Firmware Downloader Utility

User's Manual

UM-0015

About Oztek

Oztek Corp. is proven innovator of power, control, and instrumentation solutions for the most demanding industrial applications. Oztek products include variable motor drives, grid tie inverters, frequency converters, stand alone inverters, DC/DC converters, and DSP based control boards for power control applications.

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Exclusion for Documentation

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1.   Introduction

This manual is intended to provide instruction on how to use the Oztek Firmware Downloader Utility. The Downloader is a Microsoft Windows based Graphical User Interface (GUI) that provides the user a simple tool for updating programmable devices on Oztek's embedded Power Control products.

The Downloader Utility can be used to program the DSP FLASH memory, the Bootloader EEPROM device, and a data EEPROM device using either a CAN communication port or a serial interface such as RS-232/422/485. The Downloader Utility operates in conjunction with a "Bootloader" program that runs on the control board's DSP device following a power on reset (POR).

The Bootloader image is stored in a separate EEPROM device and is loaded into the DSP upon a POR event. If enabled, the Bootloader will run for a timeout period. During the timeout period it waits to connect to an external host such as the Firmware Downloader Utility or a higher level system controller. If it does not connect within the timeout period, it will terminate and begin execution of the main application program stored in the DSP's Flash memory. Please consult the documentation for the specific control board being used for details on enabling the Bootloader. For details on the communication protocol used by the Bootloader and how to interface to it, please reference FS-0057.

1.1   Referenced Documents

Ref.	Document	Description
[1]	FS-0057	Oztek TMS28x CAN Bootloader Functional Specification
[2]	UM-0007	Oztek OZDSP2000 Users Manual
[3]	UM-0018	Oztek OZDSP3000 Users Manual

1.2   Definitions

CAN	Controller Area Network
DSP	Digital signal processor
EEPROM	Electrically Erasable Programmable Read Only Memory
GUI	Graphical User Interface
PCB	Printed Circuit Board
POR	Power On Reset
RAM	Random Access Memory
USB	Universal Serial Bus

2.   System Requirements

- Microsoft Windows (XP or newer) based PC with an available USB port
- .NET Runtime 4.0 or higher (available via http://www.microsoft.com)
- One of the following communications interfaces (depending on the control board hardware variant being used):
  a. CAN
     i.   USB to CAN converter (see table below for supported devices)
     ii. USB cable
     iii. Control Board CAN cable (controller board specific)
  b. Serial RS-232
     i.   9-pin serial cable
  c. Serial RS-422/485
     i.   USB Adapter (if necessary), such as USPTL4-LS from B&B Electronics
     ii. USB cable
     iii. Control Board serial cable (controller board specific)

When using a CAN interface, the Downloader supports multiple USB to CAN hardware converters. Details of the supported devices are provided in Table 1. In order for these devices to work properly, manufacturer-specific drivers must be installed on the computer.

Table 1 - Supported USB to CAN Converters

Vendor	Device
Vector www.vector.com	CANcaseXL
Softing www.softing.com	CANusb
Peak / Grid Connect www.gridconnect.com	USB/CAN

3.   Installation Procedure

Before installing the Downloader application, be sure to install all of the necessary drivers for the chosen USB adapter hardware if any is being used. For instructions on how to install the drivers, please refer to the product manufacturer's documentation. Once the required hardware drivers are installed, the Downloader application can be installed using the installer executable available on the Oztek web site (www.oztekcorp.com). This installer will have a file name of **SW90095-*XX*_setup_*revY_Z*.exe**, where:

- ***XX*** is '**32'** for installing on a 32-bit Windows system or '**64'** for installing on a 64-bit Windows system
- ***revY_Z*** is the most current revision of the Downloader (i.e. rev2_0)

4.   Using the Downloader Utility

Before launching the Downloader Utility application, the CAN or serial hardware connections must be made between the PC and the Oztek DSP control board.

> **Note:** *Do not apply power to the DSP control board before launching the Downloader Utility.* The control board will only attempt to communicate with the Downloader for a short time following a POR. If the control board has already been powered on when the Downloader is launched, it may be necessary to cycle power on the control board in order to establish communications.

