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Contact us

Tel: +86-755-8981 8866 Fax: +86-755-8427 6832

Email & Skype: info@chipsmall.com Web: www.chipsmall.com

Address: A1208, Overseas Decoration Building, #122 Zhenhua RD., Futian, Shenzhen, China



Atmel ATF15xx Family: ISP Devices
.....
User Guide



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Section 1

Introduction

Traditionally, programmable logic devices have been programmed on external device programmers that provide the necessary programming signals and algorithms to program the devices. With the advent of In-System Programming (ISP), ISP devices can now be programmed on your own circuit board. This manual describes the design methods and requirements for implementing in-system Programming on Atmel ISP Complex Programmable Logic Devices (CPLDs). All devices in the ATF15xx family are ISP capable CPLDs (except ATF1500/A/AL/ABV), and ISP is implemented on these devices through the Joint Test Action Group (JTAG) interface. The following devices are supported by the Atmel-ISP software.

- ATF1502AS/ASL/ASV/ASVL
- ATF1504AS/ASL/ASV/ASVL
- ATF1508AS/ASL/ASV/ASVL

The three essential components for in-system programming are the Atmel-ISP software, ISP hardware board and ISP download cable. These components and their usage will be discussed in detail in this user guide.

In addition to these three components, a JEDEC file is also necessary to program any Atmel ISP devices. This JEDEC file can be created by compiling a design file using a compiler software that supports the Atmel ISP devices. Atmel also provides translator software (POF2JED.EXE) to convert output files from the competitor's programming format to a JEDEC file compatible with the Atmel ISP family of devices. This conversion utility is available on Atmel's web site and BBS. For further information on POF2JED, please refer to the application note, "ATF15xx Product Family Conversion", available on Atmel's web site, BBS and Fax-on-Demand. After you have created the JEDEC files for all Atmel ISP devices, you are ready to program them on your circuit/Atmel-ISP board. Using the Atmel-ISP software, download cable and ISP hardware board, you can program, verify, blank check, erase, secure and read from any Atmel ISP device directly from your personal computer while the devices are still on the circuit boards.

URL: www.atmel.com
BBS: 1-408-436-4309
Fax-on-Demand: 1-800-29-ATMEL/1-800-292-8635 (North America)
1-408-441-0732 (International)

1.1 Benefits In-system programming allows you to program and reprogram devices after they are soldered onto your circuit board. ISP eliminates the extra handling step required in the manufacturing process to program the devices on an external programmer before placing them on your circuit board. Eliminating this step reduces the possibility of damaging the delicate leads of high pin count surface mount devices or damaging the device through electrostatic discharge (ESD). ISP also allows you to make design changes and field upgrades without removing the Atmel ISP devices from the circuit board. In addition, ISP allows you to use your Automatic Test Equipment (ATE) to perform ISP operations on your ISP devices and integrate these ISP operations with the normal production test flow.

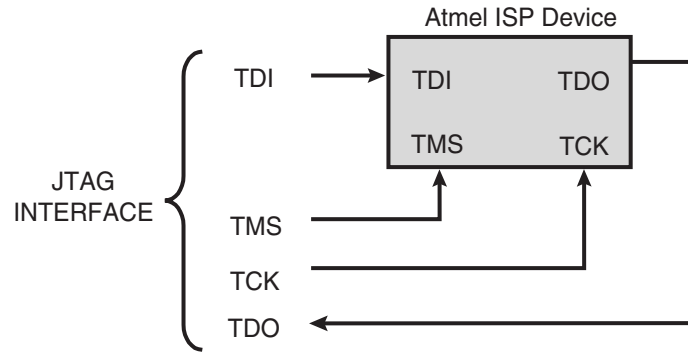
1.2 Atmel JTAG ISP Interface The Atmel JTAG ISP interface is a 4-pin, 3- or 5-volt interface compatible with the Joint Test Action Group (JTAG) IEEE 1149.1a-1993 Standard. All Atmel ISP devices can be programmed, verified and erased through this interface. The JTAG interface is a serial interface consisting of the TCK, TMS, TDI and TDO signals, and a JTAG Test Access Port (TAP) Controller. The TCK pin is the serial data clock. Programming data is clocked by this pin. The TDI pin is the serial data input. It is used to shift programming data into the Atmel device. The TDO pin is the serial data output. It is used to shift out data from the Atmel device. The TMS pin is a mode select pin. It controls the state of the JTAG TAP controller.

Atmel ISP devices are fully JTAG-compatible and support the required Boundary Scan Test (BST) operations specified in the JTAG standard. Atmel ISP devices can be configured to be a part of a JTAG BST chain with other JTAG devices for in-circuit testing of your system board. With this feature, you can test Atmel CPLDs along with other devices without resorting to bed-of-nails testing.

For more information about Atmel ISP, BST or the POF-to-JEDEC translator, please contact Atmel PLD Applications at:

