

JTAG04

**dedicated ISP programmer for
Atmel ATF1504/ATF1508 CPLDs**

User Manual

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IMPORTANT NOTICES:

WARRANTY AND DISCLAIMER

The “JTAG04” is scientific instrumentation. The success or failure of its use depends as much on the integration by the user as on the design and fabrication by the manufacturer. Improper installation or operation can result in equipment failure and/or personal injury. The user accepts responsibility to read and understand this manual, and to ensure safe operation of the installation where it is used. This manual was written to aid the skilled system integrator through the setup and installation of this instrumentation.

The “JTAG04” is a dedicated in-system programming tool for use with Atmel ATF1504 and ATF1508 Programmable logic devices. It is configured and tested to work with these devices, using accompanying software tools under Microsoft Windows (XP or 7). Rockfield Research will attempt to provide any necessary software updates should the specifications of either the Atmel chips or the Windows operating system change – but changes by these vendors are outside of the control of Rockfield Research, and no guarantees are made in this regard.

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OVERVIEW

The JTAG04 is an *in-system* programming tool for Atmel ATF1504 & ATF1508 programmable logic circuits. It allows the user to program, read, and verify either of these chip types in circuit, using the provided JTAG interface.

This device is not unique. There are numerous other methods by which these chips may be programmed in circuit. Universal programmers (such as those marketed by Xeltek and Data-man) are excellent and far more versatile, as they can be used for literally thousands of different chip types. The advantage of the JTAG04 over a universal programmer is that it is very small (thus easier to take in the field), and that it is very inexpensive (thus it is far more economical to provide dedicated programmers for individual workstations and developers, rather than share tools).

This device is quite similar to the Atmel ATDH1150USB “cable”, which is also a standalone dedicated programmer with USB interface. We have found, however, that the ATDH1150USB is both inconsistent in use, and difficult to purchase.

The development of the JTAG04 was further incentivized by the need for Rockfield Research to have dedicated Atmel CPLD programming capability buried within standalone test fixtures for commercial products. Once the circuits and capabilities for doing this were developed, it was trivial to package a standalone device for the same purpose, and helpful to do so given the difficulties with the ATDH1150USB.

