

# Intel® JTAG Debugger 2.3 for Intel® Atom™ Processor Installation Guide and Release Notes

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Installation Guide and Release Notes

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## Contents:

[Introduction](#)

[What's New](#)

[System Requirements](#)

[Installation Notes](#)

[Features](#)

[Usage Notes](#)

[Issues and Limitations](#)

[Resolved Issues](#)

[Known Issues and Limitations](#)

[Attributions](#)

[Disclaimer and Legal Information](#)

## 1 Introduction

The Intel® JTAG Debugger 2.3 for Intel® Atom™ Processor provides Linux\* hosted cross-debug solutions for software developers to debug the Linux\* kernel sources and dynamically loaded drivers and kernel modules on Intel® Atom™ Processor based devices. It does so using the In-Target Probe eXtended Debug Port (ITP-XDP) on Intel® Atom™ Processor (Z5xx, Z6xx, E6xx, CE4xxx) and Intel® Media Processor CE3100 based platforms.

As JTAG communication device you have the choice between the Macraigor usb2Demon\* and the Intel® ITP-XDP3. Beyond this the debugger also offers convenient and in-depth access to underlying hardware properties through a powerful graphical user interface (GUI). This makes it an ideal assistant for initial platform bringup and firmware and BIOS debugging. A set of features providing in-depth access to the development platform complete the offering for system developers:

- Execution trace support for identifying incorrect execution paths or memory accesses
- Bitfield editors for comprehensive and bit level access to silicon platform features
- Graphical representation of the page translation table with full access of the descriptor tables

- Flash writer plug-in that allows to update the BIOS or firmware as well as flash-resident OS images

These debugger capabilities minimizes the time it takes to isolate and correct platform and system level problems.

This document provides system requirements, installation instructions, issues and limitations, and legal information.

## Technical Support and Documentation

The directory `/opt/intel/atom/xdb/2.3.xxx/doc` includes these release and installation notes `Release_Notes_JTAG.pdf`, and a getting started guide `Getting_Started.htm`. In addition, the Intel® JTAG Debugger for Intel® Atom™ Processor includes online help provided in form of the document titled "Intel® Debugger Online Help", which is available from the Help menu of the graphical user interface (GUI).

To submit issues related to this product please visit the [Intel Premier Support](#) webpage and submit issues under the product **Intel(R) Embedded SW Dev Tools Atom**.

For information on how to register for and purchase support for the Intel® Embedded Software Development Tool Suite Intel® Atom™ processor please visit the [Intel® Software Development Products](#) webpage.

Additional information on the Intel® Embedded Software Development Tool Suite for Intel® Atom™ Processor is available at the following web resources:

- Product Page: <http://www.intel.com/software/products/atomtools>
- User Forum: <http://software.intel.com/en-us/forums/software-development-toolsuite-atom/>
- Knowledge Base Articles: <http://software.intel.com/en-us/articles/software-development-toolsuite-atom-kb/all/1/>

Please remember to register your product at <https://registrationcenter.intel.com/> by providing your email address. This helps Intel recognize you as a valued customer in the support forum.

For information about how to find Technical Support, product documentation and samples, please visit <http://www.intel.com/software/products/atomtools>

## Product Contents

- Intel® JTAG Debugger 2.3 for Intel® Atom™ Processor, Build [76.xxx.x]
- XFLASH – Intel® JTAG Debugger Flash Memory Tool 3.3.1

## 2 What's New

Below are some of the new features in the Intel® JTAG Debugger 2.3 for Intel® Atom™ Processor

### General Updates

- **Support for Yocto Project\* 1.1 based Linux\* on Intel® Atom™ Processor E6xx**
- **Updated Eclipse\* RCP based graphical user interface**
- **Fixes of outstanding issues**

### Target Platform Support

- **Support for Yocto Project\* 1.1 based Linux\* on Intel® Atom™ Processor E6xx**

The Intel® JTAG Debugger for Intel® Atom™ Processor has been tested against debugging the Yocto Project\* 1.1 operating system software stack running on Intel® Atom™ Processor E6xx based platforms.

- **Support for GUI assisted Flash Writer Plug-in for Intel® Atom™ processor CE4xxx**

The Intel® JTAG Debugger provides flashing support through its Flash Memory Tool plugin providing easy graphical user interface assisted access to reprogramming the NOR as well as NAND flashes on software development platforms based on the Intel® Atom™ Processor CE41xx or Intel® Atom™ Processor CE42xx

This includes the following flash types:

#### **Intel® Atom™ Processor CE41xx:**

- FTL Lite NAND Flash
- NOR Flash

#### **Intel® Atom™ Processor CE42xx:**

- NOR Flash
- eMMC NAND Flash
- eMMC Boot Partitions
- eMMC User Partition

- **Support for On-Chip Instruction Trace on Intel® Atom™ Processor CE4xxx**

The Intel(R) JTAG Debugger now provides full On-Chip Instruction Trace support for the Intel® Atom™ Processor CE4100 and Intel® Atom™ Processor CE4200

- **Support for Intel® Atom™ processor E6xx bitfield editor**

The Intel(R) JTAG Debugger provides access to chipset registers on the application processor as well as the Intel I/O Hub. All public registers of the Intel(R) Atom(TM) processor E6xx are accessible through the bitfield editor views offered by the Intel(R) JTAG Debugger