Hotline: 1-408-436-4333
E-mail: pld@atmel.com
URL: www.atmel.com

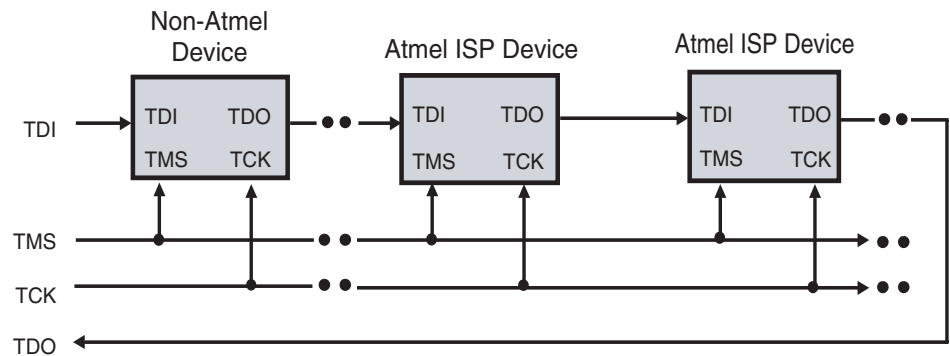
1.2.1 Single-device Programming The Atmel JTAG ISP interface can be configured to program a single Atmel ISP device. The JTAG configuration for a single device is shown in Figure 1-1. When the Atmel ISP device is configured in this way, a register appears between the TDI and TDO pins of the device. The size of the register depends on the JTAG instruction width and the data being shifted in for that instruction. The JTAG interface pins for the Atmel ISP device must be connected to a 10-pin header on your circuit board. This header mates with the ISP download cable and allows the Atmel-ISP software to transfer programming data from your personal computer to the Atmel ISP device. The pinout for the JTAG pins for different Atmel ISP devices is listed in Table 1-1.

Figure 1-1. Single-device JTAG Configuration

Note: You will need to reserve space on your circuit board to accommodate a 10-pin male header for the JTAG interface. The pinout for this header must match the Atmel-ISP cable connector pinout. The JTAG interface pins for each Atmel device must also be connected to this header.

1.2.2 Multiple-device Programming

Atmel ISP devices can be configured as part of a JTAG daisy chain. Once the daisy chain is configured, multiple Atmel ISP devices can be programmed at the same time (Parallel ISP). Figure 1-2 shows the configuration for multiple-device programming.

Figure 1-2. Multiple-device JTAG Chain Configuration

TDI, TMS, TCK and TDO comprise the JTAG interface. The ISP software allows you to create a JTAG daisy chain for multiple devices, including non-Atmel devices, and implement parallel ISP for Atmel devices.

To create a JTAG daisy chain to implement parallel ISP, perform the following steps:

1. Connect the TMS and TCK pin for each device in the JTAG chain to the appropriate pins on the 10-pin header on your circuit board.
2. Connect the TDI pin from the first device to the TDI pin on the 10-pin header.
3. Connect the TDO pin from first device to the TDI pin of the next device. Continue this process until all except the last one are connected.
4. Connect the TDO pin from the last device to the TDO pin on the 10-pin header.

A device residing in any location in the JTAG chain can be programmed exclusive of all others. You can use the Atmel-ISP software to place all other devices except the one to be programmed in the JTAG Bypass mode. When the other devices are placed in this mode, a 1-bit flow-through register appears between the TDI and TDO pins for these devices. During a programming operation, JTAG programming data passes through devices in the JTAG Bypass mode but is loaded into the device that is to be programmed. This allows only the device you want to program to be loaded with JEDEC fuse data.

1.3 Design Considerations

Performing ISP on Atmel ISP devices requires that you reserve design resources for the JTAG interface. You will need to reserve four I/O pins for the TMS, TDI, TDO and TCK pins. The pin numbers for these pins depend on which Atmel ISP device you are using and its package type. Refer to Table 1-1 for pinout information. The JTAG standard also requires that the TMS and TDI pins be pulled up for each device in the JTAG chain. The Atmel ISP devices have an internal pull-up feature for these pins which, when enabled, saves the need for external pull-up resistors. Once you have reserved logic resources for the JTAG interface, you can program, verify and erase any Atmel ISP device using the Atmel-ISP software.

Note: Even though you must reserve certain I/O pins in your design for the JTAG interface, you can still implement buried logic functions in the macrocells associated with these pins.

Table 1-1. Atmel ISP Device JTAG Pinout

JTAG Pin	44-pin TQFP	44-pin PLCC	68-pin PLCC	84-pin PLCC	100-pin PQFP	100-pin TQFP	160-pin PQFP
TDI	1	7	12	14	6	4	9
TDO	32	38	57	71	75	73	112
TMS	7	13	19	23	17	15	22
TCK	26	32	50	62	64	62	99

To use ISP to program Atmel devices, you must enable the JTAG interface. An optional but recommended practice is to also enable the TMS and TDI internal pull-ups. Enabling the JTAG interface requires choosing specific Atmel device types before compiling your design. This procedure is outlined below for Atmel-Synario™ and Atmel-WinCUPL™. If you need to enable Atmel fitter properties for other software platforms, please contact Atmel PLD Applications.

1.3.1 JTAG Interface with Atmel-Synario

To enable the JTAG interface with Atmel-Synario and multi-vendor Synario, you'll need to select an Atmel ISP device type first. You can change fitter property settings to enable the TDI and TMS internal pull-ups or the pin-keeper circuits.

Note: If you use an Atmel ISP device type for a design that uses the JTAG interface pins as logic I/O pins, Atmel-Synario will generate an error.

1. Double-click on the *Device* icon in the **Sources** section of the **Project Navigator**. The **Choose Device** dialog box will open.
2. Click once on *Atmel PLDs*. Click on the *down* arrow to scroll through the device list.
3. Click once on the appropriate Atmel ISP device type to select the device for your design. Refer to Table 1-2 for a list of Atmel ISP device types to choose from.
4. Click *OK* to close the **Choose Device** dialog box. If the **Confirm Change** dialog box appears, click *Yes* to close it.
5. Double-click *Fit Design* in the **Processes** window to run the Fit Design process. If the design fits, the fitter will generate a JEDEC file which, when programmed into the device, will keep the JTAG interface enabled and (optionally) enable the internal TMS and TDI pull-ups and pin-keeper circuits.

