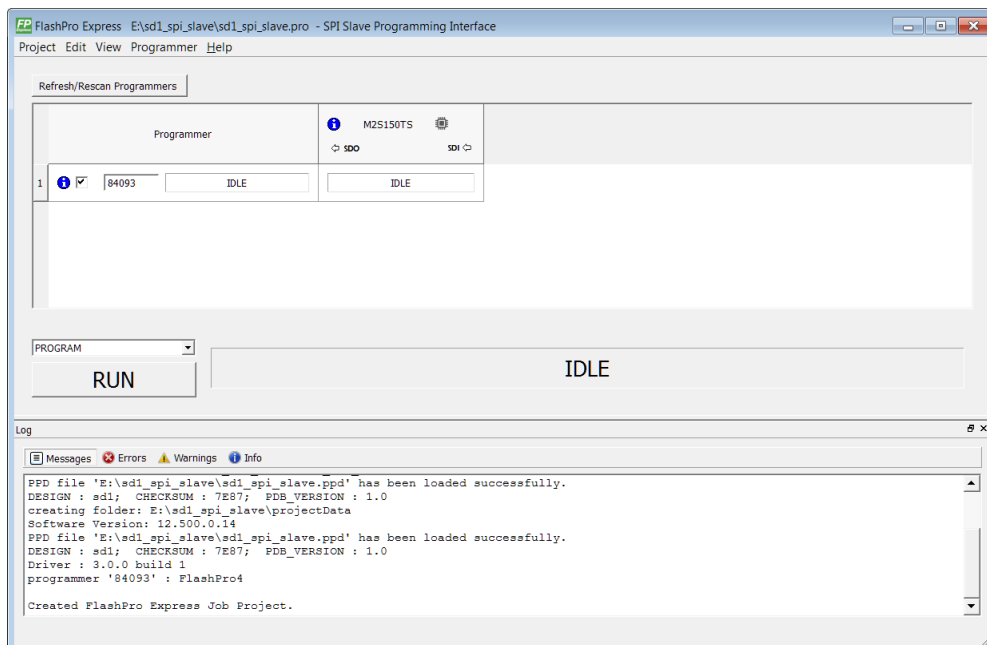
Figure 2 · FlashPro Express Programmers and Chain Table (SPI Slave example)

Note: RTG4 devices do not support SPI Slave programming.

Creating a Job Project from a FlashPro Express Job

Once you are ready to hand off your design for production you can create a job project. To do so:

1. In Libero run **Export FlashPro Express Job** to create a container that will be used to transfer programming configuration information, including programming files, to the production programming tool FlashPro Express.
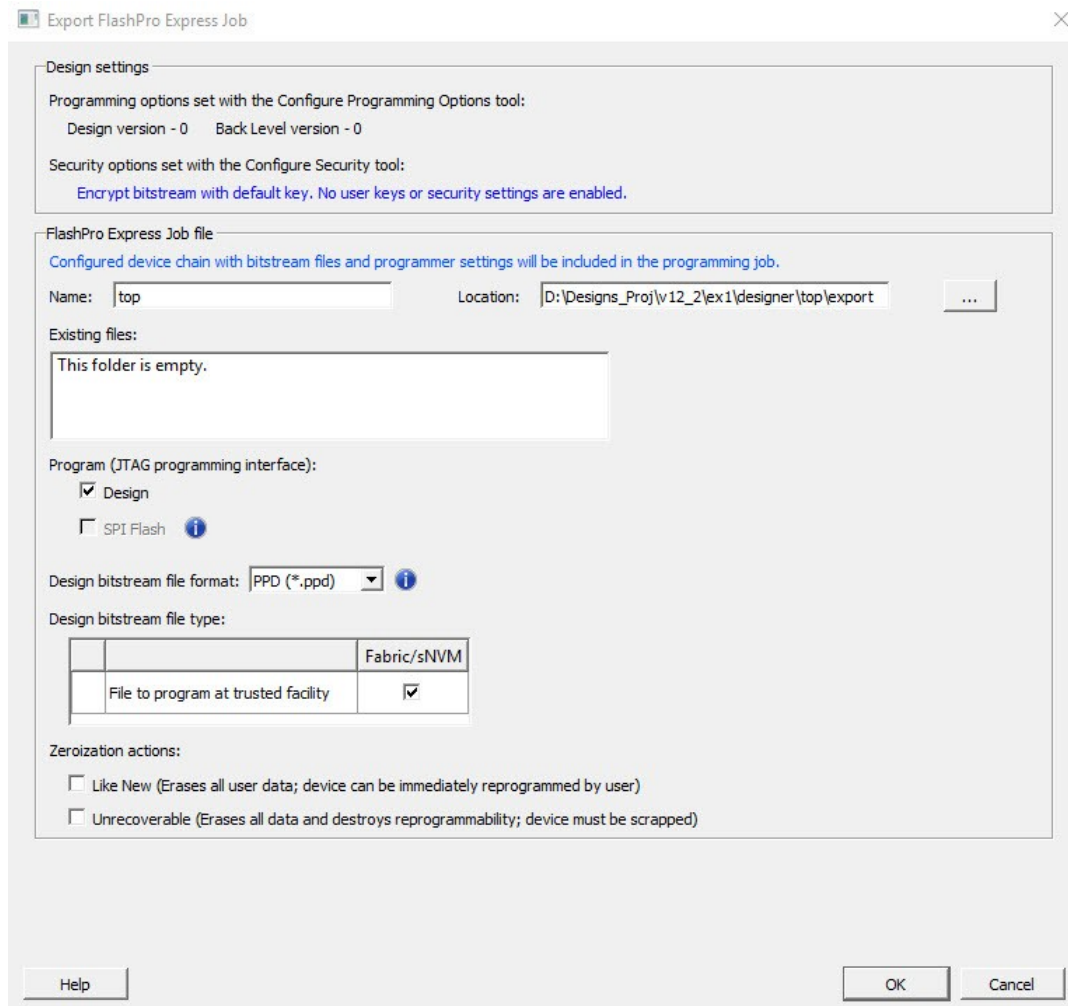
Figure 3 · Export FlashPro Express Job

2. In FlashPro Express, from the **Project** menu choose **New Job Project From FlashPro Express Job**. You will be prompted to specify the Programming Job File location that you just exported from Libero and the location of where to store the FlashPro Express Job Project. The Job Project name automatically uses the programming job name and cannot be changed. Click **OK** and a new Job Project will be created and opened for production programming.
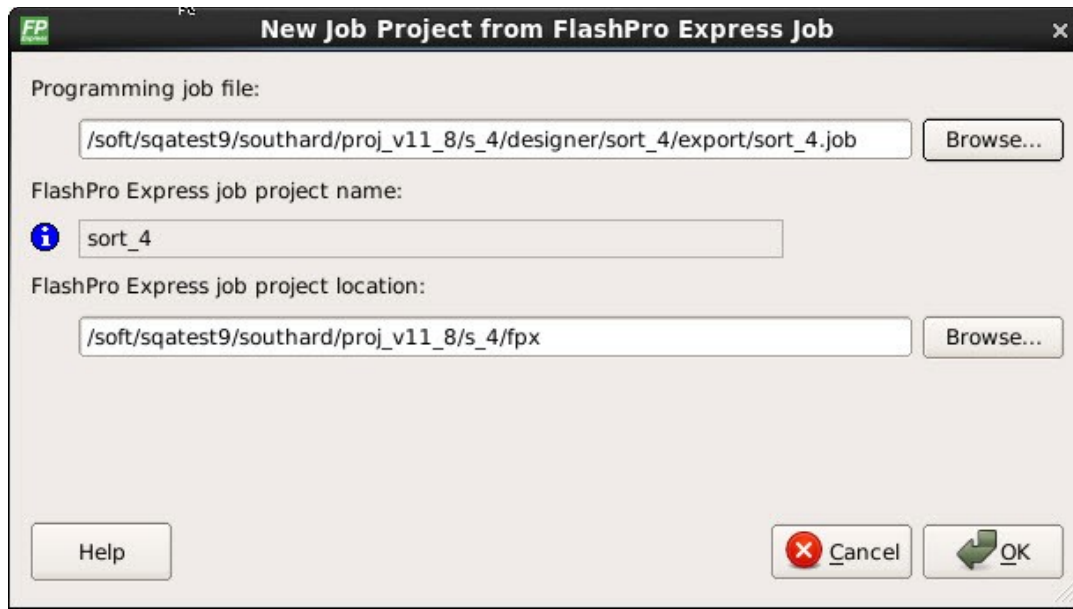
Figure 4 · New Job Project from FlashPro Express Job Dialog Box

Load a Job Project

To get started in FlashPro Express you must load a job project (*.pro file). To do so, from the **Project** menu choose **Open Job Project**. A job project will open if:

- At least 1 programmer is connected
- At least 1 Microsemi device is enabled for programming
- Any enabled Microsemi device for programming must have a bitstream file loaded

To open a project:

1. From the **Project** menu, choose **Open Job Project**. The **Open Project** dialog box appears.
2. Find your project file or type in your project file name in the **File name** field.
3. Click **Open**.
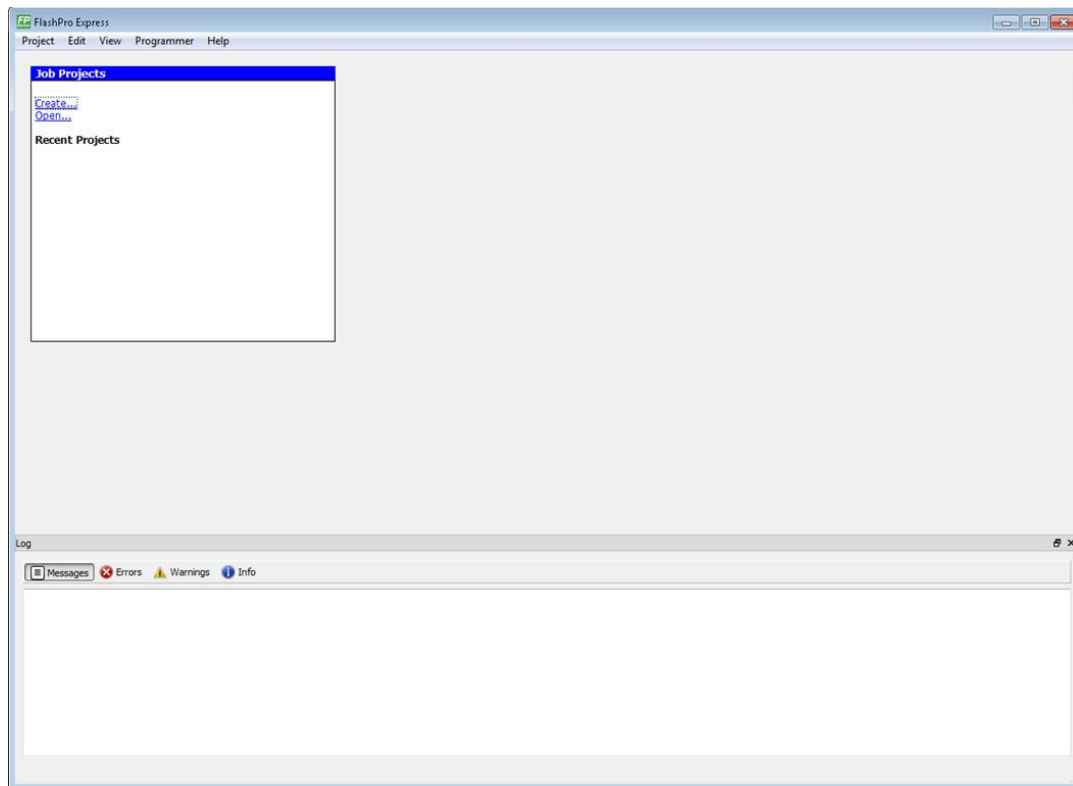
Figure 5 · FlashPro Express Launch Screen

Saving a Job Project

Click the **Save** button on the toolbar, or from the **Project** menu choose **Save Job Project** to save your project.