## 3 System Requirements

### Host Software Requirements

- For installation of the Intel(R) JTAG Debugger, root or sudo root rights are required. With user rights, the option to install the Intel(R) JTAG Debugger is not available during installation.
- Linux\* system running Fedora\* 14, Fedora\* 15, Ubuntu\* 11.04
- Ubuntu\* 10.04 for use with Intel® Atom™ Processor CExxxx target.
- Fedora\* 10 has only been partly validated for the use with Intel® Atom™ Processor CExxxx target.
- libusb 0.1.12 or higher
- fxload 0.0.20020411 or higher
- Linux32 OCDRemote v9.3-1 or newer is required for Macraigor Systems\* usb2Demon\* support. Support for the latest Intel® Atom™ processor based platforms may require newer driver versions. (check for recommended version at <http://www.macraigor.com/Intel/>)
- Java runtime environment (JRE) 1.5 or 1.6 to use the Eclipse\* framework. In a web browser, access [www.java.com](http://www.java.com) , and download and install JRE 1.6. Make sure that the \$PATH environment variable contains the path to the JRE bin-directory.
- Kernel development sources for your development host system will be required for Macraigor System\* driver installation

### Target Software Requirements

The target platform should be based on one of the following environments:

- Bare metal, BIOS, firmware environment
- MeeGo\* 1.1, MeeGo\* 1.2 based environment
- MeeGo\* compliant OS
- Timesys\* Fedora\* 11 rebuild for Intel® Atom™ processor E6xx
- Yocto Project\* 1.1 based Linux\* OS
- CE FDK Linux\* platform release PR22 or newer for Intel® Media processor CE3100 and Intel® Atom™ processor CE4xxx

### Hardware Requirements

- Intel® IA-32 architecture based host computer supporting Intel® Streaming SIMD Extensions 2 (Intel® SSE2) instructions (Intel® Pentium® 4 processor or later), or compatible non-Intel processor.
  - For the best experience, a multi-core or multi-processor system is recommended.
- 1GB RAM (2GB recommended)
- 4GB free disk space for all product features and all architectures
- USB 2.0 host interface

- In-Target Probe eXtended Debug Port on target platform
- One of the following target platforms:
  - Intel® development kit based on Intel® Atom™ processor Z5xx or Intel® Atom™ processor Z6xx
  - Intel® development kit based on Intel® Media processor CE3100 or Intel® Atom™ processor CE4xxx
  - Intel® development kit based on the Intel® Atom™ processor E6xx
- For Intel® Atom™ processor Z5xx,Z6xx, E6xx, CE4xxx the Macraigor Systems\* usb2Demon\* (<http://www.macraigor.com/usbDemon.htm>) JTAG hardware adapter.
- For all supported platforms alternatively Intel's XDP3 JTAG Hardware Adapter

## Host-Target Platform Support Matrix

**Table 1. Intel® JTAG Debugger**

Host / Target	Z5xx	Z6xx	E6xx	CE3100	CE4100	CE4200
Fedora* 10	McG, XDP	McG, XDP	McG, XDP	XDP	McG, XDP	McG, XDP
Fedora* 14	McG, XDP					
Fedora* 15	McG, XDP	McG, XDP	McG, XDP	XDP	McG, XDP	McG, XDP
Ubuntu* 11.04	McG, XDP	McG, XDP	McG, XDP	XDP	McG, XDP	McG, XDP

McG: Macraigor Systems\* usb2Demon

XDP: Intel(R) ITP-XDP3

## 4 Installation Notes

The default installation directory is `/opt/intel/atom/xdb/2.3.xxx`

For installation of the debugger update on the development host please follow the steps below:

1. Unpack the tool suite package in a directory to which you have write access.  
`> tar -zxvf l_MID_DBG_p_2.3.xxx.tgz`
2. If you do not have a license file, please note the product serial number. You will need it to complete the installation process. Otherwise copy the license file you may have received via email from the Intel® Software Development Products Registration Center to `/opt/intel/licenses/`.
3. It is recommended to register your product at <https://registrationcenter.intel.com>. If you purchased support for this product you will need to register to take full advantage of Intel Premier Support at <https://premier.intel.com>.
4. Change into the directory the tar file was extracted to `../l_MID_DBG_p_2.3.xxx`
5. Run the installation script

Execute the install script in the directory where the tar file was extracted.

```
>./install.sh
```

6. If you are not logged in as root, you will be asked if you want to install as root, install as root using sudo, or install without root privileges. Installing as root (using sudo if you have that privilege) is recommended, as that will update the system RPM database. Use the `install as current user` option if you want to install to a private area. To be able to install the Intel® JTAG Debugger however it is necessary to select "install as root" or "install as root using sudo". Without root privileges the option to install the Intel® JTAG Debugger will not be offered during install.
7. The welcome message to the Intel® Embedded Software Development Tool Suite 2.3 for Intel® Atom™ Processor appears along with an outline of the installation process. Press the `Enter` key to continue.
8. The installation routine checks for the availability of all product dependencies. Please take care of these dependencies, if a warning message appears.
9. Afterwards you will be asked to read the end-user license agreement for the tool suite. Press the `Enter` key to continue with reading the license agreement. Once done type `accept` to continue with the installation.
10. When asked whether you would like to activate and install your product select one of the options provided depending on whether you have a license file available or not. If there is already a valid license file available and installed on your system, the installation routine will recommend to simply use the existing license file. If you do not have access to the internet at the time of installation, select the alternative activation option.

11. The next screen let's you review your installation options. If you would like to only install the Intel® JTAG Debugger, select [3] and change the components settings. Else, continue with the default choice [1] to start the installation.

Step no: 4 of 6 | Options

---

You are now ready to begin installation. You can use all default installation settings by simply choosing the "Start installation Now" option or you can customize these settings by selecting any of the change options given below first. You can view a summary of the settings by selecting "Show pre-install summary".

---

1. Start installation Now
  2. Change install directory [ /opt/intel ]
  3. Change components to install [ All ]
  4. Show pre-install summary
  - h. Help
  - b. Back to the previous menu
  - q. Quit
- 

Please type a selection or press "Enter" to accept default choice [1]:

12. During the prerequisites check the presence of the Yocto Project\* Application Development Toolkit 1.1 (ADT) will be checked. If it is not present on your installation you will get a warning message.