Note: Selecting an Atmel ISP device type will automatically enable the JTAG interface by default when Atmel-Synario runs the Atmel device fitter.

1.3.2 JTAG Interface with Atmel-WinCUPL

To enable the JTAG interface with Atmel-WinCUPL and CUPL Total Designer™ software from Logical Devices, you'll need to select an Atmel ISP device type first. You can then change the fitter property settings to enable the TDI and TMS internal pull-ups, or other options. For example, pin-keeper circuits.

Note: If you use an Atmel ISP device type for a design that uses the JTAG interface pins as logic I/O pins, Atmel-WinCUPL will generate an error.

1. For Atmel-WinCUPL V4.8, click once on *Options* from the main menu, then click once on *Select Device*. This will open the **Select Device** dialog box.
For Atmel-WinCUPL V5.1, click once on *Options* from the main menu, then click once on *Compiler*. This will open the **Compiler Options** dialog box. Click once on the *Device* tab to go to the device selection menu.
2. Choose the appropriate Atmel ISP device. Refer to Table 1-2 for a device type listing for Atmel-WinCUPL.

Note: An alternate method is to choose an appropriate Atmel ISP device type from Table 1-2 and include it in the header section of your PLD source file.

3. Click *OK* to close the device selection menu.
4. Click once on *File* from the Atmel-WinCUPL main menu, then click once on *Open*. Select your PLD source file from the appropriate working directory.
5. Click *OK* to open the PLD source file.
6. Click once on *File* from the Atmel-WinCUPL main menu, then click once on *Save*. This will save any changes you made to the source file.
7. Click once on *Run* from the Atmel-WinCUPL main menu, then click once on *Device Specific Compile* (for V4.8) or *Device Dependent Compile* (for V5.1).

8. Atmel-WinCUPL will compile the design and spawn the Atmel device fitter. If the design fits, a JEDEC file is automatically created. When the JEDEC file is programmed into the device, the JTAG interface, (optionally) internal TMS and TDI pull-ups and (optionally) pin-keeper circuits will be enabled.

Note: Selecting an Atmel ISP device type will automatically enable the JTAG interface by default when Atmel-WinCUPL runs the Atmel device fitter.

If you have designs that prevent you from reserving resources for the JTAG interface or you do not wish to use ISP, you must select an Atmel non-ISP device type. See Table 1-2 below for a listing. You can then reprogram the device using an external device programmer.

Table 1-2 shows a list of Atmel ISP and Atmel non-ISP device types for Atmel-Synario and Atmel-WinCUPL.

Table 1-2. Atmel-Synario and Atmel-WinCUPL ISP and non-ISP Device Types

Atmel Device Name	Synario ISP Device Type	Synario non-ISP Device Type	WinCUPL ISP Device Type	WinCUPL non-ISP Device Type
ATF1502 44-pin PLCC	ATF1502-ISP PLCC44	ATF1502 PLCC44	F1502ISPPLCC44	F1502PLCC44
ATF1502 44-pin TQFP	ATF1502-ISP TQFP44	ATF1502 TQFP44	F1502ISPTQFP44	F1502TQFP44
ATF1504 44-pin PLCC	ATF1504-ISP PLCC44	ATF1504 PLCC44	F1504ISPPLCC44	F1504PLCC44
ATF1504 68-pin PLCC	ATF1504-ISP PLCC68	ATF1504 PLCC68	F1504ISPPLCC68	F1504PLCC68
ATF1504 84-pin PLCC	ATF1504-ISP PLCC84	ATF1504 PLCC84	F1504ISPPLCC84	F1504PLCC84
ATF1504 44-pin TQFP	ATF1504-ISP TQFP44	ATF1504 TQFP44	F1504ISPTQFP44	F1504TQFP44
ATF1504 100-pin TQFP	ATF1504-ISP TQFP100	ATF1504 TQFP100	F1504ISPTQFP100	F1504TQFP100
ATF1504 100-pin PQFP	ATF1504-ISP PQFP100	ATF1504 PQFP100	F1504ISPQFP100	F1504QFP100
ATF1508 84-pin PLCC	ATF1508-ISP PLCC84	ATF1508 PLCC84	F1508ISPPLCC84	F1508PLCC84
ATF1508 100-pin PQFP	ATF1508-ISP PQFP100	ATF1508 PQFP100	F1508ISPQFP100	F1508QFP100
ATF1508 100-pin TQFP	ATF1508-ISP TQFP100	ATF1508 TQFP100	F1508ISPTQFP100	F1508TQFP100
ATF1508 160-pin PQFP	ATF1508-ISP PQFP160	ATF1508 PQFP160	F1508ISPQFP160	F1508QFP160



Section 2

Atmel-ISP Package Options

Atmel offers two options for customers who want to implement in-system programming. The **Atmel-ISP kit** is useful for customers who want to implement ISP on their circuit board. The **Atmel-ISP board package** is an in-system programming tool. The contents of each of these two options are listed below.

1. The **Atmel-ISP kit** contains (see Section 8, “Ordering Information” for ordering number):
 - Programming interface software (ATMISP – Atmel-ISP software)
 - Atmel-ISP download cable (DB25-to-10-pin cable)
 - Atmel-ATF15xx Family: ISP Devices User Guide
2. The **Atmel-ISP board package** contains (see Section 8, “Ordering Information” for ordering number):
 - Atmel-ISP board
 - Atmel-ISP download cable (DB25-to-10-pin cable)
 - Programming interface software (ATMISP – Atmel-ISP software)
 - AC/DC adapter and cord (output 9V DC)
 - Atmel-ATF15xx Family: ISP Devices User Guide
 - An 84-pin PLCC socket comes with the Atmel-ISP board to support the 84-pin PLCC ATF15xx devices

Note: Daughter boards can be used in conjunction with the Atmel-ISP board to support all other ATF15xx packages. There are six different daughter boards available to support 44-pin PLCC, 44-pin TQFP, 68-pin PLCC, 100-pin TQFP, 100-pin PQFP and 160-pin PQFP packages.