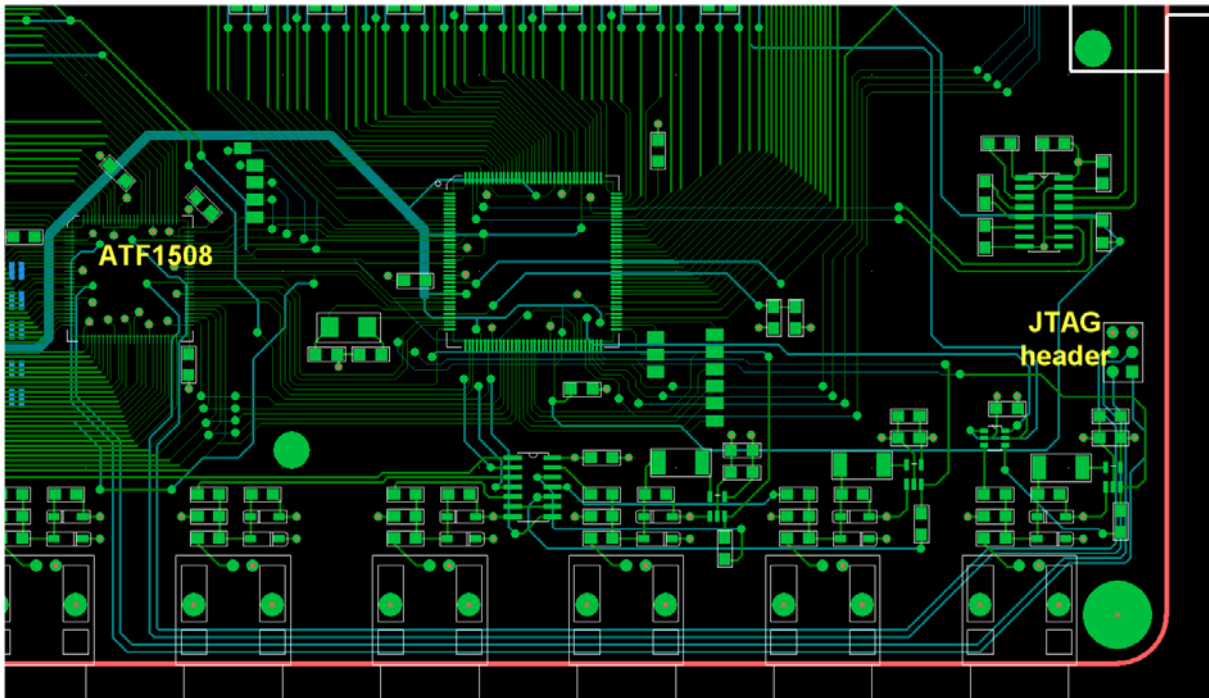
USE

In typical use, the circuit developer will place a six-pin header on the board to bring the JTAG interface from the Atmel device to a convenient connection. The pinout and orientation of this header should follow the specifications in this document, or a suitable interconnect will need to be provided by the user.

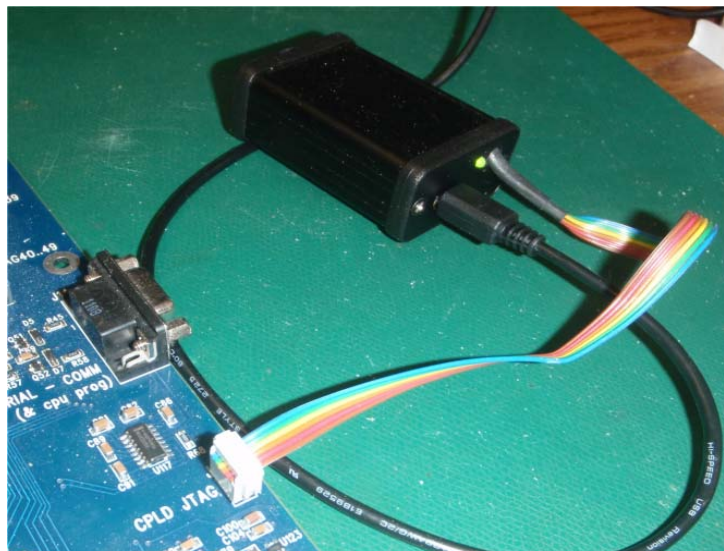
For use, the JTAG04 is plugged into a USB port on a PC with Windows XP or Windows 7. The USB port provides both communication and power. The circuit to be programmed should be powered, the six-pin header connected properly, and the Windows application provided should be run.

HEADER

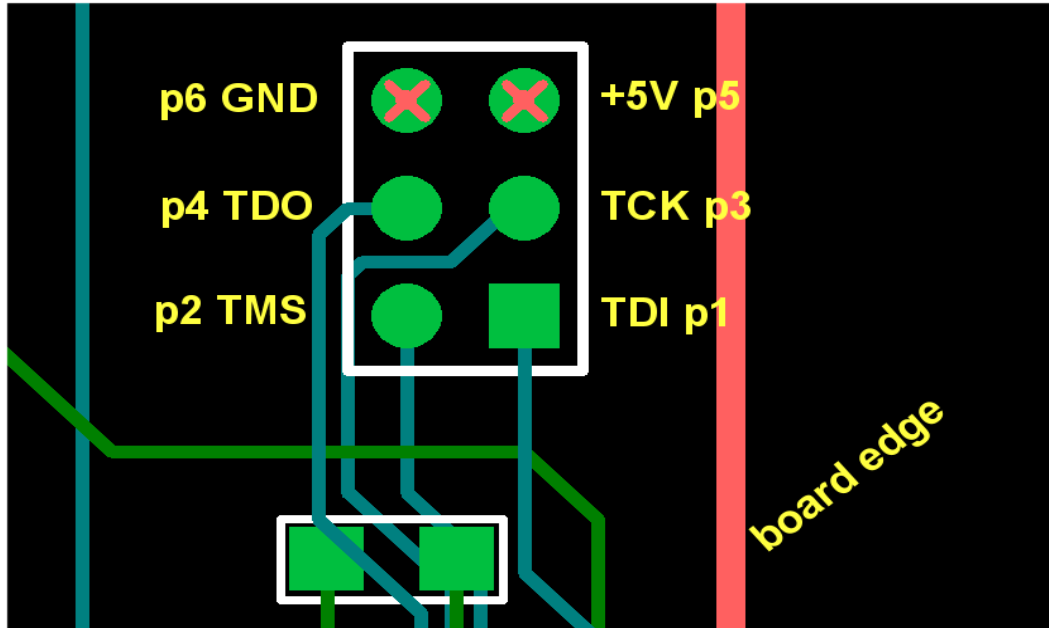
For the easiest use of the JTAG04, the board with the ATF150x chip should be prepared with a six pin header as below. Careful attention must be paid to the pinout and orientation of this header. It is not necessary for the header to be *immediately* adjacent to the ATF150x chip – in the example below, the header was placed at the board edge, with traces approximately 6” long leading to the ATF1508.