The Yocto Project\* Application Development Toolkit is required if you want to use the Intel® Composer XE for building Yocto Project\* targeted applications. For automatic Intel® Composer XE integration with the Application Development Toolkit during installation, please install Toolkit first and re-check the prerequisites.

If you do not intend to develop applications targeting Yocto Project\* builds, you can ignore this warning message.

13. The installation will be finalized and you will be informed when the installation has been completed successfully.

Step no: 6 of 6 | Complete

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Thank you for installing and for using the Intel(R) Embedded Software Development Tool Suite for Intel(R) Atom(TM) processor version 2.3. Support services start from the time you install or activate your product. If you have not already done so, please create your support account now to take full advantage of your product purchase. Your support account gives you access to free product updates and upgrades as well as interactive technical support at Intel(R) Premier Support. To create your support account, please visit the Subscription Services web site <https://registrationcenter.intel.com/RegCenter/registerexpress.aspx?media=WJP>

---

q. Quit [default]

-----  
Please type a selection or press "Enter" to accept default choice [q]:

Below is a list of ready to go target connection configurations:

xdb_CE3100.sh	Intel® Media Processor CE31xx	Intel® ITP-XDP
xdb_CE4100_mcrq.sh	Intel® Atom™ Processor CE41xx	Macraigor* usb2Demon
xdb_CE4100.sh	Intel® Atom™ Processor CE41xx	Intel® ITP-XDP
xdb_CE4200_mcrq.sh	Intel® Atom™ Processor CE42xx	Macraigor* usb2Demon
xdb_CE4200.sh	Intel® Atom™ Processor CE42xx	Intel® ITP-XDP
xdb_E600_mcrq.sh	Intel® Atom™ Processor E6xx	Macraigor* usb2Demon
xdb_E600.sh	Intel® Atom™ Processor E6xx	Intel® ITP-XDP
xdb_Z500_mcrq.sh	Intel® Atom™ Processor Z5xx	Macraigor* usb2Demon
xdb_Z500.sh	Intel® Atom™ Processor Z5xx	Intel® ITP-XDP
xdb_Z600_mcrq.sh	Intel® Atom™ Processor Z6xx	Macraigor* usb2Demon
xdb_Z600.sh	Intel® Atom™ Processor Z6xx	Intel® ITP-XDP

To have the installer define a default xdb.sh configuration start script that points to one of these, please consult the advanced installation options.

## Installing Intel® XDP3 JTAG Probe

If the install.sh installation script is executed using root access, su or sudo rights, the required drivers will be installed automatically. Root, su or sudo rights are required for the installation.

## Installing Macraigor Systems\* usb2Demon\* Support

To enable support for the Macraigor Systems\* usb2Demon\* device for debugging Intel® Atom™ processor based platforms with the Intel® JTAG Debugger it is necessary to install the Linux\* drivers for the Macraigor Systems\* usb2Demon\* device. The driver can be found at [http://www.macraigor.com/full\\_gnu.htm](http://www.macraigor.com/full_gnu.htm). Please scroll down all the way and download and install the Linux32 OCDRemote package recommended at <http://www.macraigor.com/intel/>. Follow the installation instructions posted at the same location closely.

1. For Fedora\* host installations download mcgr-hwsupport-x.x-x.i386.rpm from <http://www.macraigor.com/intel/>. For Ubuntu\* host installations you can download mcgr-hwsupport-x.x-x.i386.deb from the same location. You will find the latest recommended version of the OCDRemote\* driver set referenced there.
  - Support for the Intel® Atom™ processor Z5xx will require at least version 7.9-0.
  - Support for the Intel® Atom™ processor Z6xx will require at least version 8.3-0.
  - Support for the Intel® Atom™ processor E6xx will at least require version 8.7-0.
  - Support for the Intel® Atom™ processor CE4xxx will at least require version 9.3-1

We recommend the use of at least version 9.4-0 regardless of your hardware target.

Ensure you have root or sudo access rights on your Linux\* installation.

2. Install mcgr-hwsupport-x.x-x.i386.rpm using the `rpm -i` command or mcgr-hwsupport-x.x-x.i386.deb using the `dpkg -install` command .
3. You should now be able to launch the Intel(R) JTAG Debugger using the respective `xdb_processorname_mcrq.sh` startup script. These scripts are being put into the `/opt/intel/atom/xdb/2.3.xxx/bin` directory by the tool suite installer as described in the general installation section above.

For further details on how to configure the OCDRemote\* driver set from Macraigor\* Systems, please refer to the full installation instructions at [http://www.macraigor.com/eclipse/eclipse\\_faq.htm](http://www.macraigor.com/eclipse/eclipse_faq.htm).

## Uninstalling the Debugger

To uninstall, simply go to the bin directory of the debugger component you would like to uninstall `/opt/intel/atom/xdb/2.3.xxx/bin` and run the corresponding `uninstall_dbg.sh` script you find there.

## 5 Features

### 5.1.1 Full Intel LPIA Silicon & Chipset support

Provides an in-depth view into Intel® Atom™ Processor chipsets. Supports silicon specific features, including architectural registers, Intel® Streaming SIMD Extensions 3 (SSE3), as well as Graphics Chipset Register support through JTAG. Graphical representation of peripheral registers and bit fields with online documentation.

### 5.1.2 Execution Trace Support

Enables viewing of execution history and thus enhances understanding of the flow of an executed program allowing the analysis of the execution path to find errors and identify the root cause for exceptions.

### 5.1.3 OS Awareness / Kernel Module Debugging

The Linux\* OS awareness pulldown menu allows visibility of all currently active kernel threads. It also provides the ability to view a list of all currently loaded kernel modules with status information and memory location of initialization methods and cleanup methods. Setting whether to stop the target and commence debugging a kernel module on module load, initialization or cleanup/exit allows to start debugging a kernel module and loading its symbolic information. You can then set your breakpoints at the function entry points of the kernel module you want to debug, release the target using the *run* command and trigger an event that will cause the breakpoint to be hit to start your actual debug session.