If you already have the ByteBlaster™ or ByteBlasterMV™ download cable, you can simply download the Atmel-ISP software from Atmel’s web site or BBS and use either the ByteBlaster or ByteBlasterMV to program Atmel ISP devices on your circuit board.

2.1 System Requirements

The Atmel-ISP board operates when connected to a parallel port on a PC station running Windows[®] 3.x, Windows 95, Windows 98, Windows NT[®] 3.x or Windows NT 4.x. The minimum software and hardware requirements for programming the device are as follows:

- Atmel-ISP software (ATMISP.EXE)
- Microsoft Windows 3.x, Windows 95, Windows 98, Windows NT 3.x, or Windows NT 4.x
- 80386/486/Pentium[®]-based PC
- 8M bytes RAM
- Windows-supported mouse
- 5M bytes of free disk space
- Available parallel printer port

Note: Windows 3.x/95/98 and Windows NT3.x/4.x use different versions of the Atmel-ISP software. The install file for the Windows 3.x/95/98 version is **ATMISP.EXE**, and the install file for Windows NT 3.x/4.x is **ATMISPNT.EXE**.

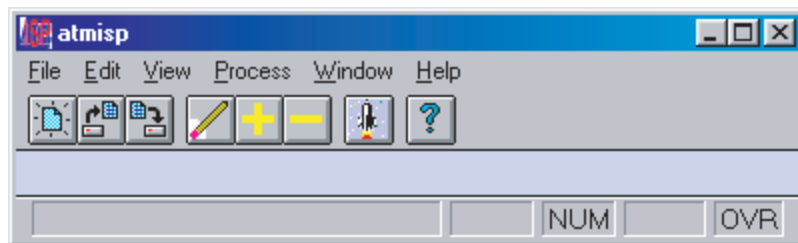


Section 3

Atmel-ISP Software

The Atmel-ISP software, **ATMISP**, is the primary means for implementing ISP on Atmel ISP devices. It can be used from your personal computer to implement ISP or to generate an output file (Serial Vector Format, SVF file) suitable for use on ATE systems. The Atmel-ISP software is a Windows-based program that runs on Windows 3.x, Windows 95, Windows 98, and Windows NT platforms (Windows NT requires a different software package, **ATMISPNT**). If you want to use the Atmel-ISP software to implement ISP from your personal computer, you will need the Atmel-ISP cable. Otherwise, it is not required. To get a copy of the software, you can order it from your local Atmel sales representative or download it from our web site. After you receive the software, you must install it before using. When it is successfully installed, the Atmel-ISP *Program* and *Help* icons are automatically created. Figure 3-1 shows the ATMISP main menu.

Figure 3-1. ATMISP Main Menu



With the Atmel-ISP software you can:

- Program, verify, erase, blank check, read and secure Atmel ISP devices on your circuit board or the Atmel-ISP board
- Implement parallel ISP (program multiple Atmel ISP devices at once) on your circuit board
- Program Atmel ISP devices before using them in your circuit board (requires Atmel-ISP board)
- Program Atmel ISP devices exclusive of other devices
- Generate SVF files for ATE systems (might require translator software utility)

The Atmel-ISP software requires you to create a JTAG chain file, which describes the characteristics of all Atmel and non-Atmel ISP devices configured on your circuit board. You can use the software to add, edit or delete items in the JTAG chain file. Any Atmel ISP device in the JTAG chain can be programmed with this software. You can also

configure an Atmel device in the JTAG Bypass mode to prevent certain Atmel ISP devices from being programmed. Non-Atmel ISP devices **must** be configured in the JTAG Bypass mode.

Once you have configured the JTAG chain, the software will prompt you to link JEDEC files to the appropriate Atmel ISP devices you want to program. The Atmel-ISP software will automatically implement parallel ISP on your circuit board if more than one Atmel device is linked.

The Atmel-ISP software cannot execute different ISP operations for Atmel devices in your JTAG chain. You can only perform the same ISP operation on several devices at the same time. For example, you can erase all devices in the chain at the same time, but you cannot erase one device while programming another in the same JTAG chain. The only exception is the Bypass instruction where it can be used in combination with any other JTAG instruction. For example, you can program the first device and bypass all remaining devices in your JTAG chain.

The Atmel-ISP software, if used with an Atmel-ISP board, can perform programming operations on only **one** device at a time. Attempting to use the software with the Atmel-ISP board to program multiple devices will generate an error. A customer's circuit board is required to program multiple devices via ISP.

Before running ATMISP, make sure to apply power to your circuit board or the Atmel-ISP board before attaching the 25-pin connector on the ISP cable to your PC. If you get the message "Check board, chips and power supplies," that means the ATMISP software is not able to communicate with the ISP hardware properly. For more information, please refer to Section 7, "Troubleshooting".

The ATMISP software allows you to use either the Atmel-ISP cable or the ByteBlaster/ByteBlasterMV cable to program the Atmel ISP devices. Refer to the "ATMISP Commands" section for more information on how to select the appropriate download cable type.

The ATMISP software also allows you to generate Serial Vector Format files. ATE vendors that support the SVF file format can execute ISP on Atmel ISP devices only. If you need to program devices from different vendors with a single SVF file, you'll need to use third-party software that supports these features. Translator software utilities such as the Atmel SVF2PCF translator and SVF2JAM™ are available to convert the SVF files into the appropriate format files to be used by different ATE systems. Contact Atmel PLD Applications for more information.