Programming Tutorials

Parallel Programming with FlashPro5/4/3/3X

Parallel programming enables you to program multiple Microsemi devices in parallel with multiple programmers. In parallel programming, all targeted devices are programmed with the same programming file (STAPL). The targeted device or chain configuration that is connected to each programmer must be identical.

The FlashPro Express software together with the FlashPro5/4/3/3X programmers supports parallel programming via a USB port. You can connect up to sixteen FlashPro5/4/3/3X's to a PC via a USB v1.1 or a USB v2.0 port. FlashPro5/4/3/3X requires a self-powered hub.

Connecting FlashPro5/4/3/3X (a USB v2.0 enabled programmer) to USB v1.1 port increases device programming time due to a slow data transfer rate on the USB v1.1 port in comparison to a USB v2.0 port.

The following figure illustrates how you can connect a FlashPro5/4/3/3X programmer for parallel programming.
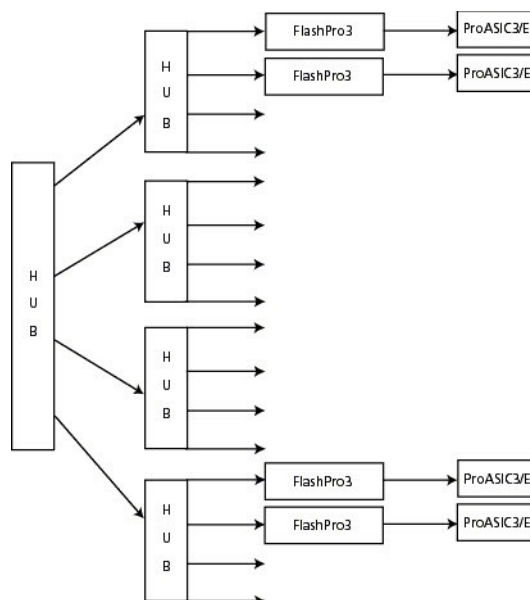
Figure 6 · Connecting a FlashPro5/4/3/3X Programmer

An independent thread processes the STAPL file during parallel programming. In an Microsemi test, parallel programming is approximately five times faster than programming 16 devices sequentially.

Note: Microsemi has tested Belkin PCI-USB cards and hubs. We have found that parallel programming works best with the vendor's latest driver installed and with the matching hubs.

Chain Programming Tutorial

This tutorial demonstrates how to use FlashPro Express to program a multi-device, multi-programmer chain. This tutorial uses the production programming flow that exports a programming job from Libero SoC, which includes chain configuration, programmer settings, and bitstream files for programming, and creates a job project from a programming job.

The figure below shows the chain used in this tutorial. M2S050T is device 1 and A3P250 is device 3. Device 1 is the first device to be programmed in the chain and device 2 is the last; device 3 is disabled and will not be programmed.
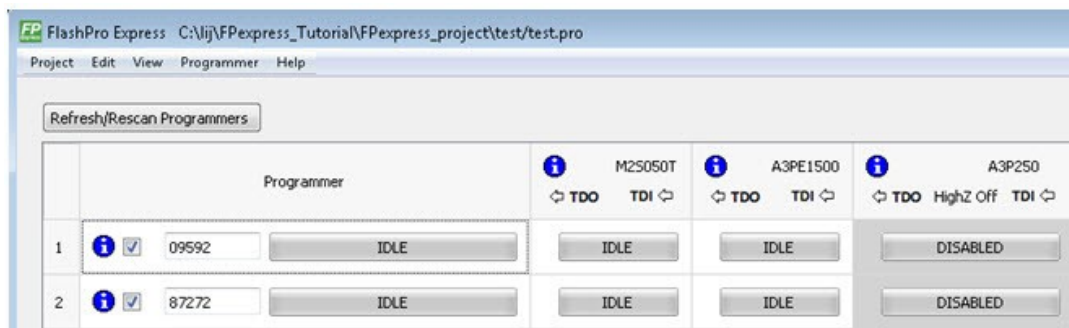
Figure 7 · Chain Programming Devices

To program a chain:

1. From the **Project** menu, choose **New Job Project from FlashPro Express Job**.
2. Click **Browse** to load a Programming Job File, and specify your **FlashPro Express job project location**. Click **OK** to continue, as shown in the figure below.
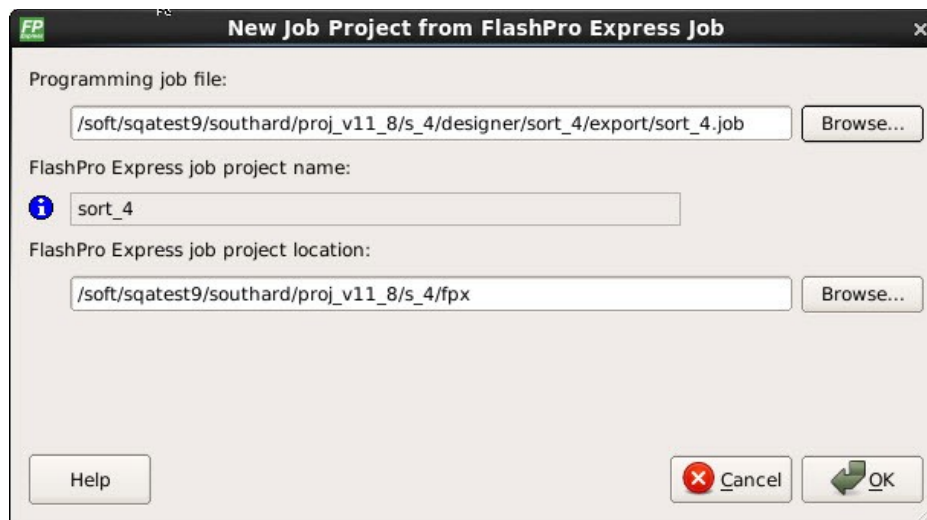
Figure 8 · New Job Project from FlashPro Express Job

FlashPro Express displays your Job Project and programmers, as shown in the figure below. The Device/Programmer states are:

- IDLE: The devices/programmers are idle and not executing any programming action
- DISABLED: Devices that are not enabled for programming
- PASSED: The last programming operation passed
- FAILED: The last programming operation failed
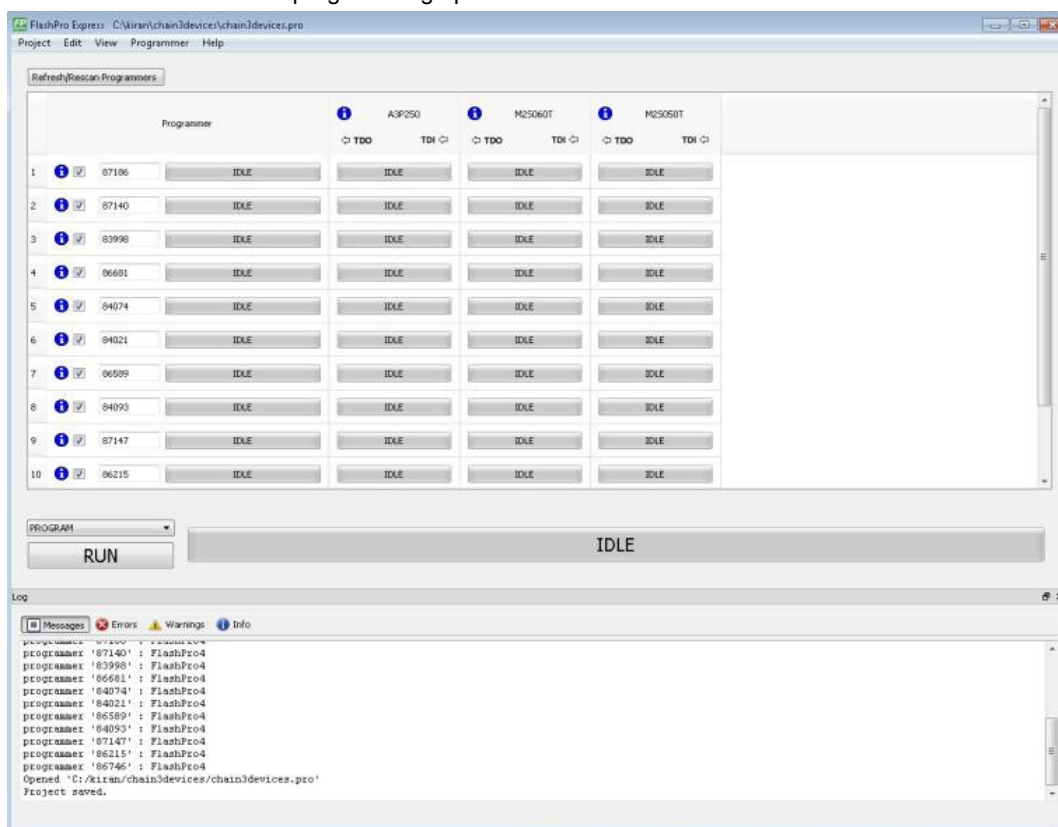
Figure 9 · FlashPro Express with Loaded Job Project (JTAG example)
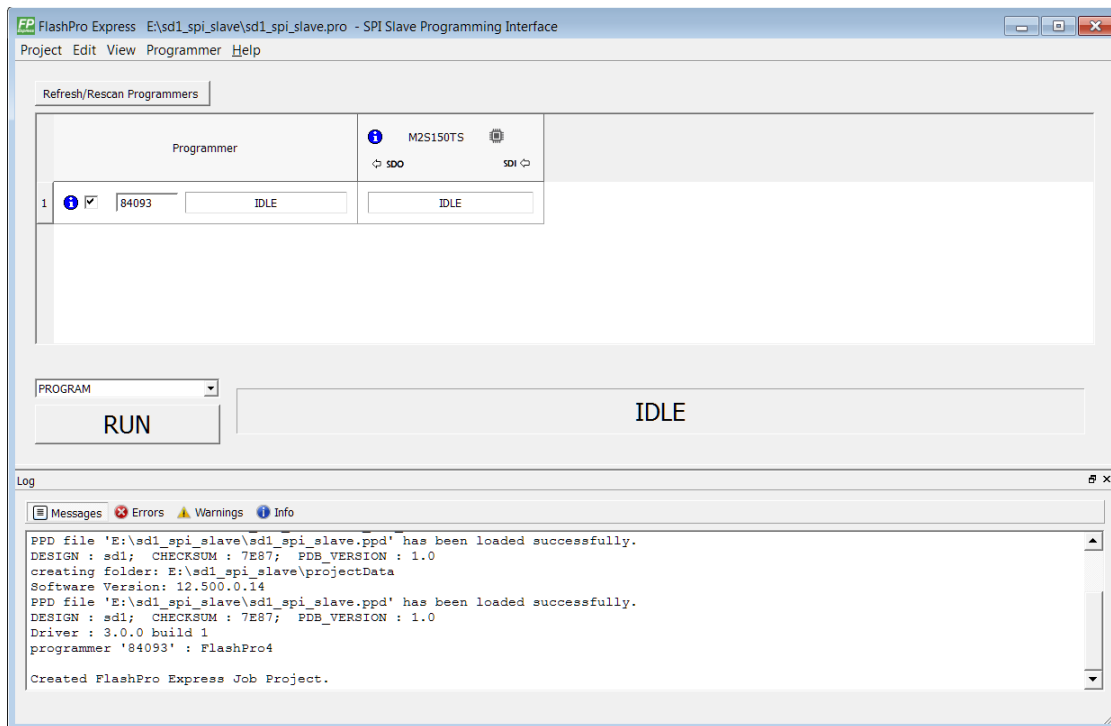
Figure 10 · FlashPro Express with Loaded Job Project (SPI Slave example – SmartFusion2/IGLOO2 only)

See the Export Programming Job topic for information on how to generate a Programming Job file.

3. Click the **Refresh/Rescan** button if your programmer is not listed. Hover your mouse over the **Info** icon to view device info. If a device is Disabled for programming the HighZ status appears in the GUI, as shown in the figure above.