You do not need to select kernel modules that are already loaded, but can add additional kernel module names to the list of kernel modules that are monitored and have the debugger stop at load, initialization or cleanup just as it would with the kernel modules that are already populated in the OS awareness pulldown menu as they were loaded during the Linux\* OS boot process.

To debug kernel modules the following steps additional to selecting or adding a kernel module in the module list are necessary.

In a debugger script or in the debugger console window enter the following commands:

```
SET DIRECTORY "<kernel module path>"
```

```
OS "SETDIR \"<kernel module source path>\""
```

These two path settings are necessary to enable the automatic source and symbol info mapping upon kernel module load as described above. Please note that the corresponding functionality in the OS Awareness plug-in graphical user interface is currently broken. You will need to use the command window to inform the debugger of the kernel module source path.

To use this feature for runtime loaded kernel module debugging you will need to have the kernel module **idbntf.ko** running and installed on the target device. The folder

**/opt/intel/atom/xdb/2.3.xxx/kernel-modules/idbntf** contains code to generate a Linux\* kernel module that enables kernel module debugging with the Intel system debugger.

For generation simply transfer these files to your target system and invoke make. This will generate the kernel object **idbntf.ko**.

To enable module debugging this object has to be loaded prior to starting the debugger via the command **insmod idbntf.ko**. After finishing the debug session, the module can be unloaded with **rmmod idbntf**.

#### 5.1.4 FTL Lite NAND Flash Programming on the Intel® Atom™ Processor CE4100

**Note-** Please see the Platform Support Guide that came with your development kit for more detailed information about programming the FTL Lite partition in the Intel® Atom™ Processor CE4100 NAND flash.

The first 66 blocks of the flash memory is reserved as the FTL Lite partition. In this space each block is written redundantly 8 times per DHG's spec. In order to minimize user complexity, our implementation of the FTL Lite partition accounts for these extra copies. However, by doing so, this requires a minimum read or write size to be 1 block (128 KB).

#### Addressing

The conversion from FTL Lite partition block number to address is simple however not straightforward. Since the redundant blocks are not addressable you must divide the block number by 8 (number of redundant copies) then multiply by block size (128KB). Below is a formula and table that converts some frequently used block locations. (As described in the Platform Support Guide)

$$\text{address} = \text{block \#} / 8 * 0x20000$$

<u>Data</u>	<u>Block #</u>	<u>Address</u>
MBH and BBT	0	0x 0000 0000
CEFDK	8	0x 0002 0000
Redboot	40	0x 000A 0000
Platform parameters	48	0x 000C 0000

## Backup

When doing a backup use the same addressing method described above. For the length parameter, values must be a multiple of block size. Therefore 128KB (0x20000) is the minimum read size. Also keep in mind that only 1 block will be read from the first 8 blocks of redundant data. Our algorithm automatically accounts for the redundant block and will return only 1 of the 8 copies. Therefore reading 2 blocks at offset 0 will return block 0 and block 8.

**Warning-** Reading back a recently erased block of data will sometimes crash the target. ECC error logic isn't in sync with erased blocks and therefore can cause the target to hang.

### 5.1.5 eMMC NAND Flash Programming on the Intel® Atom™ Processor CE4200

## Partitions

There are 3 partitions defined on eMMC. Our flash tool is capable of programming each of the 3 partitions: boot1, boot2 and the user partition.

## Addressing

Addressing space for each partition is independent. Therefore you should address the beginning of each partition as address 0. Currently 32KB is the minimum write or read size that we support.

## Erasing

Block erasing is not implemented for this flash. eMMC flash can be written to without erasing first. Therefore the only erase we support is on the entire partition.

Note- Currently "Verification" is not supported on eMMC flash. Please do a backup and manual binary diff the two files.

### 5.1.6 JTAG Debugger Flash Memory Tool support on Intel® Atom™ processor based software development platforms

The Intel® JTAG Debugger provides support for download and burning of images into flash memory on platforms based on the Intel® Atom™ processor Z6xx and E6xx. The flash memory tool plug-in and menu entry in the Intel® JTAG Debugger graphical user interface permits selection of the desired platform type via pulldown menu and thus offers a convenient method to update flash content.

In addition flashing from within the debugger can be automated using the debugger's powerful scripting language. Below is an example of the debugger script language that could be used for this purpose

```
Flash "select /board= 'targetboard'"  
Flash "change offset 0x00"
```

```
Flash "change datafile '/home/demo/BIOS50.bin'"
Flash "burn flash false true true"
```

The same flashing support is also available in form of the command line XFLASH - Intel(R) JTAG Debugger Flash Memory Tool located at /opt/intel/atom/xdb/2.3.xxx/xflash-bin. Please refer to the ./xflash.sh -help option for details about the command line syntax.

XFLASH - Intel(R) JTAG Debugger Flash Memory Tool - Version: 3.3.1

Copyright (c) 2001 - 2010 Intel Corporation. All rights reserved.

XFLASH [<options>] -platform <arg> [<image file>]

```
[-(help|?)]          print usage
[-(platform|p) <arg>]  specify the hardware platform
[-(erase|e)]          erase flash
[-(lock|l)]           lock flash
[-(unlock|ul)]        unlock flash
[-(check|c)]          check that the flash is erased
[-(erasecheck|ec)]    erase and check that flash is erased
[-(verify|v)]         verify flash memory after burning
[-(verifyonly|vo)]    verify flash memory WITHOUT burning
[-(special|s) <num>]  execute special flash function
[-(overwrite|ow)]     overwrite existing data
[-(fileformat|ff) <arg>] specify image file format
[-(offset|o) <num>]   image offset
[-(flashbase|fb) <num>] flash base address in the target
[-(algorithmbase|ab) <num>] burn algorithm address in memory
[-(flashname|n) <arg>] select the flash name
[-(block|b) <arg>]    specify blocks
[-(blockdata|bd)]     all data blocks
[-(blockboot|bb)]     all boot blocks
```

Usage examples:

```
=====
```

```
xflash.sh test.bin -platform "target platform"
```

The "target platform" argument for the -platform option has the format BOARDNAME\_FLASHNAME.