Open the Downloader application by double-clicking on the "Oztek Downloader" icon. The following graphic depicts the main dialog window for the Downloader Utility. Note that only the menu bar and the **Browse** button are enabled. Other components are enabled as the user interacts with the application.
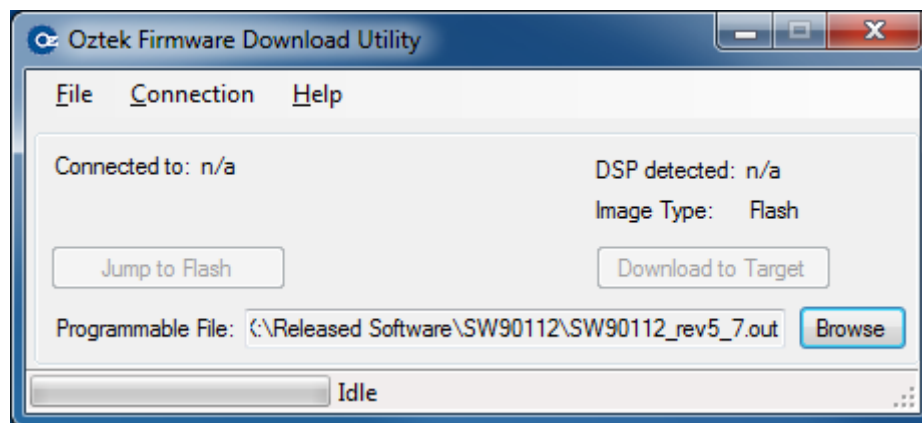
4.1   Specifying the Log File Directory

The Download Utility automatically saves a log file for each download session started. The user can specify the log file directory by selecting the *"File -> Log File Directory…"* menu item.

4.2   Selecting the Programmable File

The **Browse** button to the right of the **Programmable File** text box can be used to select a new code image to download. Pressing this button will open the **Select Target** window, shown below.
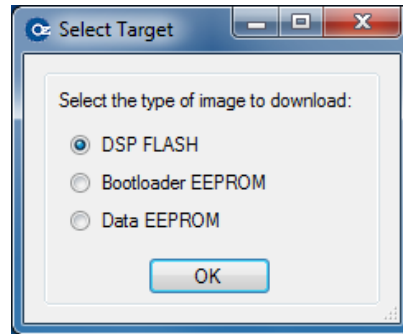
Note that Oztek control boards may have up to three different programmable devices whose images are defined as follows:

- **DSP FLASH**: This image is the controller's runtime application and is stored in the internal FLASH memory of the DSP on the control board.
  Valid File Type: Code Composer Linker Generated COFF output file (*.out).

- **Bootloader EEPROM**: This image contains the routines necessary to connect with the Downloader Utility and is responsible for programming the selected device. Care must be taken when selecting the EEPROM Boot Image for programming since future programming of the FLASH and Boot EEPROM images will not work if a non-EEPROM Boot image is selected.
  Valid File Type: Code Composer Linker Generated COFF output file (*.out).

- **Data EEPROM**: This image can be used for different purposes depending on the application code running on the DSP. As such, this download type is optional and may not be supported by some applications. This is typically not an executable image, but rather user or application data that gets stored in an external EEPROM device.
  Valid File Type: Motorola S-record formatted HEX file (*.hex).

Selecting the type of image and pressing "**OK**" will open a file dialog window. At this point the user will navigate to the appropriate location and select the desired programming file.