Any unshrouded vertical header with six pins and 0.100” pitch may be used. An example we use is the Molex 90131-0763. By Rockfield Research convention, the header should be oriented with the long axis parallel to a board edge, and the pin 1 side closest to that edge. This will result in correct attachment to the JTAG04 with the ribbon cable directed *off* the board, rather than towards the center of the board, as in the photo at right. (The JTAG04 is shipped with a FCI 71600-106LF connector, which does have a polarization key – a suitable mating keyed header may be used to ensure proper orientation if desired.)



The pinout of the header is shown below. Again, ensure that the pin 1 side (with TDI, TCK, and +5V) is on the side closest to the board edge, so that the JTAG04 will naturally connect with the ribbon cable hanging off the board.



All of these lines may be routed directly from the ATF150x chip, without any intervening buffering. Some series R may be added as a precaution, however care should be taken not to add too much, else the parasitic capacitance will filter out the fast serial transmission necessary.

(The internals of the JTAG04 use fast 5V 30mA buffers (SN74LVC3G34DCTR) with 300 Ω series on all three of the driven lines (TMS, TCK, TDI), and a 300 Ω series with a TTL receiver on the single receive line (TDO). The circuit +5V line is sensed through 2k Ω , but not used for powering the JTAG04...only USB derived power is used for the JTAG04 circuit.)

The Vp pin is *not* used in the JTAG04 circuit. The ATF150x devices can be programmed repeatedly without use of the Vp pin, provided that it has not been programmed with JTAG enabling off previously (with another programming device). The JTAG04 will not program any devices in such a way to subsequently disable JTAG access....JTAG access is forced on in the programming bitmap regardless of the “jtag enable” status used by the JEDEC assembler.