4. Set the Programming Action in the dropdown menu to **PROGRAM**, as shown in the figure below.
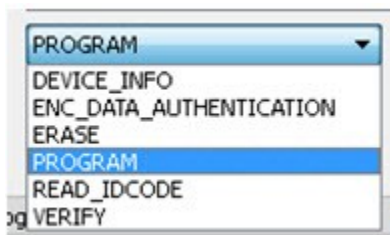
Figure 11 · Programming Action Set to PROGRAM

5. Click **RUN**. Detailed individual programmer and device status information appears in the Programmer List. Your programmer status (PASSED or FAILED) appears in the Programmer Status Bar, as shown in the figure below.

- Hover over the Programmer Status Bar to display information on the programmers.
- Hover over the FAILED status to list all programmers that failed programming.
- Hover over the PASSED status to list all the programmers that programmed successfully.
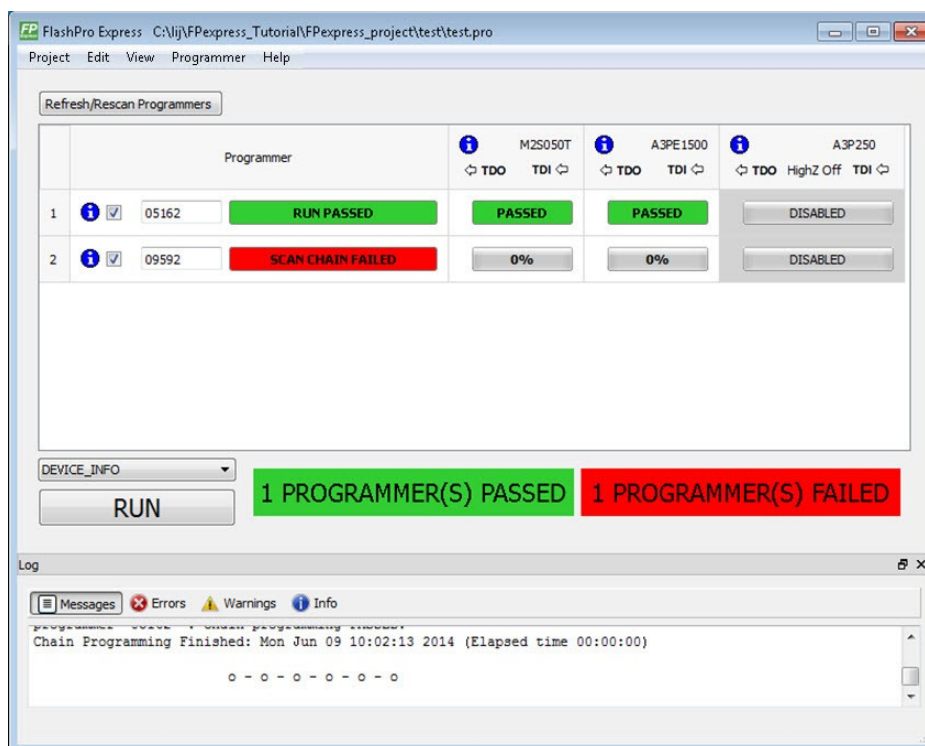
Figure 12 · Chain Programming Complete

View the **Log** for Messages, Errors, Warnings and Info generated during programming.

Programmer Settings and Operations

Introduction

The FlashPro Express software enables you to connect multiple programmers to your computer. With each programmer you select, you can connect the programmer, perform a self-test, customize, add, and remove and analyze the JTAG chain, as shown in the figure below.
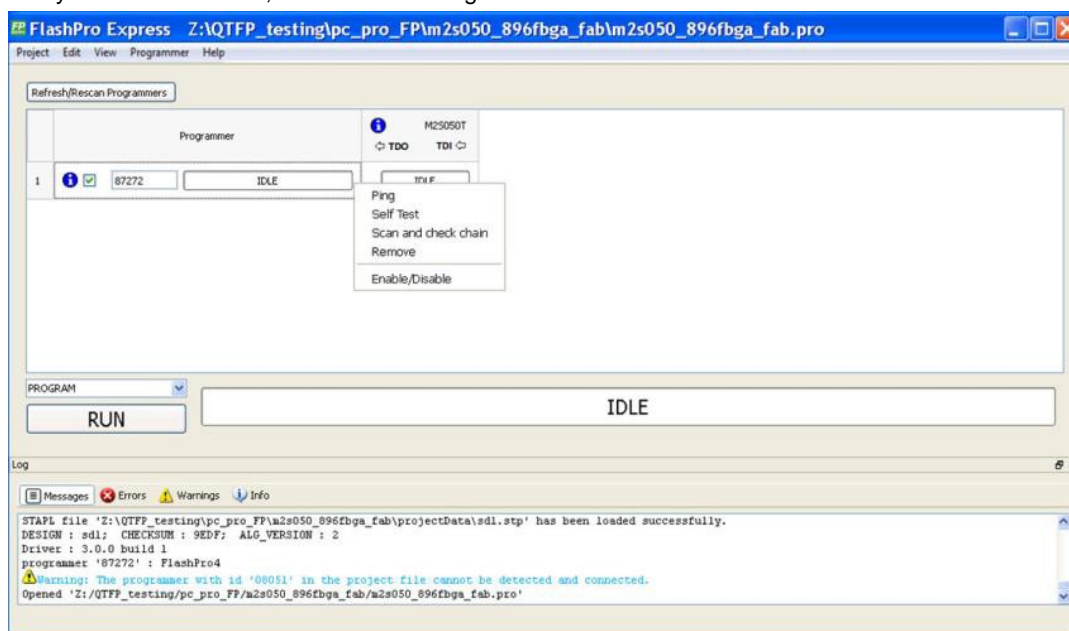
Figure 13 · FlashPro Express Right-Click Menu

Programmer Settings

In the Libero SoC Design Flow window, expand **Configure Hardware**, double-click **Configure Programmer**, or right-click **Configure Programmer** and choose **Programmer Settings** to view the Programmer Settings dialog.

For the JTAG interface, you can set specific voltage and force TCK frequency values for your programmer in this dialog. For the SPI Slave interface, you can set specific voltage and force SCK frequency values for your programmer. SPI Slave mode is supported by FlashPro5 for SmartFusion2 and IGLOO2 devices, and by FlashPro6 for SmartFusion2, IGLOO2, and PolarFire devices. SPI Slave mode is not supported for RTG4 devices. JTAG is the default interface.
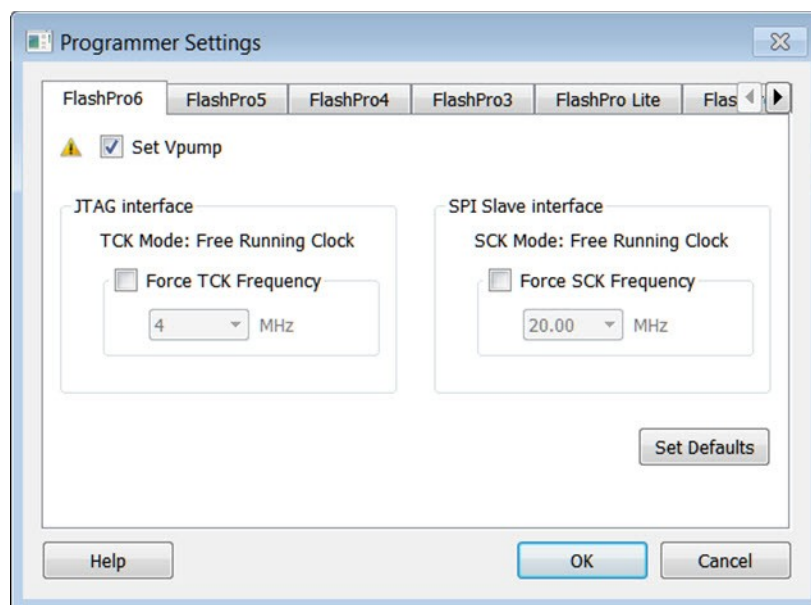
Figure 14 · Programmer Settings

The Programmer Settings dialog includes setting options for FlashPro6/5/4/3/3X.

Limitation of the TCK frequency for the selected programmer:

- FlashPro6: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20 MHz
- FlashPro5: 1, 2, 3, 4, 5, 6, 10, 15, 30 MHz
- FlashPro4: 1, 2, 3, 4, 5, 6 MHz
- FlashPro3/3X: 1, 2, 3, 4, 6 MHz

TCK frequency limits by target device:

- Refer to target device data sheet

During execution, the frequency set by the FREQUENCY statement in the PDB/STAPL file overrides the TCK frequency setting selected by you in the Programmer Settings dialog box unless you also select the Force TCK Frequency checkbox.

Limitation of the SCK frequency for the selected programmer: 1.00, 2.00, 2.50, 3.33, 4.00, 5.00, 6.67, 8.00, 10.00, 13.33, 20.00 MHz

FlashPro5/4/3/3X Programmer Settings

For FlashPro5/4/3/3X, you can choose the Set Vpump setting or the Force TCK Frequency. If you choose the Force TCK Frequency, select the appropriate MHz frequency. For FlashPro4/3X settings, you can switch the TCK mode between Free running clock and Discrete clocking. Discrete clocking should be used when there is a JTAG non-compliant device in a chain with Microsemi devices. After you have made your selections(s), click **OK**.

Default Settings

- The Vpump option is checked to instruct the FlashPro5/4/3/3X programmer(s) to supply Vpump to the device.
  NOTE: VPUMP voltage will not be checked for the SmartFusion2/IGLOO2 and newer families of devices. VPUMP does not need to be connected to the programmer for these devices.
- The Force TCK Frequency option is unchecked to instruct the FlashPro5/4/3/3X to use the TCK frequency specified by the Frequency statement in the PDB/STAPL file(s).
- FlashPro5/4/3/3X default TCK mode setting is Free running clock.

TCK Setting (Force TCK Frequency)

If **Force TCK Frequency** is checked (in the **Programmer Setting**), the selected TCK value is set for the programmer and the Frequency statement in the PDB/STAPL file is ignored.

Default TCK frequency

When the IPD/STAPL file or Chain does not exist, the default TCK frequency is set to 4MHz. When more than one Microsemi flash device is targeted in the chain, the FlashPro Express software passes through all of the files and searches for the "freq" keyword and the "MAX_FREQ" **Note** field. The FlashPro Express software uses the lesser value of all the TCK frequency settings and the "MAX_FREQ" **Note** field values.

Ping Programmers

Right-click a programmer and choose Ping.

> Note: You can click the Refresh/Rescan for Programmers button to quickly ping new programmers.

Performing a Self-Test

Right-click the programmer you want to self-test and choose Self Test.

> Note: You must connect the programmer to the self-test board that comes with your programmer before performing a self-test.

> Note: Self-test is not supported with FlashPro5/4 programmers. These programmers are rigorously tested at the factory during production.

Scanning and Checking a Chain

The scan chain operation scans and analyzes the JTAG chain connected to programmer(s) you have selected and checks that chain scanned matches the chain configured in FlashPro Express.

To scan a chain:

Right-click the programmer you want to scan and choose **Scan and check chain**.

Enabling and Disabling Programmers

After loading a job project, you can enable/disable or remove a programmer and can also ping, self-test, run scan and check chain on any of the connected programmers. These actions are available in the shortcut menu (right-click) for each of the programmers listed in the programmer column.

Click the checkbox next to a programmer in the Programmer column to enable or disable it. The programmer is enabled when there is a tick mark in the checkbox and disabled when the checkbox is empty.

Renaming a Programmer

Enter the new programmer name in the **Programmer** window to rename the programmer. By default, the programmer name is the same as the programmer ID.

Removing a Programmer

Right-click the programmer and choose **Remove**.

Selecting and Running an Action

FlashPro Express supports the following programming actions:

- DEVICE_INFO

- ENC_DATA_AUTHENTICATION
  This action is only visible if every device in the chain contains encrypted bitstream files. Selecting this action causes each bitstream file to be checked for authentication.
- ERASE
- PROGRAM
- READ_IDCODE
- VERIFY

To select a programming action:

Select an action from the Programming Action dropdown menu in FlashPro Express, as shown in the figure below.