4.3   Connecting to the Target

To search for an attached target control board, the user must use the *"Connection"* menu item. If using CAN, select the appropriate CAN adapter from the *"Connection -> CAN -> Connect"* menu item as shown in the figure below. Note that the *"Enable Legacy CAN I/F"* menu item is typically only used to support older legacy Oztek controllers and should be left unchecked by default.
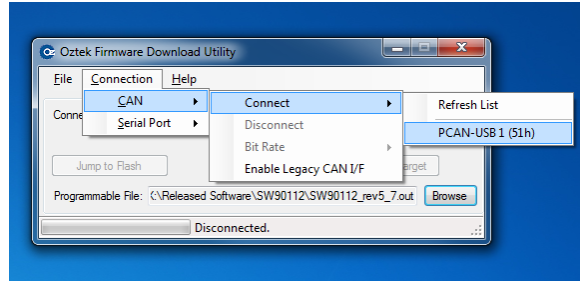
Similarly, if using a serial interface, select the appropriate COM port using the *"Connection -> Serial Port -> Connect"* menu item. Note that the serial interface uses the Modbus serial protocol for communicating with the target controller. By default, the Downloader utility uses a target slave address of "2" when attempting to connect to the controller as this is the default Modbus slave address for most Oztek controllers. For some applications, it is possible for the user to change the slave address to a value other than "2" – in this case, the user must select the correct slave address using the *"Connection -> Serial Port -> Slave Address"* drop down list.
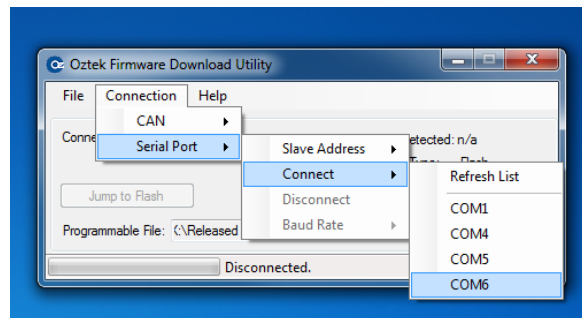
Once the desired communication interface has been selected, the status bar at the bottom of the window will briefly show an "Initializing CAN/Serial Device" message. If initialization is successful, the next message shown in the status bar will be "Searching for Target," at which point the user can apply power to the control board. If the Downloader fails to initialize the selected CAN or Serial adapter, the user should double check their USB connections (if applicable) and click the *"Refresh List"* menu item under either the CAN or Serial Port menus to rediscover the attached CAN or Serial devices.

> **Note:** Many Oztek control boards require a hardware jumper to enable the Bootloader. Refer to the User's Manual for your specific control board for details on proper installation of any required jumpers. Failure to do so may prevent the Downloader Utility from connecting to your target control board.

The following graphic indicates a successful connection with a target controller just after it has been powered up. In this case, the target is a standard Oztek OZDSP3000 control board with the Serial Bootloader image installed.
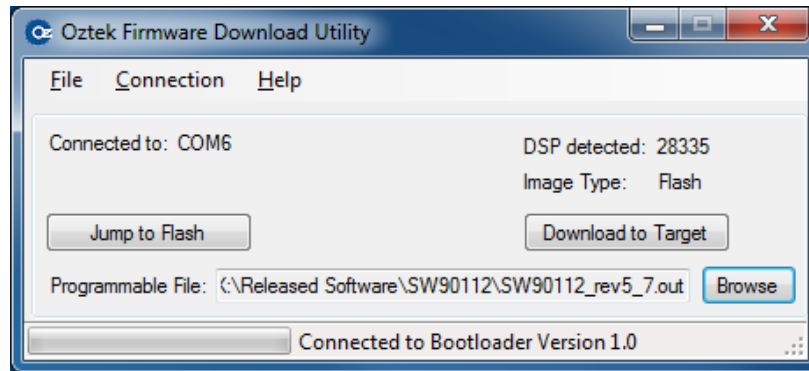
Once connected, the revision of the Bootloader code running on the control board is displayed in the status bar. The Downloader Utility has now created a communications link with the Bootloader through which a programmable image may now be transferred to the control board target.

4.4   Download To Target Button

After a connection to the Bootloader has been made, the *"Download to Target"* button will be enabled. Pressing this button will initiate the download process for the file specified in the "Programmable File" text box.