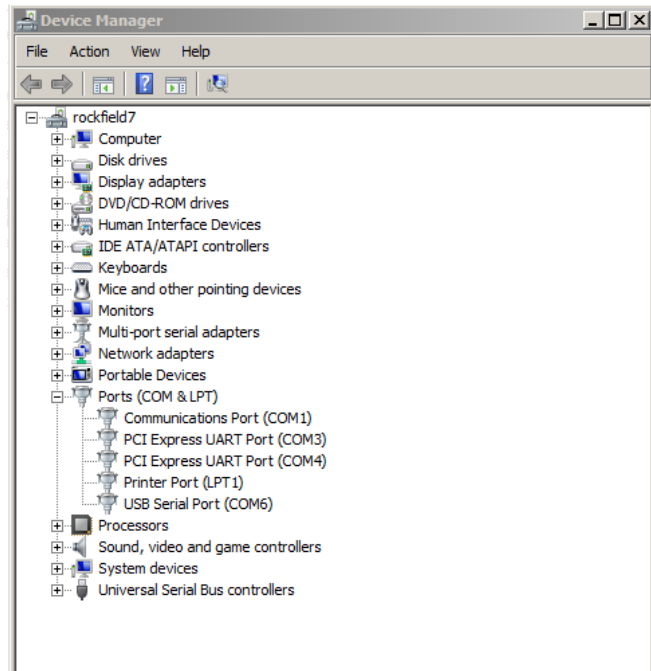
USB Driver

The USB interface within the JTAG04 uses the Future Technologies FT231XS chip, which is a full duplex USB-serial interface. To use the JTAG04, you must install the proper driver for this chip. Obtain this driver directly from the Future Technology Devices website for the most recent version – use the “VCP” (virtual COM port) driver, rather than the D2XX direct driver. The website for this is: <http://www.ftdichip.com/Drivers/VCP.htm>.

The JTAG04 with the Windows VCP driver has been tested on both Windows XP 32-bit and Windows 7 64-bit, with no difficulties. Rockfield Research will be happy to hear of other platforms which have been tested, and we will attempt to help debug any difficulties that may arise.

Once you install the VCP driver, you may plug in the USB cable for the JTAG04. The plug-and-play interface will enumerate and assign a port. You must find the port number to proceed further (note that this comport will remain unchanged on future uses if no conflicts present themselves, provided you plug into the same USB port on your computer).

To find the comport, you must pull up the Windows Device Manager – the means to do this vary with different versions of Windows, but generally involve “right-clicking” on the “my computer” icon, or accessing through the control panel. Once the Device Manager comes up, expand the line for “Ports (COM & LPT)”, and the VCP interface should show up as a “USB Serial Port”. In the example at right, we see that the VCP port has been assigned to COM6.



(As of this writing, only comports 1-9 are available for use by JTAG04 software....we have found that the Windows code necessary to access 2-digit comports varies with the Windows version. If you require the use of a two digit comport, and cannot reassign other comports to free up a single digit port, contact us, and we can attempt to provide you with a custom version of the software which will work for your version of Windows.)

You must install a configuration file to communicate this comport to the JTAG04 software. On most computers, this will need to be the file “C:\rockfield\jtag.ini”. (If the system root is on a disk or partition other than “C:”, substitute the appropriate letter drive). The contents of this file should be a single line with the name of the comport (e.g. “COM6”). You should create this directory and file with any text editor.

** Note – we have noted that some other peripherals, such as license dongles, can interfere with the JTAG04 communication. If you have difficulties, try unplugging other USB devices.

JTAG04 Software Installation

The windows software for the JTAG04 device may be downloaded from the Rockfield Research website. The link may be accessed through the appropriate page for the JTAG04 product, or you may use the direct link here: <http://www.rockfieldresearch.com/jtag04/atf150x.exe>

Once you download this executable, you can place it anywhere on your computer. It is recommended to either:

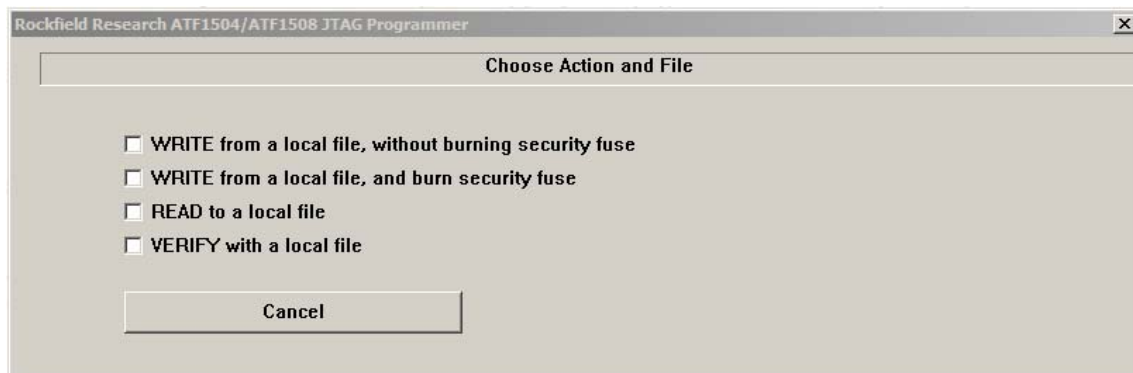
- * place a copy of it in the directory with the JEDEC file(s) you wish to burn into the chips, as it will conveniently open into the same directory to look for these files.....or..