Figure 15 · FlashPro Express Programming Actions

To run the selected programming action:

Click on the **RUN** button below the Programming Action drop-down menu.

Chain Programming

Chain Order

Chain Programming enables you to program several devices at one time. The order of devices in the chain imported from Job Project must match the physical chain to be programmed.

The TDO for the first device connects to the programmer, and the last device's TDI connects to the programmer. The devices in the chain go in order from a device's TDI into the next device's TDO, as shown in the figure below.
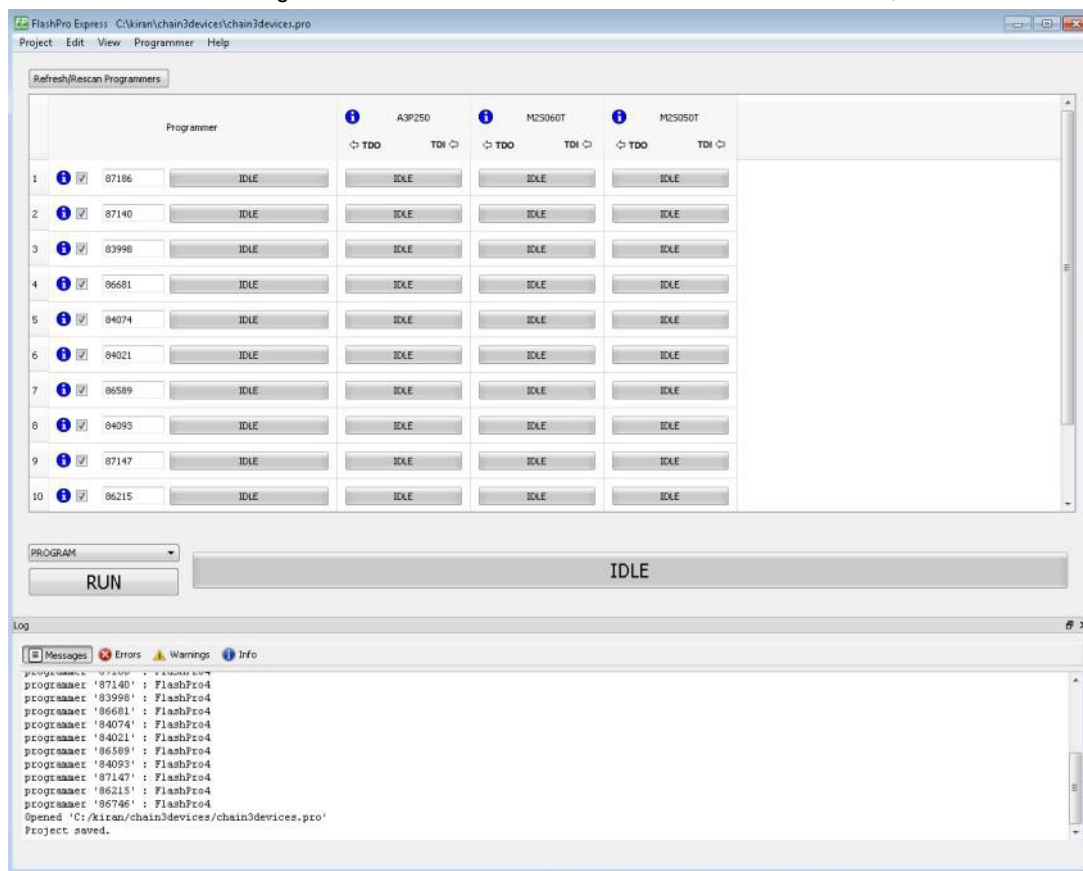
Figure 16 · Chain Order

Multiple Device Chain Programming

The FlashPro Express software enables direct chain programming without generating a chain STAPL file. Each device will be programmed in sequential order starting from device 1 to device N. See example below. For more information about chain order, see the Chain Order help topic.

TDI > Device N > Device N-1 >… > Device 2 > Device 1 > TDO

Device Programming Compatibility

PolarFire, SmartFusion2, IGLOO2, and RTG4 devices can be programmed in the same chain.

Programmer Support

FlashPro5/4/3/3X supports PolarFire, SmartFusion2, IGLOO2, and RTG4 devices. The Vpump on FlashPro5/4/3/3X is designed to support the programming of only one device. Please make sure that Vpump, Vcc and Vjtag are provided on board for chain programming. Connect the Vpump to the header as the Flashpro Express software will attempt to check for all external supplies, including Vpump, to ensure successful programming. There is no limitation to the chain length; however, ensure that the JTAG signal integrity and the timing are preserved.

TCL Commands - FlashPro Express

About TCL Commands - FlashPro Express Tcl Command Reference

Note: For details about all Tcl commands supported by FlashPro Express, see the following documents:

Note: Tcl Command Reference Guide (SmartFusion2, IGLOO2, RTG4)

Note: Tcl Command Reference Guide (PolarFire)

A Tcl (Tool Command Language) file contains scripts for simple or complex tasks. You can run scripts from the Windows command line or store and run a series of Tcl commands in a *.tcl batch file.

Note: Tcl commands are case sensitive. However, their arguments are not.

Running Tcl Scripts from within FlashPro Express

Instead of running scripts from the command line, you can use FlashPro Express's Execute Script dialog box to run a script.

To execute a Tcl script file within FlashPro Express:

1. From the **File** menu, choose **Execute Script** to display the **Run Script** dialog box.
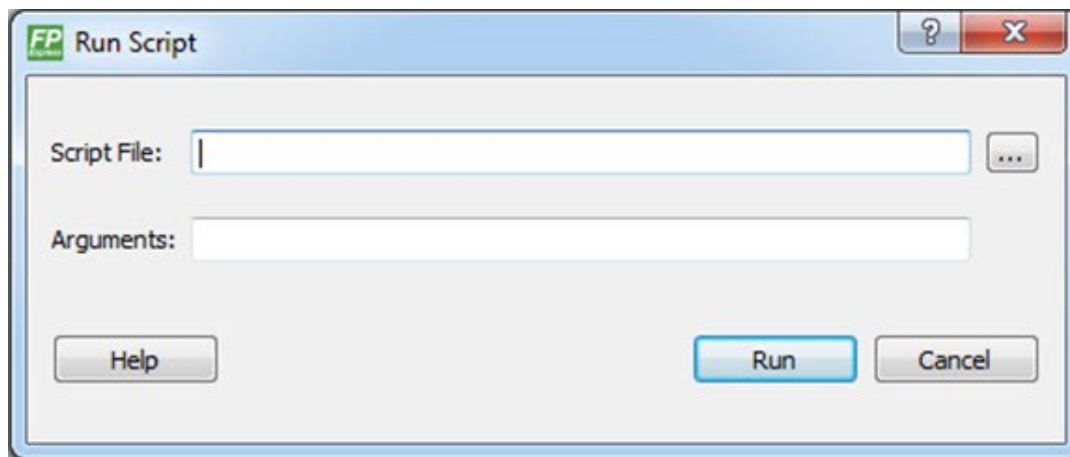
Figure 17 · Run Script Dialog Box

2. Click the **Browse** button to display the **Open** dialog box, in which you can navigate to the folder containing the script file to open. When you click **Open**, FlashPro Express enters the full path and script filename into the Run Script dialog box for you.

3. In the Arguments box, enter the arguments to pass to your Tcl script. Separate each argument by a space character. For information about accessing arguments passed to a Tcl script, see Running Tcl Scripts From the Command Line.

4. Click **Run**.

Running Tcl Scripts from the Command Line

You can run Tcl scripts from your Windows or Linux command line.

To execute a Tcl script file in the FlashPro Express software from a shell command line:

1. At the prompt, type the path to the Microsemi software followed by the word "SCRIPT" and a colon, and then the name of the script file as follows:

   ```
   <location of Microsemi software>/bin/FPExpress.exe SCRIPT:<filename>
   ```

   The example below executes in batch mode the script *foo.tcl*:

   ```
   <location of Microsemi software>/bin/FPExpress.exe script:foo.tcl
   ```

   The example below executes in batch mode the script foo.tcl and exports the log in the file *foo.txt*:

   ```
   <location of Microsemi software>/bin/FPExpress.exe script:foo.tcl logfile:foo.txt
   ```

   The example below executes in batch mode the script *foo.tcl*, creates a console where the log is displayed briefly, and exports the log in the file *foo.txt*:

   ```
   <location of Microsemi software>/bin/FPExpress.exe script:foo.tcl console_mode:brief
   logfile:foo.txt
   ```

   If you leave console_mode unspecified or set it to 'hide' FlashPro Express executes without a console window. If you want to leave the console window open you can run the script with the console_mode parameter set to 'show', as in the following example:

   ```
   <location of Microsemi software>/bin/FPExpress.exe script:foo.tcl console_mode:show
   logfile:foo.txt
   ```

2. If you want to pass arguments to the Tcl script from the command line, then use the "SCRIPT_ARGS" variable as follows:

   ```
   <location of Microsemi software>/bin/FPExpress.exe SCRIPT:<filename> SCRIPT_ARGS:"param1
   param2 param3"
   ```

   Arguments passed to a Tcl script can be accessed through the Tcl variables *argc* and *argv*. The example below demonstrates how a Tcl script accesses these arguments:

   ```
   puts "Script name: $argv0"
   puts "Number of arguments: $argc"
   set i 0
   foreach arg $argv {
      puts "Arg $i : $arg"
      incr i
   }
   ```

   Note: Script names can contain spaces if the script name is protected with double quotes:

   ```
   FPExpress script:"FPExpress tcl/foo 1.tcl"
   ```

Exporting Tcl Scripts from within FlashPro Express

To export a set of Tcl commands from the FlashPro Express history:

1. From the **File** menu, choose **Export Script File**.
2. Enter the filename and click **Save**. The Export Script Options dialog appears (as shown in the figure below).
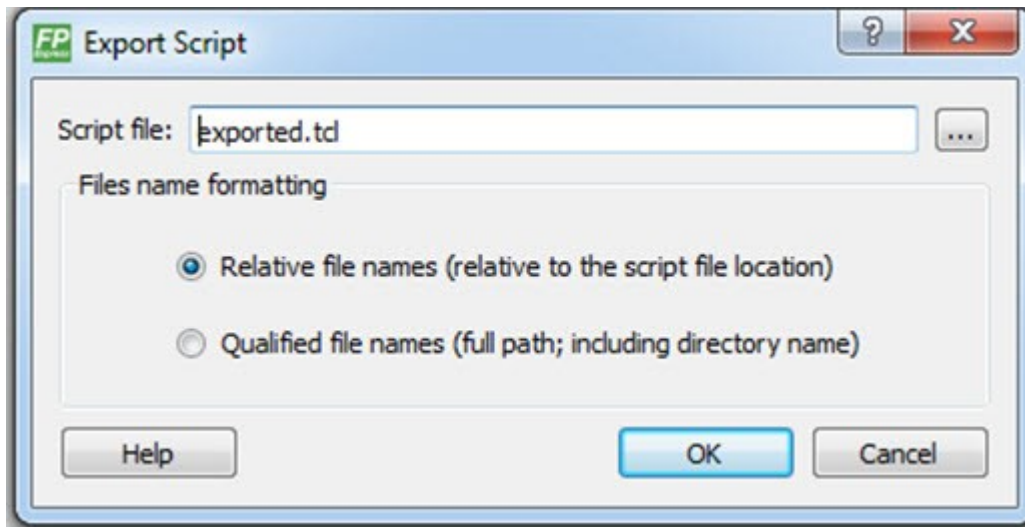
Figure 18 · Script Export Options Dialog Box

Check the **Include commands from current project only** to export commands of the current project only. You can specify the filename formatting by selecting **Relative filenames** (relative to the current directory) or **Qualified filenames** (absolute path, including the directory name).