If the user is attempting to reprogram the Bootloader EEPROM, the following message box will be displayed:
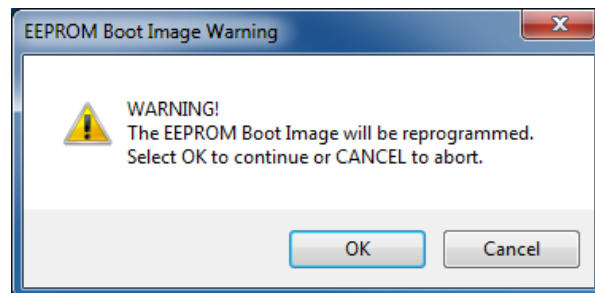
Depending on the size of the programmable image, the download time could take a minute or longer to complete. The following images illustrate the download process during the actions of clearing memory, programming, and successful completion.
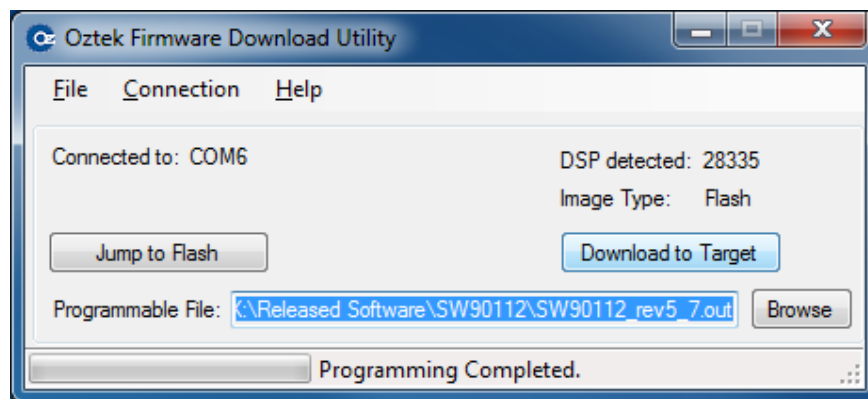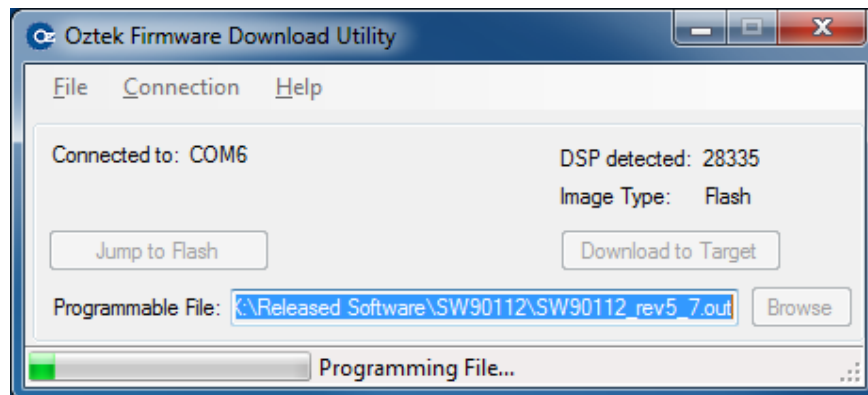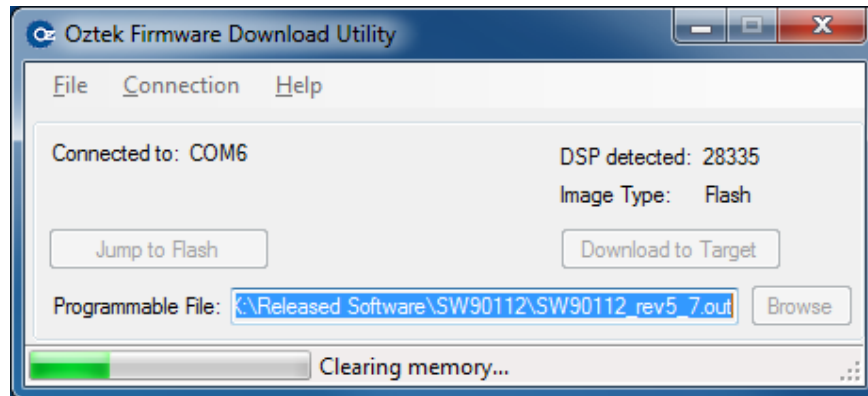
Once the download is complete, the Downloader Utility remains connected to the target. At this point the user may download another image, or press the *"Jump to Flash"* button to start executing the application stored in FLASH memory. Closing the GUI *does not* cause the control board to automatically jump to FLASH – the user must either use the *"Jump to Flash"* button or cycle power on the control board in order to start executing the FLASH image.