-
- 3.1 ATMISP Commands**
- The **Device Properties** dialog box will appear when you are creating a new chain file or editing an existing chain file. This dialog box allows you to specify the ISP operation you want to perform for each Atmel ISP device in your JTAG hardware chain. Some of the ISP commands and operations available on the Atmel-ISP software are discussed below. There is also an online help available for all the commands discussed below. Just click on *Help...Contents* from the Atmel-ISP software main menu.
- 3.1.1 Device Properties Dialog Box**
- The five sections of the **Device Properties** dialog box are outlined below.
- **Device Type** – Click to choose a specific Atmel ISP device. If there are non-Atmel ISP devices in your chain, you **must** select *Unknown*.
 - **JTAG Instruction Width** – This dialog item defaults to 10 bits, and all Atmel ISP devices have 10-bit JTAG instruction width. Some non-Atmel ISP devices may have JTAG instruction widths different from the default value. Make sure to specify the correct instruction width for those devices.
 - **IDCODE Register Option** – Make sure this option is always selected before executing any ISP operation on Atmel devices. Some non-Atmel ISP devices do not power-up with the IDCODE register available. Deselect this option for these devices.
 - **JTAG Instruction** – This dialog box specifies the ISP operation to be performed. All JTAG operations are listed below:
 1. *Bypass* – This instruction bypasses the selected device from responding to ISP operations. It is required for all non-Atmel ISP devices in your JTAG hardware chain.
 2. *Program/Verify* – This instruction will erase, program and verify the Atmel ISP device.
 3. *Erase* – Erases the appropriate Atmel ISP device. This is the recommended state for all Atmel ISP devices prior to programming.
 4. *Blank Check* – This operation checks to see if a device is blank. If it isn't, an error will be generated. Devices previously secured may pass Blank Check. However, this does not mean that they are blank. To unsecure a device, simply erase it.
 5. *Verify* – This operation performs a fuse verify on the device. The JEDEC data programmed into the device is compared with the JEDEC file. If the fuses do not verify, an error message is generated.
 6. *Load* – Loads the fuse data programmed in the Atmel ISP device into RAM. If you specify a JEDEC file with this command, the fuse data is saved to that file.
 7. *Secure* – Secures the Atmel ISP devices to prevent unauthorized loading of their fuse data.
 8. *Program/Verify/Secure* – This ISP operation will program, fuse verify, secure and then verify that the device is secured.
 9. *Verify Secure* – This operation will verify that an Atmel ISP device is secured. Verify Secure can be performed on only one device at a time. All other ISP devices in a multi-device chain system should be set to the Bypass mode.
 - **JEDEC File Name** – This dialog box specifies the JEDEC file and its directory that is linked to the ISP device. For the Program, Program/Verify, Program/Verify/Secure, Verify and Load commands, you must specify a JEDEC file. To select a JEDEC file, click on the *Browse* button. The ISP software will prompt you to browse the

appropriate file directory where the JEDEC file is located. When you are done, click *OK*. The path for the JEDEC file will be highlighted in this dialog box.

Once you have entered all of the above information, click *OK* to close the dialog box. These operations will be updated in your chain file. If you have a chain file for more than one device, this dialog box will reappear until information about all devices is entered. If you need help at any time, click *Help* to open this Help topic.

3.1.2 Description of ATMISP File Menu Commands

New This command allows you to create a new chain file. The chain file is needed so that you can execute ISP operations for the Atmel ISP device(s) in the JTAG chain on your circuit board or ISP board. After you execute this command, the ISP software will prompt you to specify the number of devices in your JTAG chain.

Note: If you are using the Atmel-ISP software with the Atmel-ISP board, you must enter `1` at this prompt.

Open This command opens an existing chain file. The software will prompt you to either enter the name of the chain file or to browse to the appropriate directory where it is located. The software defaults to defining the chain file with a *.chn suffix. Once the chain file is open, it is ready to be executed by the ISP software to perform ISP operations on your JTAG device chain.

Close This command allows you to close an already-open chain file. Only one chain file can be opened at a time. To open a new chain file you must use this command to close the existing one so that a new chain file can be used. If you attempt to close an open chain file without saving it, the ISP software will prompt you to save it first. If you click *No*, the chain file is lost and you will have to enter new information.

Save This command allows you to save an open chain file for use at a later time. It is recommended that you always save your chain file after you have entered the ISP operations you want to perform for all devices in your JTAG chain.

Save As This command allows you to save a chain file with a different file name than the default name chosen by the ISP software.

Port Setup This command allows you to specify a parallel port address that is different from the default port setting (LPT1 - 378H) specified by the software. The software will prompt you to select LPT2 (278H). If your port address isn't one of these addresses, click *No* and enter the new port address you want the software to use. The port setting will remain in effect until you change it or until the software is closed.

If your computer's BIOS is set to AUTO, you may have some problems getting the ISP software to communicate with your target system. Change your BIOS setting to either the ECP or EPP mode. Another option is to use Windows 95/98 to configure the correct ECP or EPP driver. Windows NT 3.x and above requires a separate installation of the ISP software (ATMISPNT) to communicate with the parallel port.

Note: To quickly determine what the parallel port address setting is, execute the View Chain File command to see your chain file. The port address will be shown in the top left-hand corner.

Self-Calibrate This option is intended to help you if you are having problems getting the Atmel-ISP software to communicate between your PC's parallel port and either your circuit board or the Atmel-ISP board. When this option runs, the software dynamically adjusts the communication speed between the parallel port on your PC and the Atmel ISP devices in your JTAG chain.