4. Click **OK**.

Troubleshooting

Exit Codes (PolarFire)

Error Code	Exit Message	Exit Code	Possible Cause	Possible Solution
	Passed (no error)	0	-	-
0x8002	Failed to disable programming mode Failed to set programming mode	5	Unstable voltage level Signal integrity issues on JTAG pins	Monitor related power supplies that cause the issue during programming; check for transients outside of Microsemi specifications. See your device datasheet for more information on transient specifications. Monitor JTAG supply pins during programming; measure JTAG signals for noise or reflection.
0x8032	Device is busy	5	Unstable VDDIx voltage level	Monitor related power supplies that cause the issue during programming; check for transients outside of Microsemi specifications. See your device datasheet for more information on transient specifications.
0x8003	Failed to enter programming mode	5	Unstable voltage level Signal integrity issues on JTAG pins DEVRST_N is tied to LOW	Monitor related power supplies that cause the issue during programming; check for transients outside of Microsemi specifications. See your device datasheet for more information on transient specifications. Monitor JTAG supply pins during programming; measure JTAG signals for noise or reflection. Tie DEVRST_N to HIGH prior to programming the device.
0x8004	Failed to verify IDCODE	6	Incorrect programming file Incorrect device in chain Signal integrity issues on JTAG pins	Choose the correct programming file and select the correct device in the chain. Measure JTAG pins and noise for reflection. If TRST is left floating then add pull-up to pin. Reduce the length of Ground connection.
0x8005 0x8006 0x8007 0x8008	Failed to verify FPGA Array Failed to verify Fabric Configuration Failed to verify Security	11	Device is programmed with a different design or the component is blank. Unstable voltage level. Signal integrity issues on JTAG pins.	Verify the device is programmed with the correct data/design. Monitor related power supplies that cause the issue during programming; check for transients outside of Microsemi specifications. See your device datasheet for more information on transient specifications.

Error Code	Exit Message	Exit Code	Possible Cause	Possible Solution
	Failed to verify sNVM			Monitor JTAG supply pins during programming; measure JTAG signals for noise or reflection.
0x8013	External digest check via JTAG/SPI Slave is disabled.	-18	External Digest check via JTAG/SPI Slave is disabled.	Need to use a bitstream file which has a valid FlashLock/UPK1 to enable external digest check via JTAG/SPI Slave.
0x8015	FPGA Fabric digest verification: FAIL

Deselect procedure 'DO_ENABLE_FABRIC' to remove this digest check. | -20 | FPGA Fabric is either erased or the data has been corrupted or tampered with | If the Fabric is erased, deselect procedure "DO_ENABLE_FABRIC" from action "VERIFY_DIGEST" |
| 0x8016 | sNVM digest verification: FAIL

Deselect procedure 'DO_ENABLE_SNVM' to remove this digest check. | -20 | sNVM is either erased or the data has been corrupted or tampered with | If the sNVM is erased, deselect procedure "DO_ENABLE_SNVM" from action "VERIFY_DIGEST" |
| 0x8018 | User security policices segment digest verification: FAIL

Deselect procedure 'DO_ENABLE_SECURITY' to remove this digest check. | -20 | Security segment is either erased or the data has been corrupted or tampered with | If the security is erased, deselect procedure "DO_ENABLE_SECURITY" from action "VERIFY_DIGEST" |
| 0x8019 | UPK1 segment digest verification: FAIL

Deselect procedure 'DO_ENABLE_SECURITY' to remove this digest check. | -20 | UPK1 segment is either erased or the data has been corrupted or tampered with | If the UPK1 is erased, deselect procedure "DO_ENABLE_SECURITY" from action "VERIFY_DIGEST" |
| 0x801A | UPK2 segment digest verification: FAIL

Deselect procedure 'DO_ENABLE_UKS2' to remove this digest check. | -20 | UPK2 segment is either erased or the data has been corrupted or tampered with | If the UPK2 is erased, deselect procedure "DO_ENABLE_UKS2" from action "VERIFY_DIGEST" |
| 0x801B | Factory row and factory key segment digest verification: FAIL | -20 | Factory row and factory key segment have been erased through zeroization or the data has been corrupted or tampered with | |

Error Code	Exit Message	Exit Code	Possible Cause	Possible Solution
0x801C	Fabric configuration segment digest verification: FAIL Deselect procedure 'DO_ENABLE_FABRIC' to remove this digest check.	-20	Fabric configuration segment is either erased or has been corrupted or tampered with	If the Fabric configuration is erased, deselect procedure "DO_ENABLE_FABRIC" from action "VERIFY_DIGEST"
0x8052	UEK1 segment digest verification: FAIL Deselect procedure 'DO_ENABLE_UEK1' to remove this digest check.	-20	UEK1 segment is either erased or the data has been corrupted or tampered with	If the UEK1 is erased, deselect procedure "DO_ENABLE_UEK1" from action "VERIFY_DIGEST"
0x8053	UEK2 segment digest verification: FAIL Deselect procedure 'DO_ENABLE_UEK2' to remove this digest check.	-20	UEK2 segment is either erased or the data has been corrupted or tampered with	If the UEK2 is erased, deselect procedure "DO_ENABLE_UEK2" from action "VERIFY_DIGEST"
0x8054	DPK segment digest verification: FAIL Deselect procedure 'DO_ENABLE_DPK' to remove this digest check.	-20	DPK segment is either erased or the data has been corrupted or tampered with	If the DPK is erased, deselect procedure "DO_ENABLE_DPK" from action "VERIFY_DIGEST"
0x8057	SMK segment digest verification: FAIL	-20	SMK segment is either erased or the data has been corrupted or tampered with	If the SMK is erased, deselect procedure "DO_ENABLE_SMK" from action "VERIFY_DIGEST"
0x8058	User Public Key segment digest verification: FAIL	-20	User Public Key segment is either erased or the data has been corrupted or tampered with	If the User Public Key is erased, deselect procedure "DO_ENABLE_USER_PUBLIC_KEY" from action "VERIFY_DIGEST"
0x801D	Device security prevented operation	-21	The device is protected with user pass key 1 and the bitstream file does not contain user pass key 1. User pass key 1 in the bitstream file does not match the device.	Run DEVICE_INFO to view security features that are protected. Provide a bitstream file with a user pass key 1 that matches the user pass key 1 programmed into the device.
0x801F	Programming Error.	-22	Bitstream file has been corrupted or was incorrectly generated.	Regenerate bitstream file Monitor related power supplies that cause the

Error Code	Exit Message	Exit Code	Possible Cause	Possible Solution
	Bitstream or data is corrupted or noisy		Unstable voltage level. Signal integrity issues on JTAG pins.	issue during programming; check for transients outside of Microsemi specifications. See your device datasheet for more information on transient specifications. Monitor JTAG supply pins during programming; measure JTAG signals for noise or reflection.
0x8021	Programming Error. Invalid/Corrupted encryption key	-23	File contains an encrypted key that does not match the device File contains user encryption key, but device has not been programmed with the user encryption key	Provide a programming file with an encryption key that matches that on the device First program security with master programming file, then program with user encryption 1/2 field update programming files
0x8023	Programming Error. Back level not satisfied	-24	Design version is not higher than the back-level programmed device	Generate a programming file with a design version higher than the back level version
0x8001	Failure to read DSN	-24	Device is in System Controller Suspend Mode Check board connections	TRSTB should be driven High or disable "System Controller Suspend Mode".
0x8027	Programming Error. Insufficient device capabilities	-26	Device does not support the capabilities specified in programming file	Generate a programming file with the correct capabilities for the target device
0x8029	Programming Error. Incorrect DEVICEID	-27	Incorrect programming file Incorrect device in chain Signal integrity issues on JTAG pins	Choose the correct programming file and select the correct device in chain Measure JTAG pins and noise or reflection. If TRST is left floating, then add pull-up to pin Reduce the length of ground connection
0x802B	Programming Error. Programming file is out of date, please regenerate.	-28	Programming file version is out of date	Generate programming file with latest version of Libero SoC
0x8030	Programming Error Invalid or inaccessible Device Certificate	-31	FAB_RESET_N is tied to ground	FAB_RESET_N should be tied to HIGH
0x8032 0x8034 0x8036 0x8038	Instruction timed out	-32	Unstable voltage level Signal integrity issues on JTAG pins	Monitor related power supplies that cause the issue during programming; check for transients outside of Microsemi specifications. See your device datasheet for more information on transient specifications.

Error Code	Exit Message	Exit Code	Possible Cause	Possible Solution
				Monitor JTAG supply pins during programming; measure JTAG signals for noise or reflection.
0x8010	Failed to unlock user pass key 1	-35	Pass key in file does not match device	Provide a programming file with a pass key that matches pass key programmed into the device.
0x8011	Failed to unlock user pass key 2	-35	Pass key in file does not match device	Provide a programming file with a pass key that matches pass key programmed into the device.
0x804F	Bitstream programming action is disabled	-38	Unstable voltage level Bitstream programming action has been disabled in Security Policy Manager	Monitor related power supplies that cause the issue during programming; check for transients outside of Microsemi specifications. See your device datasheet for more information on transient specifications. Need to use a bitsream file which has a valid FlashLock/UPK1 to enable the bitstream programming action.
0x805B	Error, security must be either programmed on a blank device or with the FPGA Fabric design	-42	Security only bitstream programming on a programmed device	Use this bitstream on a blank device or generate a new bitstream that contains the FPGA Fabric design along with the security

Exit Codes (RTG4)

Error Code	Exit Message	Possible Cause	Possible Solution
	Passed (no error)	-	-
0x8001	Failure to read DSN	Device is in System Controller Suspend Mode Check board connections	TRSTB should be driven High on device power up. Disable System Controller Suspend Mode in "Programming Bitstream Settings' tool within Libero and reprogram the device.
0x8002	Device is busy	Unstable VDDIx voltage level	Monitor related power supplies that cause the issue during programming; check for transients outside of Microsemi specifications. See your device datasheet for more information on transient specifications.
0x8003	Failed to enter programming mode	Unstable voltage level Signal integrity issues on	Monitor related power supplies that cause the issue during programming; check for transients

Error Code	Exit Message	Possible Cause	Possible Solution
	JTAG pins DEVRST_N is tied to LOW		outside of Microsemi specifications. See your device datasheet for more information on transient specifications. Monitor JTAG supply pins during programming; measure JTAG signals for noise or reflection. Tie DEVRST_N to HIGH prior to programming the device
0x8004	Failed to verify IDCODE	Incorrect programming file Incorrect device in chain Signal integrity issues on JTAG pins	Choose the correct programming file and select the correct device in the chain. Measure JTAG pins and noise for reflection. If TRST is left floating then add pull-up to pin. Reduce the length of Ground connection.
0x8005	Failed to verify IDCODE RT4G150_ES STAPL file is not compatible with RT4G150 production devices. You must use a STAPL file for RT4G150 device.	Programming file is for RT4G150_ES and device is RT4G150 Incorrect programming file Incorrect device in chain Signal integrity issues on JTAG pins	Generate a programming file for RT4G150 device Choose the correct programming file and select the correct device in the chain. Measure JTAG pins and noise for reflection. If TRST is left floating then add pull-up to pin. Reduce the length of Ground connection.
0x8006	Failed to verify IDCODE RT4G150 STAPL file is not compatible with RT4G150_ES devices. You must use a STAPL file for RT4G150_ES device.	Programming file is for RT4G150 and device is RT4G150_ES Incorrect programming file Incorrect device in chain Signal integrity issues on JTAG pins	Generate a programming file for RT4G150_ES device Choose the correct programming file and select the correct device in the chain. Measure JTAG pins and noise for reflection. If TRST is left floating then add pull-up to pin. Reduce the length of Ground connection.
0x8007	Failed to verify FPGA Array	Device is programmed with a different design or the component is blank. Unstable voltage level. Signal integrity issues on JTAG pins.	Verify the device is programmed with the correct data/design. Monitor related power supplies that cause the issue during programming; check for transients outside of Microsemi specifications. See your device

Error Code	Exit Message	Possible Cause	Possible Solution
			datasheet for more information on transient specifications. Monitor JTAG supply pins during programming; measure JTAG signals for noise or reflection.
0x8008	Device is blank	Attempting to verify digest of a blank device	Program the device prior to running action "VERIFY_DIGEST"
0x8009	FPGA array digest check is disabled	Digest check has been disabled by "Programming Bitstream Settings" tool within Libero	Drive TRSTB high during device power up. Enable digest check in "Programming Bitstream Settings" tool within Libero and reprogram the device.
0x800A	Failed to verify digest: Instruction timed out	Unstable voltage level Signal integrity issues on JTAG pins	Try running VERIFY_DIGEST action again. Monitor related power supplies that cause the issue during programming; check for transients outside of Microsemi specifications. See your device datasheet for more information on transient specifications. Monitor JTAG supply pins during programming; measure JTAG signals for noise or reflection.
0x800B	FPGA Fabric digest verification: FAIL	Programming bitstream components do not match components programmed FPGA Fabric is either erased or the data has been corrupted or tampered with	Use the same programming file that was used to program the device.
0x800C	Factory row segment digest verification: FAIL	Programming bitstream components do not match components programmed Factory row segment data has been corrupted or tampered with	Use the same programming file that was used to program the device.
0x800D	Bitstream Error. Bitstream or data is corrupted or noisy.	Bitstream file has been corrupted Bitstream was incorrectly generated Unstable voltage level Signal integrity issues on JTAG pins	Regenerate bitstream file Monitor related power supplies that cause the issue during programming; check for transients outside of Microsemi specifications. See your device datasheet for more information on transient specifications.