If an error is detected during programming, the Downloader Utility will automatically initiate a Clear Memory command to wipe the target of any partial image. The user should take special care if this happens while updating the Bootloader itself as it may be possible that the Bootloader is no longer programmed into the EEPROM. The user should *NOT* cycle power to the control board until a successful programming attempt has been completed.

> **Warning:**   Should the Bootloader become corrupt for any reason, or if the control board has not been previously loaded with the Bootloader, please refer to Appendix A for the procedure to program the initial Bootloader image.

4.5   Jump to Flash Button

After a connection to the Bootloader has been made, the *"Jump to Flash"* button is enabled. This button can be used either to forego a programming operation or to disconnect once the intended programming has completed. Pressing this button causes the Downloader Utility to attempt to disconnect from the Bootloader. At this point the Bootloader check if a valid FLASH application image is available and if so, it will start executing this application and the Downloader will show that it is now disconnected. If a valid FLASH image is not available, an error message will be displayed and the Downloader Utility will remain connected to the Bootloader as shown in the images below.
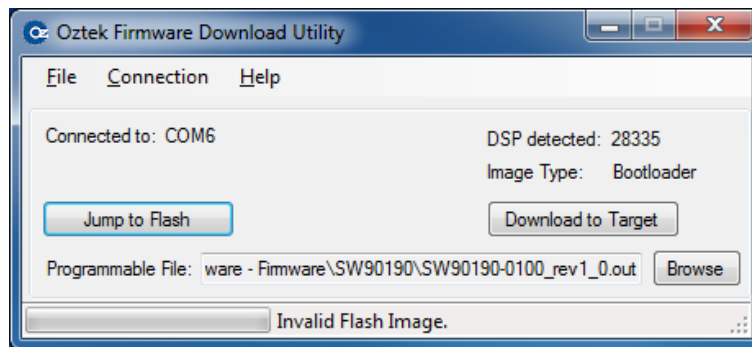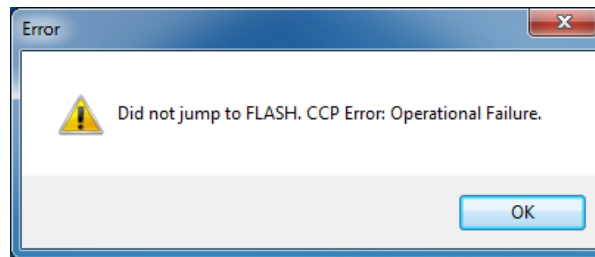
4.6   Enabling Support for Legacy Bootloaders

The downloader utility provides support for boards that contain older Oztek Bootloaders. This feature must be enabled by clicking the *"Connection -> CAN -> Enable Legacy CAN I/F"* menu item while disconnected from the CAN USB interface as shown below.
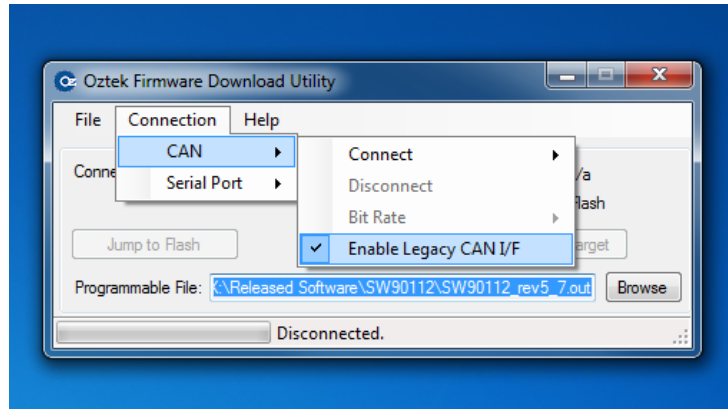
Note that this mode will only work when connected to the legacy Bootloader targets as the CAN message identifiers and baud rate are different and incompatible with the standard Oztek Bootloader. When operating in this mode, only DSP FLASH images may be updated; the option to update the Bootloader or data EEPROM images is not available. Similarly, the "Jump to Flash" option is also not supported on the older Bootloader targets; the user must cycle the target's power in order to start executing the newly programmed FLASH image.