- * place one copy in a central place on the computer (such as the same directory with the ini file), and associate the default action of jedec (“*.jed”) files with this executable...you can then access it anytime by double clicking any jedec file.

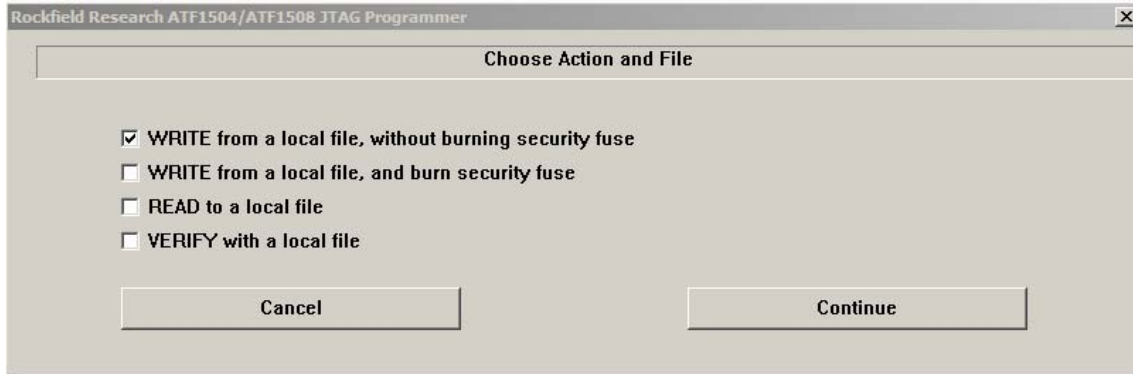
JTAG04 Use

To use the JTAG04, ensure it is plugged in and the configuration file points to the proper comport. The ribbon cable should be plugged onto the 6-pin header of your board, and your board should be powered.

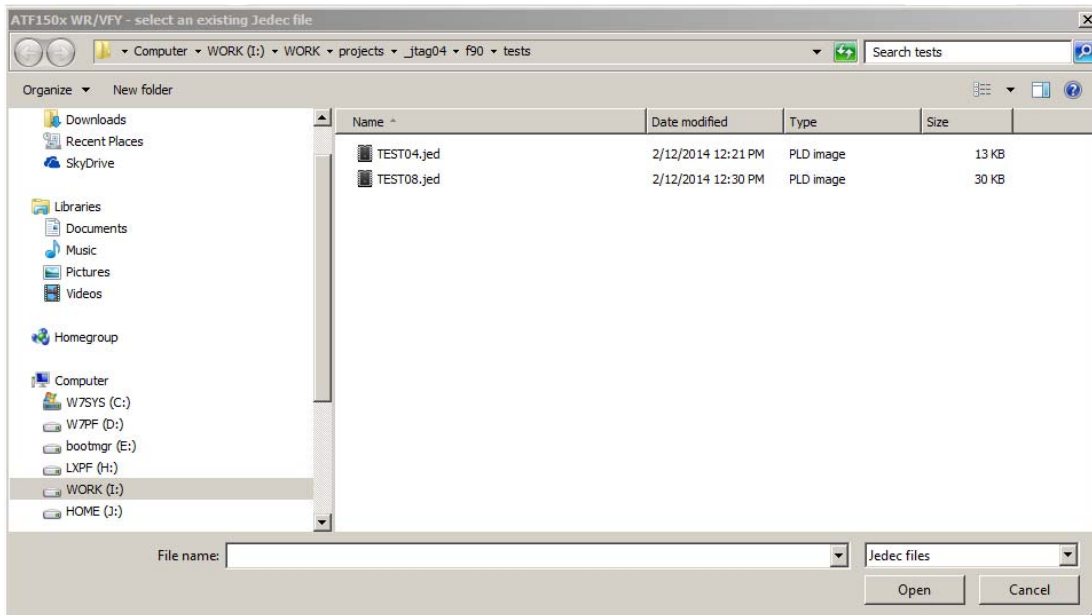
Execute the accompanying software, “ATF150X.exe” (see above for two methods to do this). You will first see the following window:



You must first select the action you wish to perform. Select one of the check boxes.