If the self-calibration process is successful, the software was able to find a reliable transfer speed to communicate with your hardware. It will save this transfer speed as long as the main menu remains open. If you save your chain file after running the Self-Calibrate option, the transfer speed will also be saved. Therefore, the next time you run the software with this chain file, it will communicate at the specified transfer speed in the chain file.

If the self-calibration process fails, the software automatically selects the slowest transfer rate. It will use this rate for all further ISP operations unless the self-calibration process is repeated and the software selects a faster transfer rate. If you do not use this option, the software defaults to using the fastest transfer speed to communicate with your hardware.

With V3.00 or later ATMISP software versions, this self-calibration process will be automatically run when a chain file is executed for the first time.

Manual Calibration This option is available in V3.00 or later software versions. It allows you to directly control the transfer speed of the data between the parallel port on your PC and the JTAG device on your board. This feature is useful when you are trying to communicate with your board with a long (greater than 3 feet) parallel port cable.

Long cables can reduce signal rise and fall times and possibly create crosstalk between JTAG interface signals. The combination or individual contribution of these effects may cause programming or verify errors. Using the Manual Calibration setting allows you to adjust the transfer rate to minimize these effects from interfering with programming. There are 4095 settings to choose from: 1 is the fastest setting and 4095 is the slowest.

To use this feature, select this command and enter a number between 1 and 4095. The default value is 1. The value selected will be displayed as the calibration constant in the **Chain File** window. If you are using a previously saved chain file, the Atmel-ISP software will retain your calibration setting. Otherwise, it will default to using the fastest speed.

Exit This command exits the ISP software. If your chain file was not saved before exiting, the ISP software will prompt you to save it. If you click *No*, the chain file contents will be lost.

3.1.3 Description of
ATMISP Edit Menu
Commands

Add Device

This command allows you to add devices to an open chain file. When this command is executed, the Device Properties dialog box will be displayed, prompting you to enter the ISP operations you want to perform on the new device. After completing this information, click OK on the dialog box. The ISP software will then append information about the new device to the existing chain file.

Before you can use this command you must solder a new Atmel ISP device and connect it to your existing JTAG hardware chain on your circuit board. The device type, its position in the chain, the JEDEC file used and JTAG instruction width must all be specified in the **Device Properties** dialog box.

The ISP software requires you to enter this information for all devices in your JTAG hardware chain whether they are Atmel or non-Atmel ISP devices. This is necessary so the software can perform the right ISP operation on the right device on your circuit board.

Edit Device

This command allows you to edit the device information in an open chain file. You can use this command if you want to change the ISP operations you want to perform. A prompt will appear asking you to enter the device number in the JTAG chain that you want to modify. After you enter the device number, the **Device Properties** dialog box will reappear. You can then change the ISP operations for the appropriate device. Click *OK* when done. The ISP software will automatically update your chain file.

Delete Device

This command deletes devices from an open chain file. When this command is executed, it will prompt you to enter the device numbers you want to delete. Click *OK*. The chain file will be updated and devices renumbered automatically. Before you can use this command, you must remove the Atmel devices you want to delete from the JTAG chain on your circuit board. The device type, its position in the chain, the JEDEC file used and the JTAG instruction width must all be specified in the **Device Properties** dialog box. These must match your JTAG hardware chain on your circuit board. To correctly use the ISP software, you must specify information about all devices in your JTAG chain, including non-Atmel devices.

Atmel-ISP software versions V2.99 and later allow you to edit device properties more easily. To **edit** a chain, you can perform the following:

1. View your chain file. You can either select it from your Windows Taskbar or select *View..Chain File* from the main menu.
2. Select the device and/or operation you want to change. The line you select will be highlighted.
3. Double-click with the left mouse button.
4. The **Device Properties** dialog box for the appropriate chip will appear. For example, if you have a 2-device chain, select *Chip 1* and do a double-click with the mouse button, the **Device Properties** dialog box for Chip 1 will appear.
5. Change the properties for the device accordingly and click *OK* when you are done.
6. The chain file will be automatically updated to reflect the changes you made. It is recommended that you save your chain file before you exit the ISP software. The software will prompt you to save it before exiting.

To **add** device(s) to a chain in Atmel-ISP V2.99 and later, you can perform the following:

1. Follow steps 1 and 2 above.
2. To insert a device before the chip you've selected, press the [Insert] key. The **Device Properties** dialog box for the new device will appear. Enter the appropriate ISP operations and other information you need to specify for that device.
3. The new device's properties will automatically be updated in the chain file. The chip number in your chain will also be adjusted accordingly.

To **remove** device(s) from a chain in Atmel-ISP V2.99 and later, you can perform the following:

1. Follow steps 1 and 2 in the "Edit Device" section above.
2. Follow step 2 of the "Add Device" section above except press the [Delete] key. The software will prompt you on whether you want to delete the device from your chain.
3. Select *Yes* on the Delete Device prompt. Selecting *No* will cancel the delete operation.
4. Your chain file will be automatically updated to reflect the new device configuration you have specified.

Note: Be careful when you execute any Add or Remove operations to a chain file. Since these operations change the number of devices in your chain file, the JTAG hardware chain on your circuit board *must* match your chain file in number and type(s) of devices.