4.7   Changing Serial Bit Rate

The embedded Bootloader images are initially configured to run their communications interface at a specific bit rate following a power on reset (POR). For CAN-based Bootloaders, the default CAN bit rate is 250kbps. For Serial-based Bootloaders, the default baud rate is 19200. The Bootloader and Downloader Utility applications support changing the serial bit rate after a connection has been established. To do so, the user can use the *"Connection -> CAN -> Bit Rate"* or *"Connection -> Serial Port -> Baud Rate"* menu items. Note that these menus are disabled when first launching the Downloader Utility as it expects to connect to the Target at the default rate following a POR of the target controller. The appropriate bit rate menu will become enabled once a connection has been made to the target controller.

Note that for small to average sized programming files, the download time does not decrease significantly when increasing the serial bit rate. The user must also keep in mind the physical communications connections in their system as not all systems may be capable of downloading at the maximum bit listed in the Downloader Utility. For this reason it is recommended that the user not change the serial bit rate unless they are attempting to program very large images and where the download time can be significantly decreased by using the faster bit rate.

Once the bit rate has been changed, the Downloader and Bootloader will continue to communicate at the new rate for all subsequent Downloader operations. Note that the Bootloader will remain at this bit rate until either a) changed by the user using the Downloader or b) by cycling the power on the control board. Recall that when first opening the Downloader Utility, it will always attempt to connect at the default bit rate, so it may be necessary to cycle

power on the control board in the event that the Bootloader has been left running at a different bit rate than the default value.

5.   Troubleshooting and Error Messages

If for any reason an error is encountered during initialization of the CAN or Serial converter or when downloading the selected image, the user will be notified via the Downloader Utility's status bar at the bottom of the window and/or through a Message Box. The following error messages will be displayed if problems are encountered during the application's operation.

5.1   USB to CAN or Serial Error Messages

Table 2 - Troubleshooting USB to CAN or Serial Error Messages

Error Message	Troubleshooting steps
"No device detected" "Get Info Failed" "Send failed" "Receive Failed"	1. Check that the CAN or Serial device drivers are installed and working properly. 2. Check the cable connections between the CAN/Serial device, the PC, and the control board. 3. Try closing and restarting the Downloader Utility.

5.2   File Errors

Table 3 - Troubleshooting File Error Messages

Error Message	Troubleshooting steps
"Cannot Open File"	Verify that the selected "Programmable File" exists.
"Cannot Read from File"	Verify the integrity of the selected "Programmable File".
"Cannot Write to File"	Verify that the selected log file directory is not set to read only.
"End of File Detected"	Verify that the selected "Programmable File" is of the correct type.
"Invalid File Extension"	Verify the type of selected "Programmable File" as follows: • ***.out** file if the selected target is "DSP Flash" or "Bootloader EEPROM" • ***.hex** file if the selected target is "Data EEPROM"
"Unknown S-record type"	If a ***.hex** file is selected for a Data EEPROM target, it must be in the Motorola S-record format.

5.3   Programming Errors

Table 4 - Troubleshooting Programming Error Messages

Error Message	Troubleshooting steps
"Illegal Target Type"	Verify that the control board supports the selected target. Not all Oztek Control boards support all of the available targets.
"CCP Error: Unknown command returned." "CCP Error: Invalid command syntax." "CCP Error: Parameter Out of Range." "CCP Access Denied." "CCP Error: Resource or Function unavailable." "CCP Error: Operation Failure."	These are low level, CAN CCP protocol errors. Take the following steps: 1. Verify that the correct order was followed when connecting to the target, i.e. the Downloader **must** be started and the "Connect" command selected **BEFORE** applying power to the control board. 2. Verify that the Downloader is attached to the Bootloader.