Error Code	Exit Message	Possible Cause	Possible Solution
			Monitor JTAG supply pins during programming; measure JTAG signals for noise or reflection.
0x800E	Failed to query programming bitstream settings: Instruction timed out	Unstable voltage level Signal integrity issues on JTAG pins	Try running DEVICE_INFO action again. Monitor related power supplies that cause the issue during programming; check for transients outside of Microsemi specifications. See your device datasheet for more information on transient specifications. Monitor JTAG supply pins during programming; measure JTAG signals for noise or reflection.
0x800F	Bitstream Error. Incorrect DEVICEID	Incorrect programming file Incorrect device in chain Signal integrity issues on JTAG pins	Choose the correct programming file and select the correct device in the chain. Measure JTAG pins and noise for reflection. If TRST is left floating then add pull-up to pin. Reduce the length of Ground connection.
0x8010	Operation has been disabled by programming bitstream settings	Operation has been disabled by "Programming Bitstream Settings" tool within Libero User disabled Fabric Erase/Write/Verify and attempted to Erase/Program/Verify the device	Drive TRSTB high during device power up Enable the disabled operation in the "Programming Bitstream Settings" tool with Libero and reprogram the device
0x8011	Failed to check bitstream: Instruction timed out	Unstable voltage level Signal integrity issues on JTAG pins	Monitor related power supplies that cause the issue during programming; check for transients outside of Microsemi specifications. See your device datasheet for more information on transient specifications. Monitor JTAG supply pins during programming; measure JTAG signals for noise or reflection.
0x8012, 0x8013	Failed to erase device: Instruction timed out	Unstable voltage level Signal integrity issues on JTAG pins	Monitor related power supplies that cause the issue during programming; check for transients outside of Microsemi specifications. See your device

Error Code	Exit Message	Possible Cause	Possible Solution
			datasheet for more information on transient specifications. Monitor JTAG supply pins during programming; measure JTAG signals for noise or reflection.
0x8014	Failed to program device: Instruction timed out	Unstable voltage level Signal integrity issues on JTAG pins	Monitor related power supplies that cause the issue during programming; check for transients outside of Microsemi specifications. See your device datasheet for more information on transient specifications. Monitor JTAG supply pins during programming; measure JTAG signals for noise or reflection.
0x8015	Error, device is not ready.	DEVRST_N may have been driven LOW during programming	Need to ensure that DEVRST_N is driven HIGH during programming. The reliability of the device in space cannot be guaranteed if this has occurred. It is the user's responsibility to ensure that DEVRST_N is driven HIGH during programming.

Exit Codes (SmartFusion2 and IGLOO2)

Error Code	Exit Code	Exit Message	Possible Cause	Possible Solution
	0	Passed (no error)	-	-
0x8002	5	Failure to configure device programming at 1.2/1.0 VCC voltage	Unstable voltage level Signal integrity issues on JTAG pins	Monitor related power supplies that cause the issue during programming; check for transients outside of Microsemi specifications. See your device datasheet for more information on transient specifications. Monitor JTAG supply pins during programming; measure JTAG signals for noise or reflection.
0x8032	5	Device is busy	Unstable VDDIx voltage level	Monitor related power supplies that cause the issue during programming; check for transients outside of Microsemi specifications. See your device datasheet for more information on transient specifications.

Error Code	Exit Code	Exit Message	Possible Cause	Possible Solution
0x8003	5	Failed to enter programming mode	Unstable voltage level Signal integrity issues on JTAG pins DEVRST_N is tied to LOW	Monitor related power supplies that cause the issue during programming; check for transients outside of Microsemi specifications. See your device datasheet for more information on transient specifications. Monitor JTAG supply pins during programming; measure JTAG signals for noise or reflection. Tie DEVRST_N to HIGH prior to programming the device.
0x8004	6	Failed to verify IDCODE	Incorrect programming file Incorrect device in chain Signal integrity issues on JTAG pins	Choose the correct programming file and select the correct device in the chain. Measure JTAG pins and noise for reflection. If TRST is left floating then add pull-up to pin. Reduce the length of Ground connection.
0x8005 0x8006 8x804A	10	Failed to program eNVM	Unstable voltage level. Signal integrity issues on JTAG pins.	Monitor related power supplies that cause the issue during programming; check for transients outside of Microsemi specifications. See your device datasheet for more information on transient specifications. Monitor JTAG supply pins during programming; measure JTAG signals for noise or reflection.
0x8027 0x8028	10	Authentication Error Bitstream and device mismatch	Libero device selection does not match the target device.	Generate a programming file with the correct device selection for the target device.
0x8007 0x804C	11	Failed to verify FPGA Array Failed to verify Fabric Configuration Failed to verify Security	Device is programmed with a different design or the component is blank. Unstable voltage level. Signal integrity issues on JTAG pins.	Verify the device is programmed with the correct data/design. Monitor related power supplies that cause the issue during programming; check for transients outside of Microsemi specifications. See your device datasheet for more information on transient specifications. Monitor JTAG supply pins during programming; measure JTAG signals for noise or reflection.

Error Code	Exit Code	Exit Message	Possible Cause	Possible Solution
0x8008 0x8009 0x8049	11	Failed to verify eNVM	Device is programmed with a different design. Unstable voltage level. Signal integrity issues on JTAG pins.	Verify the device is programmed with the correct data/design. Monitor related power supplies that cause the issue during programming; check for transients outside of Microsemi specifications. See your device datasheet for more information on transient specifications. Monitor JTAG supply pins during programming; measure JTAG signals for noise or reflection.
0x8013	-18	Digest request from SPI/JTAG is protected by User Pass Key 1	Digest request from SPI/JTAG is protected by user pass key 1. Lock bit has been configured in the Debug Policy within SPM (Security Policy Manager)	Provide a programming file with a pass key that matches pass key programmed into the device.
0x8014	-19	Failed to verify digest	>Unstable voltage level Signal integrity issues on JTAG pins	Monitor related power supplies that cause the issue during programming; check for transients outside of Microsemi specifications. See your device datasheet for more information on transient specifications. Monitor JTAG supply pins during programming; measure JTAG signals for noise or reflection.
0x8015	-20	FPGA Fabric digest verification: FAIL	Programming bitstream components do not match components programmed FPGA Fabric is either erased or the data has been corrupted or tampered with	Use the same programming file that was used to program the device.
0x8016	-20	eNVM_0 digest verification: FAIL	Programming bitstream components do not match components programmed eNVM_0 data has been corrupted or tampered with	Use the same programming file that was used to program the device.
0x8017	-20	eNVM_1 digest verification: FAIL	Programming bitstream components do not match components programmed eNVM_1 data has been corrupted or tampered with	Use the same programming file that was used to program the device.

Error Code	Exit Code	Exit Message	Possible Cause	Possible Solution
0x8018	-20	User security policies segment digest verification: FAIL	Programming bitstream components do not match components programmed User security policy segment data has been corrupted or tampered with	Use the same programming file that was used to program the device.
0x8019	-20	User key set 1 segment digest verification: FAIL	Programming bitstream components do not match components programmed User key set 1 segment data has been corrupted or tampered with	Use the same programming file that was used to program the device.
0x801A	-20	User key set 2 segment digest verification: FAIL	Programming bitstream components do not match components programmed User key set 2 segment data has been corrupted or tampered with	Use the same programming file that was used to program the device.
0x801B	-20	Factory row and factory key segment digest verification: FAIL	Programming bitstream components do not match components programmed Factory row and factory key segment data has been corrupted or tampered with	Use the same programming file that was used to program the device.
0x801C	-20	Fabric configuration segment digest verification: FAIL	Programming bitstream components do not match components programmed. Fabric configuration segment data has been corrupted or tampered with	Use the same programming file that was used to program the device.
0x801D 0x801E 0x804B	-21	Device security prevented operation	The device is protected with user pass key 1 and the bitstream file does not contain user pass key 1. User pass key 1 in the bitstream file does not match the device.	Run DEVICE_INFO to view security features that are protected. Provide a bitstream file with a user pass key 1 that matches the user pass key 1 programmed into the device.
0x801F 0x8020 0x8040	-22	Authentication Error Bitstream or data is corrupted or noisy	eNVM has been locked by a master in your design Running VERIFY action on a blank device.	Release the lock on the eNVM after your master has completed its access operations. Write 0x00 to "REQACCESS" register in eNVM Control Registers (address 0x600801FC) to release the

Error Code	Exit Code	Exit Message	Possible Cause	Possible Solution
			Bitstream file has been corrupted Bitstream was incorrectly generated	access. Program the device prior to running VERIFY action Regenerate bitstream file.
0x8021 0x8022	-23	Authentication Error Invalid/Corrupted encryption key	File contains an encrypted key that does not match the device Attempting to erase a device with no security using master security file File contains user encryption key, but device has not been programmed with the user encryption key Device has user encryption key 1/2 enforced and you are attempting to reprogram security settings	Provide a programming file with an encryption key that matches that on the device. Run DEVICE_INFO action to verify that the device has no security. If the device does not have secuirty, you cannot erase it. First program security with master programming file, then program with user encryption 1/2 field update programming files. You must first ERASE security with the master security file, then you can reprogram new security settings.
0x8041	-23	Authentication Error Invalid/Corrupted encryption key	File contains an encrypted key that does not match the device File contains user encryption key, but device has not been programmed with the user encryption key Attempting to erase a device with no security using master security file Device has user encryption key 1/2 enforced and you are attempting to reprogram security settings	Provide a programming file with an encryption key that matches that on the device. Run DEVICE_INFO action to verify that the device has no security. If the device does not have secuirty, you cannot erase it. First program security with master programming file, then program with user encryption 1/2 field update programming files. You must first ERASE security with the master security file, then you can reprogram new security settings.
0x8023 0x8024 0x8042	-24	Authentication Error Back level not satisfied	Design version is not higher than the back-level programmed device	Generate a programming file with a design version higher than the back level version.
0x8001	-24	Failure to read DSN	Device is in System Controller Suspend Mode Check board connections	TRSTB should be driven High or disable "System Controller Suspend Mode".
0x8025 0x8026 0x8043	-25	Authentication Error DSN binding mismatch	DSN specified in programming file does not match the device being programmed	Use the correct programming file with a DSN that matches the DSN of the target device being programmed.