Below is a listing of the supported target platform types:

- CE4100\_NOR
- CE4200\_EMMC\_BOOT1
- CE4200\_EMMC\_BOOT2
- CE4200\_EMMC\_USER
- CE4200\_NOR
- E600\_BIOS
- MIDZ500\_BIOS
- MIDZ600\_NAND

**Below is a brief description of the supported flash types for the specific target platforms:**

**Intel® Atom™ processor Z6xx**

- Unprotected NAND flash partition
- When choosing an OS Image as data file in the Flash Memory Tool dialog, it automatically analyses the file and writes the OS and OS headers to the correct location in the NAND partition.

**Intel® Atom™ procesor E6xx**

- SPI-FLASH .

**Intel® Atom™ Processor CE41xx:**

- FTL Lite NAND Flash
- NOR Flash

**Intel® Atom™ Processor CE42xx:**

- NOR Flash
- eMMC NAND Flash
- eMMC Boot Partitions
- eMMC User Partition

**5.1.7 Support for Intel® Atom™ processor Z6xx OS images with the JTAG Debugger Flash Memory Tool**

The Flash Memory Tool for Intel(R) Atom(TM) processor Z6xx supports writing of OS Images to the unprotected NAND flash partition.

When choosing an OS Image as data file in the Flash Memory Tool dialog, it automatically analyses the file and writes the OS and OS headers to the correct location in the NAND partition.

1. To use the Flash Memory Tool for the protected NAND partition, the platform must be booted into the firmware 'shell':
2. Connect a serial cable to the IA SPI0 card
3. Setup HyperTerminal to the following COM settings: 115200 bits per second, 8 data bits, no parity, 1 stop bit and no flow control
4. Power on the target - Firmware Development Kit (FDK) message and shell prompt should be displayed in the HyperTerminal screen. If the firmware doesn't stop at the shell prompt, please refer to your Software Developer Platform (SDP) User Guide:
  - a. VV platform: Jumper setting J1B1, pins 1-3 are BIOS Option 1 - Diagnostic Mode - enter shell by default
  - b. CDK/KDK platform: SW1DB6 - SW1 DIAGNOSTIC ON - OFF = ENABLED: Enter FDK shell

5. Start the JTAG debugger and open the Flash Memory Tool dialog

### **5.1.6 Scripting Language**

Create a batch file based on a rich set of powerful debugging script language commands and execute it in non-interactive mode. Results can be logged and analyzed afterwards.

### **5.1.7 Page Translation Table**

Instant and simple resolution and translation between physical and virtual address space.

### **5.1.8 Unload of Symbol Information**

To unload a symbol file, open the Load dialog. Click the “Unload Symbol File” tab and select the symbol file to be unloaded. This will remove the symbol information from the debug session. Removing symbol information is useful in order to load different or new symbol information.

### **5.1.9 Power Events Handling**

The debugger can properly handle externally controlled power events without needing to close the debugger. If a target is reset or powered-off the debugger will identify the “Target power loss.” Once power is restored the debugger will attempt to halt the target at the reset vector.

## 6 Usage Notes

### 6.1.1 Starting the Debugger

To start the Intel® JTAG Debugger for Intel® Atom™ Processor change into the `<install-dir>/atom/xdb/2.3.xxx/bin/ia32/` directory.

From there run the debugger launch shell script that best fits your host-target setup.

Below is a list of ready to go target connection configurations:

<code>xdb_CE3100.sh</code>	Intel® Media Processor CE31xx	Intel® ITP-XDP
<code>xdb_CE4100_mcrq.sh</code>	Intel® Atom™ Processor CE41xx	Macraigor* usb2Demon
<code>xdb_CE4100.sh</code>	Intel® Atom™ Processor CE41xx	Intel® ITP-XDP
<code>xdb_CE4200_mcrq.sh</code>	Intel® Atom™ Processor CE42xx	Macraigor* usb2Demon
<code>xdb_CE4200.sh</code>	Intel® Atom™ Processor CE42xx	Intel® ITP-XDP
<code>xdb_E600_mcrq.sh</code>	Intel® Atom™ Processor E6xx	Macraigor* usb2Demon
<code>xdb_E600.sh</code>	Intel® Atom™ Processor E6xx	Intel® ITP-XDP
<code>xdb_Z500_mcrq.sh</code>	Intel® Atom™ Processor Z5xx	Macraigor* usb2Demon
<code>xdb_Z500.sh</code>	Intel® Atom™ Processor Z5xx	Intel® ITP-XDP
<code>xdb_Z600_mcrq.sh</code>	Intel® Atom™ Processor Z6xx	Macraigor* usb2Demon
<code>xdb_Z600.sh</code>	Intel® Atom™ Processor Z6xx	Intel® ITP-XDP

To have the installer define a default `xdb.sh` configuration start script that points to one of these, please consult the advanced installation options.

The debugger is now running and will establish a debug connection to the powerd-on target device.

### 6.1.2 Enabling Run-Time Loaded Kernel Module Debugging

To use this feature for runtime loaded kernel module debugging you will need to have the kernel module **idbntf.ko** running and installed on the target device. The folder `/opt/intel/atom/xdb/2.3.xxx/kernel-modules/idbntf` contains code to generate a Linux kernel module that enables kernel module debugging with the Intel system debugger.

For generation simply transfer these files to your target system and invoke `make`. This will generate the kernel object **idbntf.ko**.