3.1.4	Description of ATMISP View Menu Commands	View Chain File	<p>Use this command to view the contents of a chain file. The chain file will show the following information:</p> <ul style="list-style-type: none">■ The chain file name■ The parallel port used (e.g., Port 1 corresponds to LPT1)■ The cable type used (if the ByteBlaster/ByteBlasterMV cable type is selected)■ The calibration value■ The device number (position of device in the JTAG hardware chain)■ The device type■ JEDEC file used for each device (if appropriate)■ ISP operation performed for each device■ Warning message indicating the IDCODE box has not been checked in the Device Properties dialog box for an Atmel device (this only appears when the IDCODE box has not been checked in the Device Properties dialog box for an Atmel device)
		Log File	<p>This command opens a log file that shows you the status of all ISP operations after they were executed in your chain file. For example, if you executed a programming operation, it will indicate whether it passed or failed and the checksum read from the device. For other operations not involving a JEDEC file, the log file will indicate success or failure of the ISP operation.</p>
3.1.5	Description of ATMISP Process Menu Commands	Run	<p>This command executes the operations specified in your chain file. If there is more than one device specified in your chain file, the ISP software will execute the same operation on all devices in parallel.</p> <p>You cannot mix different ISP operations on different devices. For example, you cannot erase one device while verifying another. If you do so, the ISP software will generate an error. However, you can execute the same ISP operation on several devices while putting other devices in the Bypass mode.</p> <p>Do not execute the Verify Secure command on more than one device. It will generate incorrect results.</p>

Options

This command allows you to choose from the following options when executing your chain file:

- Writing to SVF file instead of LPT port. – If you select Yes for this option, the ISP software will stream its programming information to an SVF (Serial Vector Format) file instead of to the parallel (LPT) port. The SVF format is an industry-standard format used by a variety of ATE (automated test equipment) vendors to program ISP devices in a production environment. In addition, an SVF file can be used in conjunction with conversion utilities to generate the proper format files required by the ATE vendors.

The ISP software will generate an SVF file for Atmel devices only. All other devices need to be placed in the Bypass mode. The SVF file will include whether the IDCODE register is available on power-up, the JTAG instruction width, programming algorithm and any Atmel-specific ISP instructions and programming data to be downloaded to Atmel ISP devices.

If you want to program devices from multiple vendors with the same SVF file, you will need to use external JTAG boundary scan software, which offers the capability of configuring multiple vendor device JTAG chains and executing ISP operations on these devices from one SVF file.

If you want to perform JTAG boundary scan operations on Atmel or other devices, you also will need to use external boundary scan software to configure your BST chain and create an output file supported by your ATE environment.

Note: Contact Atmel PLD Applications if you need a vendor list that supports SVF or if you need more information.

- Does the Target System Support SVF Specification Rev. D? – This option requires you to specify what revision of SVF file the Atmel-ISP software creates. Please refer to paragraph 5.3, “Creating SVF Files”, on page 5-4 for further information.
- Use State-Resets in SVF File? – This option gives you the choice of including JTAG TAP reset statements in your source file. Please refer to paragraph 5.3, “Creating SVF Files”, on page 5-4 for further information.
- Using the ByteBlaster Cable. – This option allows you to use the ByteBlaster/ByteBlasterMV cable you normally use for MAX7000S/A/AE devices to execute ISP on Atmel ATF15xx family devices. This saves you from using the Atmel-ISP cable. Once you enable the ByteBlaster/ByteBlasterMV option, it remains enabled until you disable it. This means that if this option is enabled, the Atmel-ISP cable will not work on your target system and vice versa, if it is disabled.

The Atmel-ISP software defaults to disabling this option. If you get errors when executing your chain file with the Atmel-ISP software, make sure this option is not enabled first.

3.1.6	Description of ATMISP Help Menu Commands	Contents	This command displays the table of contents of this Help file.
		About Atmel-ISP	This command displays the version number of the Atmel-ISP software you are currently using. If you are unsure whether you have the latest version, check with Atmel PLD Applications.

3.2 ATMISP Hidden Commands (Advanced Users Only)

There are many protection features built in to the Atmel-ISP software. For example, features to ensure that the correct device is being programmed, that the correct voltage level is being applied to the ISP device, that the JTAG port will not be disabled after programming. To allow advanced users to override some of these built-in protection features, hidden commands are made available in order to allow these advanced users to force the ISP operation to proceed despite the fact that ATMISP detected potential problems. **Please use these hidden commands with discretion.** These hidden commands are listed and described below.

ID Check

This option allows you to override the ISP software setting that checks the correct manufacturer ID for Atmel ISP devices. If you receive the ID Check error, you can use this command to bypass the manufacturer ID check process. The default setting for this option is disabled. *This option will remain enabled until you disable it and vice versa, if it is disabled.*

To enable/disable this option, do the following:

- Before executing your chain file, hold down the [Shift] key and press the [Alt] and [L] keys simultaneously. The Atmel-ISP software will display a warning message indicating the state of the manufacturer ID Check option after you enter this key sequence. Click *OK* to close the warning message.

Mixed Voltage (V3.00 or Later)

This option overrides the normal error message you would receive from the ISP software when you attempt to program both 3V and 5V Atmel devices in the same JTAG hardware chain. The default state of this option is disabled. *It remains enabled until you disable it and vice versa.*

If you decide to enable this option, please be aware of the following precautions:

- 5V device may not program correctly with a 3V supply. This may create functional problems with your board.
- Interfacing 3V and 5V devices on the same board may create problems if your 3V devices are not completely 5V tolerant. This may cause functional problems on your board.

To enable/disable this option, do the following:

- Before executing your chain file, hold down the [Shift] key and press the [Alt] and [V] keys simultaneously. The Atmel-ISP software will display a warning message indicating the state of the JTAG port option after you enter this key sequence. Click *OK* to close the warning message.