Error Code	Exit Code	Exit Message	Possible Cause	Possible Solution
0x8044	-26	Authentication Error Insufficient device capabilities	Device does not support the capabilities specified in programming file	Generate a programming file with the correct capabilities for the target device.
0x8027 0x8028	-26	Authentication Error Bitstream and device mismatch	Libero device selection does not match the target device	Generate a programming file with the correct device selection for the target device.
0x8029 0x802A 0x8045	-27	Authentication Error Incorrect DEVICEID	Incorrect programming file Incorrect device in chain Signal integrity issues on JTAG pins	Choose the correct programming file and select the correct device in chain. Measure JTAG pins and noise or reflection. If TRST is left floating, then add pull-up to pin. Reduce the length of ground connection.
0x802B 0x802C	-28	Authentication Error Programming file is out of date, please regenerate	Programming file version is out of date	Generate programming file with latest version of Libero SoC.
0x8046	-28	>Authentication Error Unsupported bitstream protocol version	Old programming file	Generate programming file with latest version of Libero SoC.
0x802F	-30	JTAG interface is protected by UPK1	Invalid or no UPK1 is provided	User needs to provide correct UPK1 to unlock device.
0x8030 0x8031 0x8048	-31	Authentication Error Invalid or inaccessible Device Certificate	M2S090 Rev. A or M2S150 Rev. A: Either certificate is corrupted or the user hasn't provided the application code in the eNVM or provided invalid application code FAB_RESET_N is tied to ground	User can program a valid application code. This can be done with SoftConsole. FAB_RESET_N should be tied to HIGH.
0x8032 0x8033 0x8034 0x8035 0x8036 0x8037 0x8038 0x8039	-32	Instruction timed out	Unstable voltage level Signal integrity issues on JTAG pins	Monitor related power supplies that cause the issue during programming; check for transients outside of Microsemi specifications. See your device datasheet for more information on transient specifications. Monitor JTAG supply pins during

Error Code	Exit Code	Exit Message	Possible Cause	Possible Solution
				programming; measure JTAG signals for noise or reflection.
0x8010	-35	Failed to unlock User Pass Key 1	Pass key in file does not match device. Plaintext pass key match is disabled. This occurs if HSM was used to program the device.	Provide a programming file with a pass key that matches pass key programmed into the device. Match pass key using HSM.
0x8011	-35	Failed to unlock User Pass Key 2	Pass key in file does not match device. Plaintext pass key match is disabled. This occurs if HSM was used to program the device.	Provide a programming file with a pass key that matches pass key programmed into the device. Match pass key using HSM.
0x8012	-35	Failed to unlock debug pass key	Pass key in file does not match device. Plaintext pass key match is disabled. This occurs if HSM was used to program the device.	Provide a programming file with a pass key that matches pass key programmed into the device. Match pass key using HSM.
0x804D	-36	<HSM related error message based on scenario>	HSM communication error. HSM call returns error.	Check if HSM the communication path to HSM is up. Make sure project is loaded properly and that HSM tickets have not been cleaned.
0x804E	-37	Device already has Security programmed. Please erase the device using master file before reprogramming Security Settings.	HSM flow does not support reprogramming device directly if Security has already been programmed.	Erase security and try programming the device.

SmartDebug

Microsemi's SmartDebug tool complements design simulation by allowing verification and troubleshooting at the hardware level.

For detailed information about SmartDebug for SmartFusion2, IGLOO2, and RTG4, refer to the SmartDebug User Guide (SmartFusion2, IGLOO2, RTG4).

For detailed information about SmartDebug for PolarFire, refer to the SmartDebug User Guide (PolarFire).

Electrical Parameters

DC Characteristics for FlashPro6

Table 2 · DC Characteristic for FlashPro6

Parameter	Test Condition	VJTAG Voltage Range	Min	Typ	Max	Unit
V_{IH} High-level input voltage		1.20V - 1.95V	VJTAG_VSPI x 0.65			V
		1.95V - 2.70V	1.6			V
		2.70V - 3.60V	2			V
V_{IL} Low-level input voltage		1.20V - 1.95V			VJTAG_VSPIx0.35	V
		1.95V - 2.70V			0.7	V
		2.70V - 3.60V			0.8	V
V_{OH}	$I_{OH} = -100\mu A$	1.2 V to 3.6 V	VJTAG_VSPI - 0.2			V
	$I_{OH} = -3mA$	1.2V				V
	$I_{OH} = -6mA$	1.4V	1.05			V
	$I_{OH} = -8mA$	1.65V	1.2	0.95		V
	$I_{OH} = -9mA$	2.3V	1.75			V
	$I_{OH} = -12mA$	3V	2.3			V
V_{OL}	$I_{OH} = -100\mu A$	1.2 V to 3.6 V				V
	$I_{OH} = -3mA$	1.2V		0.25		V
	$I_{OH} = -6mA$	1.4V				V
	$I_{OH} = -8mA$	1.65V				V
	$I_{OH} = -9mA$	2.3V				V
	$I_{OH} = -12mA$	3V				V
I_{OH} High-level output current		1.1 V to 1.2 V			-3	mA
		1.4 V to 1.6 V			-6	mA
		1.65V to 1.95V			-8	mA
		2.3 V to 2.7 V			-9	mA
		3 V to 3.6 V			-12	mA
		1.1 V to 1.2 V			3	mA
		1.4 V to 1.6 V			6	mA

I_OL Low-level output current		1.65V to 1.95V			8	mA
		2.3 V to 2.7 V			9	mA
		3 V to 3.6 V			12	mA

DC Characteristics for FlashPro5/4/3/3X

Note: The target board must provide the VCC, VCCI, VPUMP, and VJTAG during programming.

Note: The VJTAG signal is driven from the target/DUT board. The VJTAG pin is sensed by the FP4 to configure the internal input and output buffers to the same IO Voltage levels. The VJTAG pin is only an input pin to the programmer.

Table 3 · DC Characteristic for FlashPro5/4/3/3X

Description	Symbol	Min	Max	Unit
Input low voltage, TDO	VIL	-0.5	0.35*VJTAG	V
Input high voltage, TDO	VIH	0.65*VJTAG	3.6	V
Input current, TDO	IIL, IIH	-20	+20	mA
Input capacitance, TDO			40	pF
Output voltage, VPUMP, operating	VPP	+3.0	+3.6	V
Output current, VPUMP	IPP		250	mA
VJTAG = 1.5V				
Output low voltage, TCK, TMS, TDI, 100µA load	VOL	0.0	0.2	V
Output low voltage, TCK, TMS, TDI, 4mA load	VOL	0.0	0.30*VJTAG	V
Output high voltage, TCK, TMS, TDI, 100µA load	V	VJTAG-0.2	VJTAG	V
Output high voltage, TCK, TMS, TDI, 4mA load	VOH	0.70*VJTAG	VJTAG	V
Output current, TCK, TMS, TDI	IOL, IOH	-4	+4	mA
VJTAG = 1.8V				
Output low voltage, TCK, TMS, TDI, 100µA load	VOL	0.0	0.2	V
Output low voltage, TCK, TMS, TDI, 6mA load	VOL	0.0	0.3	V
Output high voltage, TCK, TMS, TDI, 100µA load	VOH	VJTAG-0.2	VJTAG	V
Output high voltage, TCK, TMS, TDI, 6mA load	VOH	1.25	VJTAG	V
Output current, TCK, TMS, TDI	IOL, IOH	-6	+6	mA
VJTAG = 2.5V				
Output low voltage, TCK, TMS, TDI, 100µA load	VOL	0.0	0.2	V

Description	Symbol	Min	Max	Unit
Output low voltage, TCK, TMS, TDI, 8mA load	VOL	0.0	0.6	V
Output high voltage, TCK, TMS, TDI, 100µA load	VOH	VJTAG-0.2	VJTAG	V
Output high voltage, TCK, TMS, TDI, 8mA load	VOH	1.8	VJTAG	V
Output current, TCK, TMS, TDI	IOL, IOH	-8	+8	mA
VJTAG = 3.3V				
Output low voltage, TCK, TMS, TDI, 100µA load	VOL	0.0	0.2	V
Output low voltage, TCK, TMS, TDI, 8mA load	VOL	0.0	0.4	V
Output high voltage, TCK, TMS, TDI, 100µA load	VOH	VJTAG-0.2	VJTAG	V
Output high voltage, TCK, TMS, TDI, 8mA load	VOH	2.4	VJTAG	V
Output current, TCK, TMS, TDI	IOL, IOH	-8	+8	mA

Electrical Specifications

FlashPro6

The FlashPro6 is a JTAG-based programmer for flash based Microsemi devices.

The FlashPro6 output is supplied via a connector to which a detachable 10-pin cable is fitted. The connector on the FlashPro6 unit is a 2x5, RA male Header connector, which is manufactured by 3M and has a manufacturer's part number of N2510-5002-RB. This is a standard 2x5, 0.1 pitch connector which is keyed. Use the 10 pin right-angle header, 3M P/N N2510-5002-RB (DigiKey P/N MHE10K-ND) for FlashPro6 and use the 10 pin straight header,

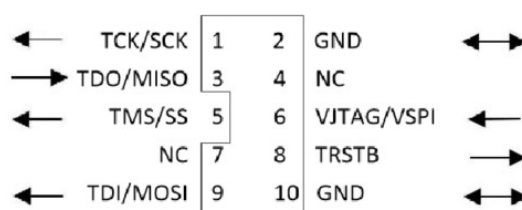The signals on the pins of the FlashPro6 10-pin connector are shown in the figure below.

Figure 19 · FlashPro6 10-Pin Connector

Note: All ground pins must be connected. The rectangular shape shows connections on the programmer itself. Arrows show current flow towards or from the rectangular programmer.

The table below shows a description of the signals.

Table 4 · FlashPro6 Signal Description

Signal	Description
GND	Signal reference
TCK/SCK	JTAG clock; SPI clock
TDI/SDI	JTAG data input to device; SPI MOSI
TDO/SDO	JTAG data output from device; SPI MISO
TMS/SS#	JTAG mode select; SPI Chip Select
nTRST	Programmable output pin may be set to off, toggle, low, or high level
VJTAG	Reference voltage from the target board

Some designers of high-integrity boards (military and avionic) may arrange their boards so that TRST is tied to ground via a weak pull-down resistor. The purpose of this is to hold the JTAG state-machine in a reset state by default, so that even with TCK oscillating, some sudden ion bombardment or other electrical even will not suddenly throw the JTAG state-machine into an unknown state. If your design also uses a weak pull-down resistor on TRST on your board, then enabling the "Drive TRST" flag will be required to force the JTAG state-machine out of reset to permit programming to take place. With most boards, there is no need to select this flag.

FlashPro5

The FlashPro5 is a JTAG and a SPI based programmer for flash based Microsemi devices.

The FlashPro5 output is supplied via a connector to which a detachable 10-pin cable is fitted. The connector on the FlashPro5 unit is a 2x5, RA male Header connector, which is manufactured by AMP and has a manufacturer's part number of 103310-1. This is a standard 2x5, 0.1 pitch connector which is keyed. Use the 10 pin right-angle header, AMP P/N 103310-1 (DigiKey P/N A26285-ND) for FlashPro4 and use the 10 pin straight header, AMP P/N 103308-1 (DigiKey P/N A26267-ND) for the straight version.

The signals on the pins of the FlashPro5 10-pin connector are shown in the figure below.
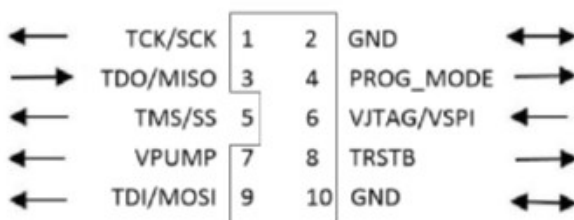

Figure 20 · FlashPro5 10-Pin Connector

Note: All ground pins must be connected. The rectangular shape shows connections on the programmer itself. Arrows show current flow towards or from the rectangular programmer.

The table below shows a description of the signals.