To enable module debugging this object has to be loaded prior to starting the debugger via the command **insmod idbntf.ko**. After finishing the debug session, the module can be unloaded with **rmmod idbntf**.

### 6.1.3 FTL Lite NAND Flash Programming on Intel® Atom™ Processor CE4100

**Note-** Please see the Platform Support Guide that came with your development kit for more detailed information about programming the FTL Lite partition in the Intel® Atom™ Processor CE4100 NAND flash.

The first 66 blocks of the flash memory is reserved as the FTL Lite partition. In this space each block is written redundantly 8 times per DHG's spec. In order to minimize user complexity, our implementation of the FTL Lite partition accounts for these extra copies. However, by doing so, this requires a minimum read or write size to be 1 block (128 KB).

## Addressing

The conversion from FTL Lite partition block number to address is simple however not straightforward. Since the redundant blocks are not addressable you must divide the block number by 8 (number of redundant copies) then multiply by block size (128KB). Below is a formula and table that converts some frequently used block locations. (As described in the Platform Support Guide)

$$\text{address} = \text{block \#} / 8 * 0x20000$$

<u>Data</u>	<u>Block #</u>	<u>Address</u>
MBH and BBT	0	0x 0000 0000
CEFDK	8	0x 0002 0000
Redboot	40	0x 000A 0000
Platform parameters	48	0x 000C 0000

## Backup

When doing a backup use the same addressing method described above. For the length parameter, values must be a multiple of block size. Therefore 128KB (0x20000) is the minimum read size. Also keep in mind that only 1 block will be read from the first 8 blocks of redundant data. Our algorithm automatically accounts for the redundant block and will return only 1 of the 8 copies. Therefore reading 2 blocks at offset 0 will return block 0 and block 8.

**Warning-** Reading back a recently erased block of data will sometimes crash the target. ECC error logic isn't in sync with erased blocks and therefore can cause the target to hang.

### 6.1.4 eMMC NAND Flash Programming on Intel® Atom™ Processor CE4200

## Partitions

There are 3 partitions defined on eMMC. Our flash tool is capable of programming each of the 3 partitions: boot1, boot2 and the user partition.

## Addressing

Addressing space for each partition is independent. Therefore you should address the beginning of each partition as address 0. Currently 32KB is the minimum write or read size that we support.

## Erasing

Block erasing is not implemented for this flash. eMMC flash can be written to without erasing first. Therefore the only erase we support is on the entire partition.

Note- Currently “Verification” is not supported on eMMC flash. Please do a backup and manual binary diff the two files.

### 6.1.5 Support for Intel® Atom™ processor Z6xx OS images with the JTAG Debugger Flash Memory Tool

The Flash Memory Tool for Intel® Atom™ processor Z6xx supports writing of OS Images to the unprotected NAND flash partition.

When choosing an OS Image as data file in the Flash Memory Tool dialog, it automatically analyses the file and writes the OS and OS headers to the correct location in the NAND partition.

6. To use the Flash Memory Tool for the protected NAND partition, the platform must be booted into the firmware 'shell':
7. Connect a serial cable to the IA SPI0 card
8. Setup HyperTerminal to the following COM settings: 115200 bits per second, 8 data bits, no parity, 1 stop bit and no flow control
9. Power on the target - Firmware Development Kit (FDK) message and shell prompt should be displayed in the HyperTerminal screen. If the firmware doesn't stop at the shell prompt, please refer to your Software Developer Platform (SDP) User Guide:
  - a. VV platform: Jumper setting J1B1, pins 1-3 are BIOS Option 1 - Diagnostic Mode - enter shell by default
  - b. CDK/KDK platform: SW1DB6 - SW1 DIAGNOSTIC ON - OFF = ENABLED: Enter FDK shell
10. Start the JTAG debugger and open the Flash Memory Tool dialog

### 6.1.6 Unload of Symbol Information

To unload a symbol file, open the Load dialog. Click the “Unload Symbol File” tab and select the symbol file to be unloaded. This will remove the symbol information from the debug session. Removing symbol information is useful in order to load different or new symbol information.

## 7 Issues and Limitations

### Resolved Issues

#### 7.1.1 Macraigor\* usb2Demon now supports reset on Intel® Atom™ processor CE4200 reference platform

With Linux32 OCDRemote v9.0-6 driver it is now possible to trigger a board reset on the Intel® Atom™ processor CE4200 reference platform from within the debugger. When the Macraigor\* usb2Demon device is connected to the reference board the board will reset.

#### 7.1.2 Macraigor\* usb2Demon no longer requires super user rights to establish debug connection.

Establishing JTAG debug connection with the Intel® JTAG Debugger and the Macraigor\* usb2Demon device no longer requires to launch the debugger with super user rights either in a sudo shell or an su shell. Use of the Intel® ITP-XDP device does however still require this.

#### 7.1.3 Disassembly Window now fully support source level breakpoints

Only breakpoints set in the disassembly window are visible in the disassembly window. Active breakpoints set in the source window will not be indicated as such in the disassembly window.

#### 7.1.4 Variable evaluation with DWARF3 and DWARF4 symbol information

The Intel® JTAG Debugger does now have support for debug information based on DWARF3 and DWARF4 standard extensions.

#### 7.1.5 Symbol Browser usage within in dialog windows

When using the Symbol Browser from the Browse... button in dialogs, for example in the `Set Breakpoint` dialog, the browser now correctly adds the symbol name into the selection field..

#### 7.1.6 Target Release when Exiting the Debugger

When exiting and closing the debugger while the target platform is halted, the target platform will be released and resume running mode.

#### 7.1.7 C State handling

The C state of the Intel® Atom™ processor will temporarily disable parts of the processor including JTAG. The Intel® JTAG Debugger is now able to handle processor C states correctly and regain full run control as soon as JTAG is powered again.