6.   Maintenance and Upgrade

Please check the Oztek website (www.oztekcorp.com) for updates to the CAN Downloader Utility.

7.   APPENDIX A – Initial Bootloader Programming Procedure

This appendix describes how to load the Bootloader image into the EEPROM for the very first time (or after the image has been corrupted following a failed update attempt). Because newly installed EEPROM devices are blank, the Bootloader image will need to be manually loaded into the DSPs RAM memory in order to then program the Bootloader itself into the EEPROM.

It is assumed that the user has sufficient experience with the Code Composer IDE from Texas Instruments to navigate the menus and to start-up the application. This is the only software tool needed for this process. Users who do not have access to Code Composer Studio and a valid JTAG emulation adapter or who are unfamiliar with the DSP programming procedure should consult Oztek for additional support.

7.1   Hardware Requirements

- See Section 2 (System Requirements)
- JTAG emulator pods are used to connect the PC to the DSP on the target board. There are several models available from vendors such as Signum Systems (www.signum.com) and Spectrum Digital (www.spectrumdigital.com).

7.2   Software Requirements

- Code Composer Integrated Development Environment (IDE), version 3.3 or greater. See www.ti.com for ordering information.
- Bootloader file image. The file will be called *SW*****_rev#_#.out* where ***** will be the software part number for the specific Oztek Bootloader image required, and rev#_# represents the most current revision, for example: rev2_0.

7.3   Programming Procedure

Launch the Code Composer IDE and connect to the control board. Reset the CPU using the "**Debug >> Reset CPU**" menu item as shown in the screenshot below. A window may popup on the Code Composer application screen, but this can be ignored.
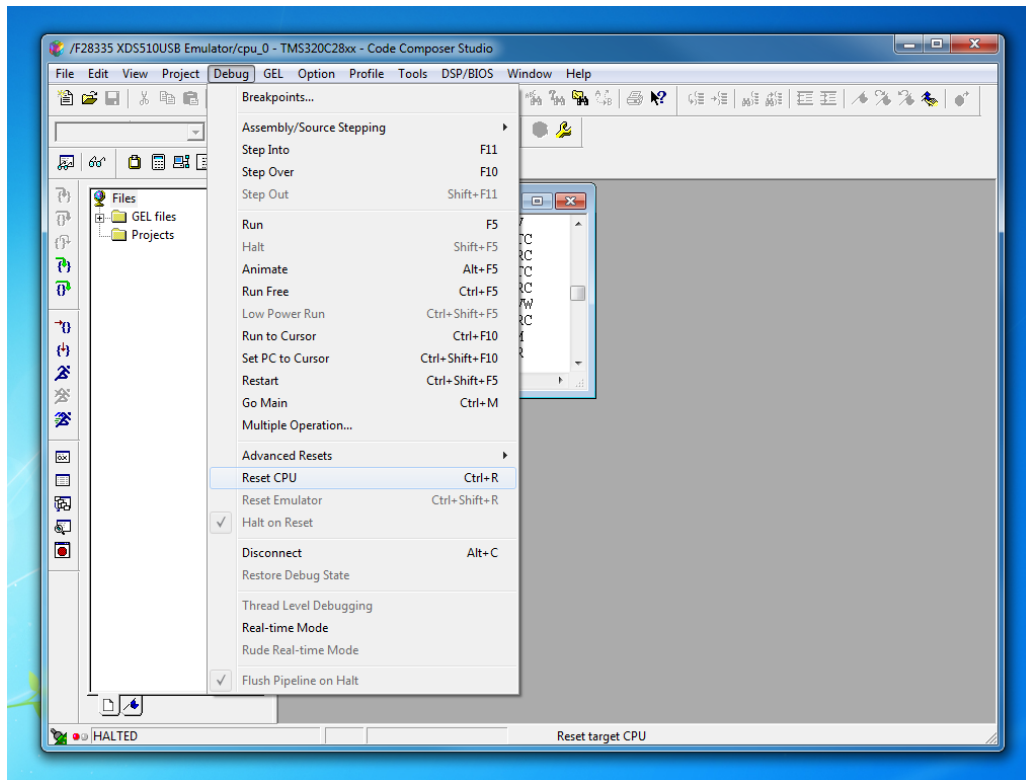
Next, load the Bootloader application itself using the "**File>>Load Program**" menu item as shown in the screenshot below.