Table 5 · FlashPro5 Signal Description

Signal	Description
VPUMP	3.3V Programming voltage
GND	Signal reference
TCK/SCK	JTAG clock; SPI clock
TDI/SDI	JTAG data input to device; SPI MOSI
TDO/SDO	JTAG data output from device; SPI MISO
TMS/SS#	JTAG mode select; SPI Chip Select
nTRST	Programmable output pin may be set to off, toggle, low, or high level
VJTAG	Reference voltage from the target board
PROG_MODE	IGLOO v2 family - Used for switching from VCC 1.2V to 1.5V during programming

Some designers of high-integrity boards (military and avionic) may arrange their boards so that TRST is tied to ground via a weak pull-down resistor. The purpose of this is to hold the JTAG state-machine in a reset state by default, so that even with TCK oscillating, some sudden ion bombardment or other electrical even will not suddenly throw the JTAG state-machine into an unknown state. If your design also uses a weak pull-down resistor on TRST on your board, then enabling the "Drive TRST" flag will be required to force the JTAG state-machine out of reset to permit programming to take place. With most boards, there is no need to select this flag.

FlashPro4

The FlashPro4 output is supplied via a connector to which a detachable 10-pin cable is fitted. The connector on the FlashPro4 unit is a 2x5, RA male Header connector, which is manufactured by AMP and has a manufacturer's part number of 103310-1. This is a standard 2x5, 0.1 pitch connector which is keyed. Use the 10 pin right-angle header, AMP P/N 103310-1 (DigiKey P/N A26285-ND) for FlashPro4 and use the 10 pin straight header, AMP P/N 103308-1 (DigiKey P/N A26267-ND) for the straight version.

The signals on the pins of the FlashPro4 10-pin connector are shown in the figure below (extracted from FlashPro4 product specification):
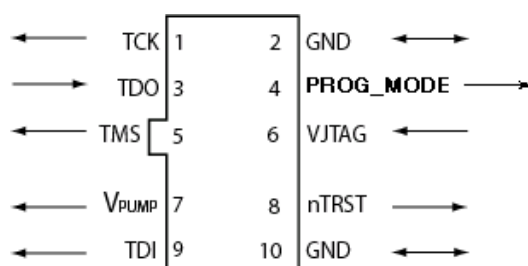

Figure 21 · FlashPro4 10-Pin Connector

Note: All ground pins must be connected. The rectangular shape shows connections on the programmer itself. Arrows show current flow towards or from the rectangular programmer.

The table below shows a description of the signals.

Table 6 · FlashPro4 Signal Description

Signal	Description
VPUMP	3.3V Programming voltage
GND	Signal reference
TCK	JTAG clock
TDI	JTAG data input to device
TDO	JTAG data output from device
TMS	JTAG mode select
nTRST	Programmable output pin may be set to off, toggle, low, or high level
VJTAG	Reference voltage from the target board
PROG_MODE	IGLOO v2 family - Used for switching from VCC 1.2V to 1.5V during programming

Some designers of high-integrity boards (military and avionic) may arrange their boards so that TRST is tied to ground via a weak pull-down resistor. The purpose of this is to hold the JTAG state-machine in a reset state by default, so that even with TCK oscillating, some sudden ion bombardment or other electrical even will not suddenly throw the JTAG state-machine into an unknown state. If your design also uses a weak pull-down resistor on TRST on your board, then enabling the "Drive TRST" flag will be required to force the JTAG state-machine out of reset to permit programming to take place. With most boards, there is no need to select this flag.

FlashPro3

The FlashPro3 output is supplied via a connector to which a detachable 10-pin cable is fitted. The connector on the FlashPro3 unit is a 2x5, RA male Header connector, which is manufactured by AMP and has a manufacturer's part number of 103310-1. This is a standard 2x5, 0.1 pitch connector which is keyed. Use the 10 pin right-angle header, AMP P/N 103310-1 (DigiKey P/N A26285-ND) for FlashPro5/4/3/3X and use the 10 pin straight header, AMP P/N 103308-1 (DigiKey P/N A26267-ND) for the straight version.

The signals on the pins of the FlashPro3 10-pin connector are shown in the figure below (extracted from FlashPro3 product specification):
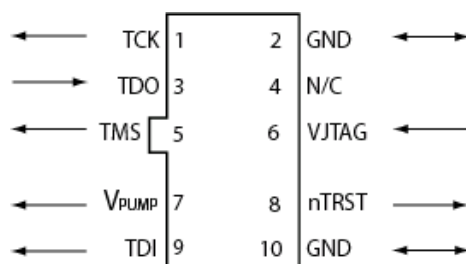

Figure 22 · FlashPro3 10-Pin Connector

Note: All ground pins must be connected. The rectangular shape shows connections on the programmer itself. Arrows show current flow towards or from the rectangular programmer.

The table below shows a description of the signals.

Table 7 · FlashPro3 Signal Description

Signal	Description
VPUMP	3.3V Programming voltage
GND	Signal reference
TCK	JTAG clock
TDI	JTAG data input to device
TDO	JTAG data output from device
TMS	JTAG mode select
nTRST	Programmable output pin may be set to off, toggle, low, or high level
VJTAG	Reference voltage from the target board
N/C	Programmer does not connect to this pin

Some designers of high-integrity boards (military and avionic) may arrange their boards so that TRST is tied to ground via a weak pull-down resistor. The purpose of this is to hold the JTAG state-machine in a reset state by default, so that even with TCK oscillating, some sudden ion bombardment or other electrical even will not suddenly throw the JTAG state-machine into an unknown state. If your design also uses a weak pull-down resistor on TRST on your board, then enabling the "Drive TRST" flag will be required to force the JTAG state-machine out of reset to permit programming to take place. With most boards, there is no need to select this flag.

JTAG Switching Characteristics

FlashPro6 Characteristics

Table 8 · JTAG Switching Characteristics for FlashPro6

Description	Symbol	Min	Max	Unit
Output Delay from TCK to TDI, TMS	TTCKTDI	2	2.2	ns
TDO setup time before TCK rising, VJTAG=3.3V	TTDOTCK	11.4	481	ns
TDO setup time before TCK rising, VJTAG=1.5V	TTDOTCK	10.5	487	ns
TDO Hold time after TCK rising	TTCKTDO	0	-	
TCK period	TTCK	49.4	-	ns

FlashPro5/4/3/3X Characteristics

Table 9 · JTAG Switching Characteristics for FlashPro5/4/3/3X

Description	Symbol	Min	Max	Unit
Output delay from TCK to TDI, TMS	TTCKTDI	-2	2	ns
TDO setup time before TCK rising, VJTAG=3.3	TTDOTCK	12		ns
TDO setup time before TCK rising, VJTAG=1.5	TTDOTCK	14.5		ns
TDO hold time after TCK rising	TTCKTDO	0		ns
TCK period	TTCK	41.7	10667	ns

Illustration of the JTAG Switching Characteristics

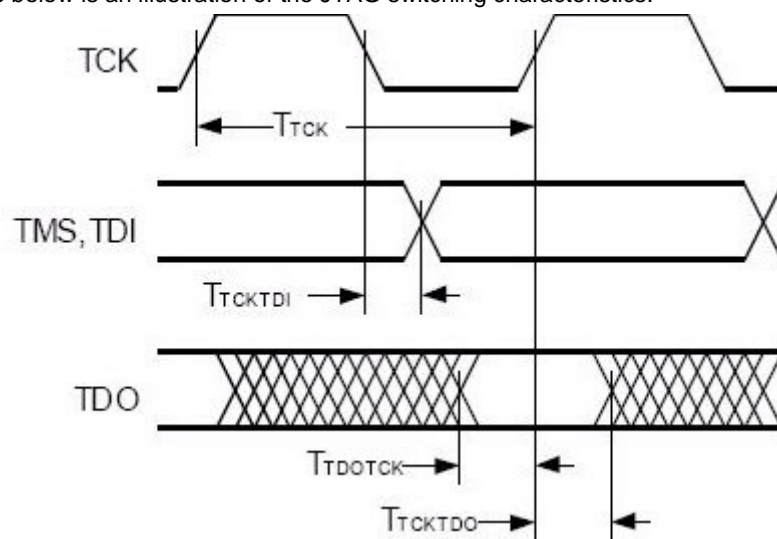The figure below is an illustration of the JTAG switching characteristics.

Figure 23 · JTAG Switching Characteristics

FlashPro Express Reference

FlashPro Express Start Page

The FlashPro Express Start Page is the first page to show when the tool starts up. This page provides the interface for loading a project into the tool by either navigating to the project location, or clicking on one of the recently opened projects.

FlashPro Express Project Menu

Command	Function
Create Job Project from Programming Job	New job project folder with programming job name will be created at the specified location.
Open Job Project	Loads a job project into the tool by reading the information in user specified .pro file.
Close Job Project	Closes the current job project
Save Job Project	Saves the current job project
Set Log File	Sets the location of the Log file to your specified location.
Export Log File	Exports the Log file to your specified location.
Execute Script	Runs your specified Tcl script.
Export Script File	Exports all commands run in this session to your specified path as a Tcl script
Exit	Exits FlashPro Express

FlashPro Express Edit Menu

Command	Function
Clear Log Window	Clears the Log window

FlashPro Express View Menu

The View menu shows or hides the FlashPro Express GUI elements.

Command	Function
Log Window	Shows/hides the Log window

FlashPro Express Tools Menu

Command	Function
Programmer Settings	Opens the Programmer Settings dialog box; enables you to set options for all types of supported Microsemi programmers
Run	Runs the current Programming Action.

FlashPro Express Help Menu

Command	Function
Help Topics	Opens the help
Microsemi Technical Support	Opens the Microsemi technical support site.
Microsemi Web Site	Opens the Microsemi website in your default browser
User Guide	Opens the FlashPro Express User Guide.
Check for Software Updates	Checks for software updates (works only if you are connected to the internet)
About FlashPro Express	Lists the FlashPro Express release information

FlashPro Express Log Window and Status Bar

FlashPro Express Log Window

The FlashPro Express log window shows status messages for user activity. Click on the appropriate tab (Messages, Errors, Warning, Info) to filter messages by type.

- Use the right-click menu to copy text, clear the log, and scroll the log.
- Use the def variable LOG_WINDOW_BUFFER_SIZE to set the buffer size.
- Use the View menu to show or hide the Log window.

FlashPro Express Status Bar

The Status Bar at the bottom displays the status of the load project action.

Contacting Microsemi

Microsemi SoC Products Group Headquarters

Microsemi Corporation is a supplier of innovative programmable logic solutions, including field-programmable gate arrays (FPGAs) based on antifuse and flash technologies, high-performance intellectual property (IP) cores, software development tools, and design services targeted for the high-speed communications, application-specific integrated circuit (ASIC) replacement, and radiation-tolerant markets.

Address:	Microsemi SoC Products Group 3870 North First Street San Jose, CA 95134
Phone:	408-643-6000

Contact Information

For the most up-to-date contact information, check the Microsemi Home Page.

Contact information for FPGAs & SoCs can be found at the FPGAs and SoCs Support Page

If you do not have internet access, the following information was accurate at the time of publication:

- Technical Support
    - Web: https://soc.microsemi.com/mycases
    - Phone (NA): 800.262.1060
    - Phone (Int'l): +1 650.313.4460
    - Email: soc_tech@microsemi.com
- Customer (non-technical) Support
    - Phone: +1 650.318.2470
    - Email: customer.service@microsemi.com
- Sales Support
    - For pricing, order status and lead time information for all Microsemi SoC products, contact your Microsemi Sales Representative
- Technical Support for RH and RT FPGAs that are regulated by International Traffic in Arms Regulations (ITAR)
    - Phone (NA): 888.988.ITAR
    - Phone (Int'l): +1 650.318.4900
    - Email: soc_tech_itar@microsemi.com

Regulatory and Compliance Information

EU Declaration of Conformity:

This product complies with Directive 2011/65/EU of the European Parliament and of the Council of 8 June 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment.

To view the Declaration of Conformity in English:

http://www.microsemi.com/index.php?option=com_docman&task=doc_download&gid=131772

Non-English:

Markings:

This product complies with 2004/108/EC, Electromagnetic Compatibility (EMC) Directive

For Korea:

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