## Known Issues and Limitations

### 7.1.8 Support for Intel® Atom™ processor bitfield editor register views

To receive information on how to access bitfield editor chipset register views for Intel® Atom™ Processors, please send an email to [EmbeddedDevTools@intel.com](mailto:EmbeddedDevTools@intel.com) for details.

### 7.1.9 Online Help for Intel® Debugger has not been updated for this release

The context sensitive help available from within the Intel® Debugger graphical user interface reflects the status prior to the Intel® Embedded Software Development Tool Suite 2.3 release. Please consult these release notes and the Getting Started Guide for the latest up-to-date information.

### 7.1.10 Debugger puts a Windows file system lock on symbol files

Currently when a Symbol file is loaded in the debugger a file system lock is placed on this file to prevent other processes from deleting or modifying this file. If this lock is preventing you from recompiling your program, simply use the Unload feature found in the Load Dialog. Unloading a symbol file will release the file system lock and allow you to modify or delete the symbol file without exiting the debugger.

### 7.1.11 Frequently loading and unloading debug symbols

Reloading symbol information numerous times can cause an “Out of Memory” exception and crash the debugger. Due to memory leaks, reloading symbol information numerous times without exiting the debugger can cause the debugger to use more than the allotted 2GB of memory. This will cause a fatal exception and will crash the debugger. A work around for this issue is to exit the debugger if the memory usage becomes high.

### 7.1.12 Maximum number of symbol files

Currently a limitation has been placed on the debugger to only allow one piece of debug information at a time. Loading multiple symbol files was causing unreliable results. These bugs will be addressed and this limitation should be lifted in future versions.

### 7.1.13 Master Flash Header Read/Write not supported for Intel® Atom™ Processor CE4200

On the Intel® Atom™ Processor CE4200 the Master Flash Header serves as a road map for the contents of flash that are processed by security and host firmware. It contains the location and size of each element in the flash, as well as a list of host firmware images that the security processor will attempt to boot. Currently the flash writer plug-in for the Intel® JTAG Debugger does not support writing or modifying the Master Flash Header.

It is of course possible to use the terminal Master Flash Header commands `mfhlist` `mfhinfo` and `mfhinit` in conjunction with the Intel® JTAG Debugger flash writer plug-in.

`mfhlist` provides the location of the Master Flash Header entries and where the current platform boot configuration expects the various flash images to be put. It's output can be used as a guidance for setting the start address when using the flash writer plug-in.

For NOR Non-Trusted Boot and NAND/eMMC Non-Trusted boot can be configured such that target boot is possible even if no Master Flash Header is present on the platform.

eMMC Trusted Boot does require the presence of a Master Flash Header and requires that the actual memory layout does match its contents.

Please read the Platform User Guide closely for further details on the Master Flash Header and its usage.

#### **7.1.14 Intel® Atom™ Processor CE4xxx flashing only supported from GUI**

The platform types for the various NAND and NOR flashes on Intel® Atom™ Processor CE4xxx based platforms are currently not supported by the XFLASH - Intel(R) JTAG Debugger Flash Memory Tool - Version: 3.3.1 command line flashing tool. Please use the debugger's graphical user interface to flash these platforms.

#### **7.1.15 Flash programming with empty flash parts (CE4100, CE4200)**

In order for the flash burning algorithm to execute the target must first be restarted and sitting at the reset vector. This is normally handled by the flash plugin. However, on CE4x00 boards that do not have programmed flash parts, the platform's reset does not function. Therefore, when programming these boards, a manual reset is required.

To successfully burn flash on platforms with blank flash, a user should follow these steps:

- 1) Connect the debugger, and verify that the target is halted
- 2) Manually reset the target by pressing the reset button on the target
- 3) Verify that the EIP is not pointing at `0xFFFF0`
- 4) Open the flash plugin dialog and resume normal steps to program the flash.

#### **7.1.16 Use of Macraigor\* usb2Demon to debug Intel® Atom™ processor CE4xxx based platforms may require board changes**

On some of the Intel reference platforms for Intel® Atom™ processor CE4100 the RefDes serial resistor R6D20 may need to be replaced with a 0 Ohm resistor. On some of the Intel reference platforms for Intel(R) Atom(TM) processor CE4200 the RefDes serial resistor R4E5 may need to be replaced with a 0 Ohm resistor. Please refer to the board schematics and the platform design guides for details.

#### **7.1.17 Older Macraigor\* usb2Demon 60pin connector headers**

The reference voltage and signal voltage pins on Macraigor\* usb2Demon 60pin connector headers from prior to September 2010 are connected. Since those two voltages differ from each other on the Intel® Atom™ Processor E600 reference platform it is strongly recommended to only use recently purchased Macraigor\* usb2Demon 60pin connector headers with these platforms. Not following this recommendation can damage the reference platform.

### **7.1.18 Backup of large flash partitions may fail**

It is recommended to avoid using the flash writer plug-in to backup large flash partitions (>200Mb) from the Intel® Atom™ Processor onto the workstation.

### **7.1.19 Verification of flash content on Intel® Atom™ processor E6xx based platform**

Verifying flash content may only be possible immediately after writing it. When the system boots, it might modify the flash content (e.g. saving changed settings). When the flash content will be compared to the original file that got written to the flash, the verification will show differences.

### **7.1.20 Intel® Media processor CE3100 Support Limitations**

The XFLASH – Intel® JTAG Debugger Flash Memory Tool 3.3.2 does currently not support the Intel® Media processor CE3100. Also On-chip Trace buffer support is not available for the Intel® Media processor CE3100.

### **7.1.21 Memory Read using Macraigor\* usb2Demon with OCDRemote 9.0-6 slow.**

Memory Read access using the Macraigor\* usb2Demon with OCDRemote 9.0-6 is slow. It is recommended to avoid flash backup from within the flash writer GUI plug-in of the Intel® JTAG Debugger when using this device driver version.