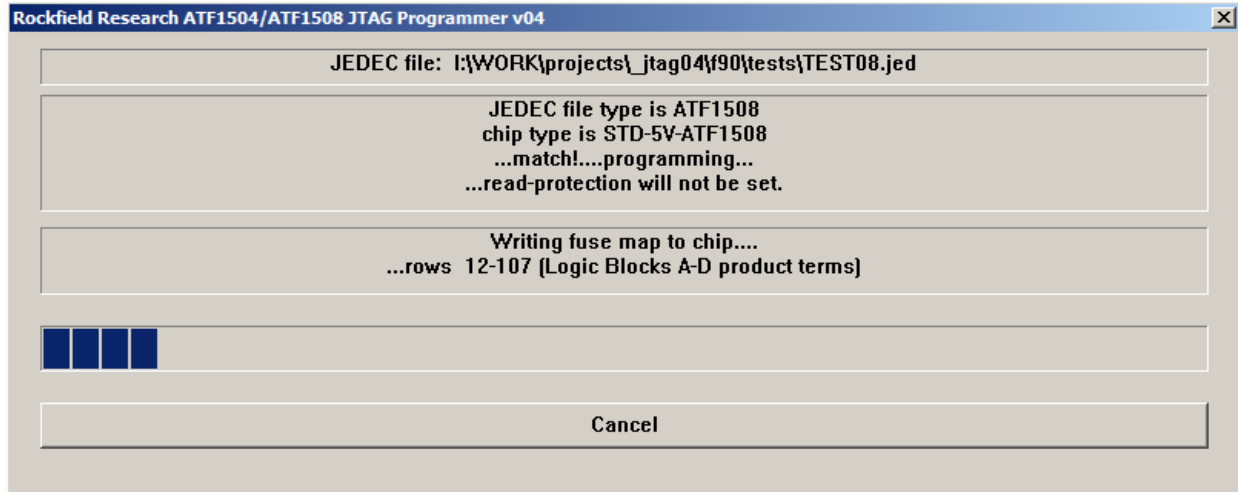
Selecting one of the checkboxes will activate the “CONTINUE” button. Press this, and you will then select a file with the standard windows interface for file selection.



Note that if you selected “VERIFY” or “WRITE”, you will be prompted for an *existing* jedec file, while if you selected “READ”, you will be prompted for a *new* jedec file. In either case, you may override this preference, but attempting to verify or write from a blank (or incorrectly formatted) file will result in failure. If you override the “READ” preference and select an existing file, you will overwrite the existing file and lose whatever contents it has.

Note also that you are restricted to files of filetype “*.jed”. No other options are allowed. If you are using an unusual assembler which puts jedec files in a different filetype, you will have to rename them appropriately.

Once you select the file, your chip will be read, verified, or written as you have selected. You will observe a screen similar to that below:



The top line shows the file you have selected. The second box shows the results of testing the ISP interface and interrogating the chip for the chip type. Note that the size and addressing of the “fuse map” for the ATF1504 and ATF1508 are wildly different. The program will verify that the file type and the chip type are similar, otherwise it will abort and perform no actions.