**JTAG Port
Check**

This option prevents the ISP software from detecting whether your JEDEC file is using the JTAG port pins as logic I/O pins. The error you would normally see when you attempt to program a device with this type of design will be disabled. The default state of this option is disabled. *It will remain enabled until you disable it and vice versa.*

If you decide to enable this option, be aware of the following precautions:

- Make sure you have first soldered an erased Atmel ISP device in your JTAG hardware chain.
- If you enable this option and still attempt to program any Atmel ISP device, *you will only be able to program it **once** using ISP.*

After the device is programmed once, *you will not be able to re-execute any ISP operations on any devices in your JTAG hardware chain.* The only way to re-implement ISP on your JTAG chain is to remove the affected device and erase it using an external device programmer.

To enable/disable this option, do the following:

Before executing your chain file, hold down the [Shift] key and press the [Alt] and [J] keys simultaneously. The Atmel-ISP software will display a warning message indicating the state of the JTAG port option after you enter this key sequence. Click *OK* to close the warning message.





Section 4

Atmel-ISP Hardware

The Atmel-ISP hardware consists of the Atmel-ISP board, the Atmel-ISP cable, 9V AC/DC adapter and Atmel-ISP daughter boards. The Atmel-ISP cable (or optionally the ByteBlaster/ByteBlasterMV) is required to implement ISP from your personal computer for Atmel devices. The Atmel-ISP board is optional, but useful for prototyping your designs before using them in your target system. The Atmel-ISP daughter boards are used in conjunction with the Atmel-ISP board so you can program devices in different package types.

4.1 Atmel-ISP Board Description

The Atmel-ISP board connects to the PC via an Atmel-ISP cable. This cable connects from the PC's parallel port to the 10-pin male header on the Atmel-ISP board. There are two sockets available for programming. One socket is the 84-pin PLCC socket (Socket #1) and this comes with the Atmel-ISP board. The other socket (Socket #2) can interface to a daughter board. The purpose of a daughter board is to program other package types. Atmel supplies a daughter board for each available package type.

The Atmel-ISP board is primarily intended as a programming tool. You can use it to program Atmel ISP devices before inserting them on your circuit board. Figure 4-2 is a diagram of the Atmel-ISP board. It includes the following items:

- PC board, 6" x 6.5"
- One 84-pin PLCC socket connector (U1)
- Socket headers for daughter boards (U2)
- 10-pin male header (J5)
- Power-supply connection (J8)
- Decoupling capacitors (C1 - C9)
- Battery connection and protection diodes (BT1, D1)
- On/Off switch (SW3)
- V_{CC} voltage selection jumper (JP3) for Rev. 3 or later
- 4-position DIP switch (SW2) for Rev. 3. or later

The programming socket is a fixed 84-pin PLCC socket. Atmel ISP devices with this package type must be programmed with this socket. Devices for other package types must use the appropriate Atmel-ISP daughter board. Only one device at a time can be programmed on the Atmel-ISP board whether on the 84-pin PLCC socket or on the daughter board.

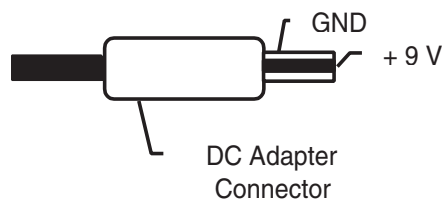
A switch block (SW2) containing four DIP switches is located on the top of the ISP board. It is used as a socket selector. *If you are programming using an 84PLCC socket, DIP Switch 4 from this group must be in the OFF (down) position. If you are using a daughter board, DIP Switch 4 from SW2 must be in the ON (up) position.* The requirement holds whether you are using either the Atmel-ISP cable or ByteBlaster/ByteBlasterMV cable.

Special features have been added to the ISP board (Rev. 3 or later) to support multi-voltage (3V/5V) device programming. These include a power supply regulation circuit that can supply either 3V or 5V supply voltage (V_{CC}) and a 3/5V header to change the V_{CC} voltage value. Additional changes to the board include: a better power-on/off switch, improved PC board layout of regulator near the 84-pin PLCC socket, battery connector terminals that are directly soldered on the board and other changes.

To select the proper V_{CC} voltage, use jumper JP3 on the Atmel-ISP board (Rev. 3 and later). If the left two jumpers are connected, V_{CC} will be set to 5V. If the right two jumpers are connected, V_{CC} will be 3.3V.

Power to the Atmel-ISP board is supplied by either an Atmel 9V AC/DC adapter or a 9V battery. Use the Atmel AC/DC adapter to power the board as some adapters may have the power and ground connections reversed, which can damage the ISP board. *If you are using a different AC/DC adapter, make sure that the **center** pin of the socket adapter is at 9V, as shown in Figure 4-1.*

Figure 4-1. DC Adapter Socket



You can find the revision of the Atmel-ISP board by looking on the front of it just below the prototype area and above the Q2 and Q3 labels. It is always recommended that you use the latest revision of the Atmel-ISP board when programming Atmel devices.

If you are unsure which is the latest ISP board revision, contact Atmel PLD Applications.

4.1.1 Optional Features on Atmel-ISP Board Useful for Prototyping

These features are not included in the Atmel-ISP board. The following components can be soldered onto the ISP board in order to test functionality of specific Atmel ISP devices.

- LEDs: LED1 is used for the power supply and the other two (LED2 and LED3) are for prototyping.
- Crystal oscillator, 1 MHz (Y1)
- Two momentary input switches (PBSW1 and PBSW2)
- 4-position slide switch that encodes to two inputs (SW1)
- 5 alphanumeric LED displays with drivers (DSP1 - 5)
- A user prototyping area
- One 84-pin PLCC programming socket
- One 10-pin JTAG header
- Signal breakout headers