### **7.1.22 Function and file information not listed for watchpoints in breakpoint window**

When setting a data breakpoint (watchpoint) the breakpoint listing in the breakpoint window does not contain file and function information for the data breakpoint.

### **7.1.23 Stepping out of kernel module into statically linked code can lead to temporary debugger stall**

When stepping out of a function inside a kernel module into statically link OS kernel code) the debugger can lose run-control of the target. Halting code execution or single stepping will not work. Using Ctrl-C with focus on the console window or pressing the button “Send interrupt to Debugger” will reestablish full target control if this occurs. The recommended workaround is to use a breakpoint in the kernel source code instead of simply stepping out of a kernel module.

### **7.1.24 Target doesn't boot when Macraigor\* usb2Demon\* JTAG device is not initialized**

If the Macraigor\* probe is connected to the host system the first time, it doesn't get initialized until a debugger is using the probe. Without initialization the probe, the JTAG pins are in an undefined state and can prevent the target system from booting. The might lead to unstable behavior on the target including failing boot sequence. After the debugger has initialized the probe the target system should boot without problems.

This does not affect the XDP3 connection. XDP3 probe is automatically initialized when it gets plugged into the host system.

### **7.1.25 Local variables and evaluation windows do not display multi-dimensional arrays correctly**

Multi-dimensional arrays are displayed as vectors in the debugger's local variables window and evaluations window suppressing one dimension of the array.

### **7.1.26 Evaluation window for global variables may be missing type information**

When evaluating a global variable in a debugger evaluation window the variable name and its value are displayed, but type information may not be displayed.

### **7.1.27 On-chip instruction trace window does not update after single step**

When single stepping while having instruction trace enabled and the instruction trace window open the content of the trace window will not be updated with the single step.

### **7.1.28 Writing to a non-writable vector registers may incorrectly update register value display**

In the vector register window it is possible that a write to a vector register seems to have been successful, when a new value was entered from within said window, despite the register being non-writable at the time and not actually having been updated.

### **7.1.29 Platform watchdog timer may trigger reset when debugging next generation Intel® Atom™ processor for handset based platforms running release builds of MeeGo\*.**

After halting target platform execution during a JTAG debug session for several seconds the platform may automatically enter reset. This may be due to a watchdog timer that needs to be disabled before debugging the software stack. Please contact technical support for details on disabling it.

### **7.1.30 With Intel® Hyper-Threading Technology disabled in BIOS debugger SMP configuration must be disabled as well when using Macraigor Systems\* usb2Demon\***

When Intel® Hyper-Threading Technology is disabled in the BIOS, the debugger SMP configuration must be turned off as well. The Macraigor System\* driver interface returns an error condition on disabled processor cores that is indistinguishable from other error conditions for the debugger. If SMP support is disabled, the debugger will not try to access the second hyper-thread and thus the error condition will not occur.

To disable SMP support please edit `xdb.sh` in the `/opt/intel/atom/xdb/2.x.xxx/bin` directory and change `-tgtype 'JTAG IA SMP'` to `-tgtype 'JTAG IA'` in the java launch command line.

With current Macraigor Systems\* drivers the above mentioned error condition may rarely also occur if on an SMP enabled system one hyper-thread is halted during debugger memory read/write operations.

### **7.1.31 Root or Sudo Access required for JTAG Debugger Install**

To be able to install the Intel(R) JTAG Debugger it is necessary to either launch the tool suite installation script `install.sh` with root privileges or to select "install as root" or "install as root using sudo" during the Intel(R) Embedded Software Development Tool Suite installation process. Installation without root privileges will not be successful.

### 7.1.32 Long Upload Time of Debug Information

Load of debug info from large applications or from system libraries (which need to be transferred from the target to the host) may take a long time although the debugger seems to have finished the symbol load. For example, in the Console window the debugger prompts quite quickly that the breakpoint has been reached, in the Source window the source file is displayed and the yellow arrow is seen at the current position of the breakpoint. However, the load of the complete symbol info may not yet have finished and the debugger may not yet be ready to accept new commands (on Console window or with the GUI).

To check whether the debugger has finished symbol load please click into the Console window and hit the "Enter" key. Once the debugger issues the debugger prompt (ldb) it's ready to accept new commands.

### 7.1.33 Memory Writes to Un-Initialized Memory

Memory writes to un-initialized or read-only memory (this includes setting software breakpoints or accessing memory mapped registers) can lead to a crash of the target or a loss of the target control. The debugger will not prevent these memory accesses when requested by the user (e.g. changing instructions in the disassembly window).

### 7.1.34 Kernel Module Source Path Selection Tool

To debug kernel modules the following steps additional to selecting or adding a kernel module in the module list are necessary.

In a debugger script or in the debugger console window enter the following commands:

**SET DIRECTORY "<kernel module path>"**

**OS "SETDIR \"<kernel module source path>\\""**

These two path settings are necessary to enable the automatic source and symbol info mapping upon kernel module load as described above. Alternatively you may use the corresponding functionality in the OS Awareness plug-in graphical user interface.

### 7.1.35 Setting Software Breakpoints during OS Boot

Setting a breakpoint during OS boot without explicitly declaring it to be a hardware breakpoint (for instance by double clicking on a line in the disassembly window) will lead to a loss of target control. The debugger tries to modify memory, by setting a software breakpoint, reads it back and realizes the software breakpoint cannot be set. It will then try to set a hardware breakpoint instead, but the attempted write access to non-initialized memory may already have corrupted the platform

The workaround is to force the use of hardware breakpoints for stepping as well by using the debugger script command:

```
set option /hard=on
```

### 7.1.36 Flash Writer disables pre-existing Breakpoints

Flashing the BIOS will disable all code breakpoints and data breakpoints you may have had set prior to using the flash writer.

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