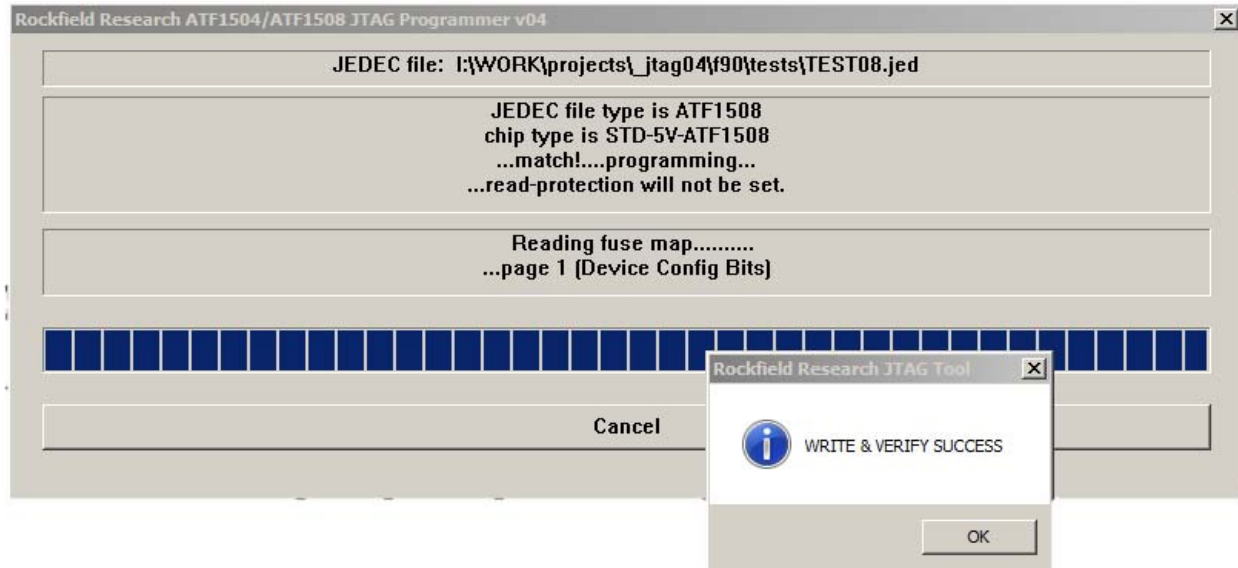
If the chip types match, it will proceed, and the third box and the progress bar will show progress as it proceeds. Writing a ATF1508 takes about a minute. Reading takes about one third of this time, and the 1504 is a bit faster than the 1508 for any activities.

If you selected WRITE: The chip will first be totally erased, and then the various blocks of the fuse map and configuration bits will be written then read & verified before proceeding to the subsequent sections, as per the Atmel specified algorithms. The final device configuration bits – which activate the output ports – will not be written unless all prior sections have verified perfectly. It is permissible to write to a chip which has been previously programmed with the security bit set, as the first step is a total erasure, which clears this bit (as well as all internal data).

If you selected VERIFY: The chip will not be written to or changed in any way. The fuse map will be read and checked against the specified file. Any differences will cause the program to abort with an error message. If the chip was written with the security bit set, the verification will proceed, but it will fail as the readout will not show the correct internal data.

If you selected READ: The chip will not be written to or changed in any way. The fuse map will be read, and a file written in standard JEDEC format, suitable for future writing or verifying. If the chip was written with the security bit set, the read will proceed, but the file will contain only information showing a blank chip.

At completion, you will get a “success” message, and the program will terminate after you click the “OK” button.



OTHER:

There are several variants of chip types in the ATF150x family. In addition to the ATF1504 and ATF1508 types, there are “standard” vs “alternate” and “5V” vs “3V” types specified in the Atmel programming literature. These last two selections differ in the timing restrictions within the programming algorithm, and the chip ID senses the correct types and sets the timing accordingly. As of this date, only the standard 5V types have been tested.

The '04 and '08 chips have very different fuse map sizes and addressing, so it is important to ensure that the map is correct before writing bits to the chip. The program makes every effort to match the chip ID and the file type, and abort any mismatch attempts.

In addition, all chip types are available in a variety of pin counts and packaging options. These are irrelevant for our purposes here. The pin count will only affect which fuse map cells are linked to external pins, and which are only internal nodes, but it does not affect the programming of the fuse map – you will deal with these differences only in your circuit design and in the assembly of your jedec file from source code.

Testing to date (2/24/14) has been done on the “ATF1508AS10AU100” and the “ATF1504AS10AU100”, both under Windows 7 64-bit as well as Windows XP 32-bit.