After clicking on "**File >> Load Program**" you will be prompted to select the program code you wish to load into the DSP. Navigate to where *SW*****_rev#_#.out* was placed on the PC and highlight the **.out** file. After selecting the file, click the "**Open**" button. This will load it into memory and make it ready for execution.
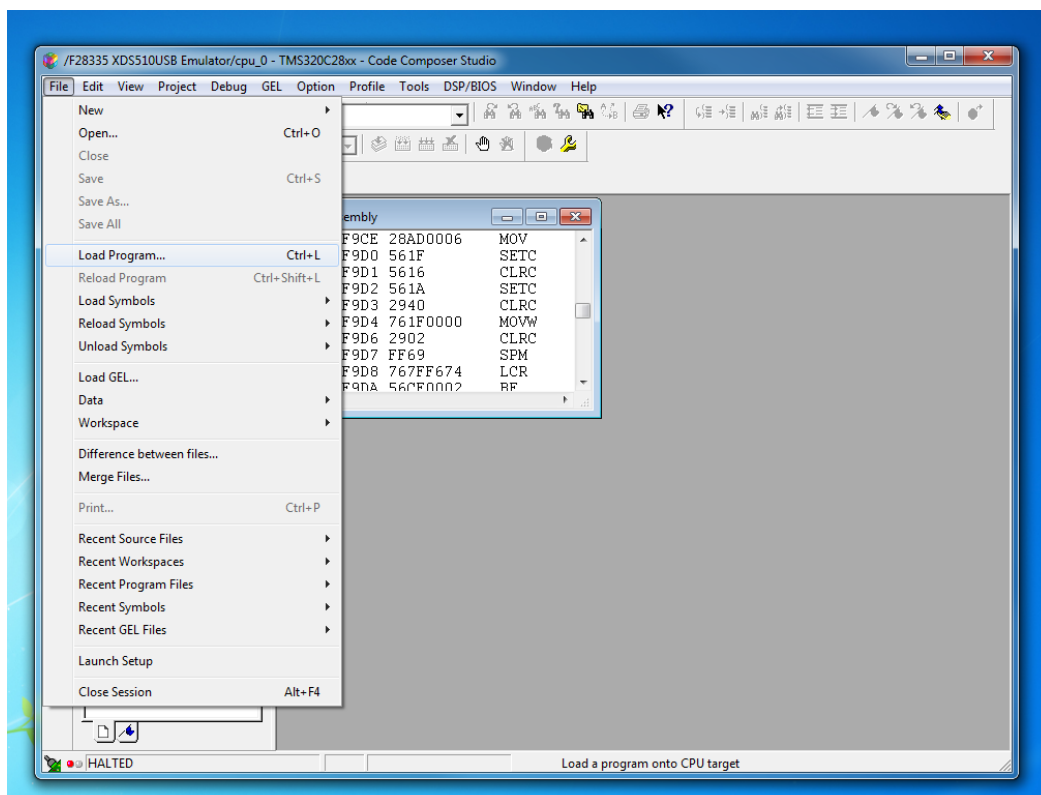
Before proceeding any further, you must now launch the Downloader Utility as described in section 4 *(Using the Downloader Utility). Ignore all instructions warning you to make sure the control board is powered off….leave the control board powered on in this case. When you reach the step instructing you to "apply power to the control board" perform the last remaining step below.*

Start the Bootloader program executing by selecting the "**Debug >> Run**" menu item as shown in the screenshot below. The Bootloader code is now running and operating just as it would if it had been automatically loaded from the EEPROM when first powering up.
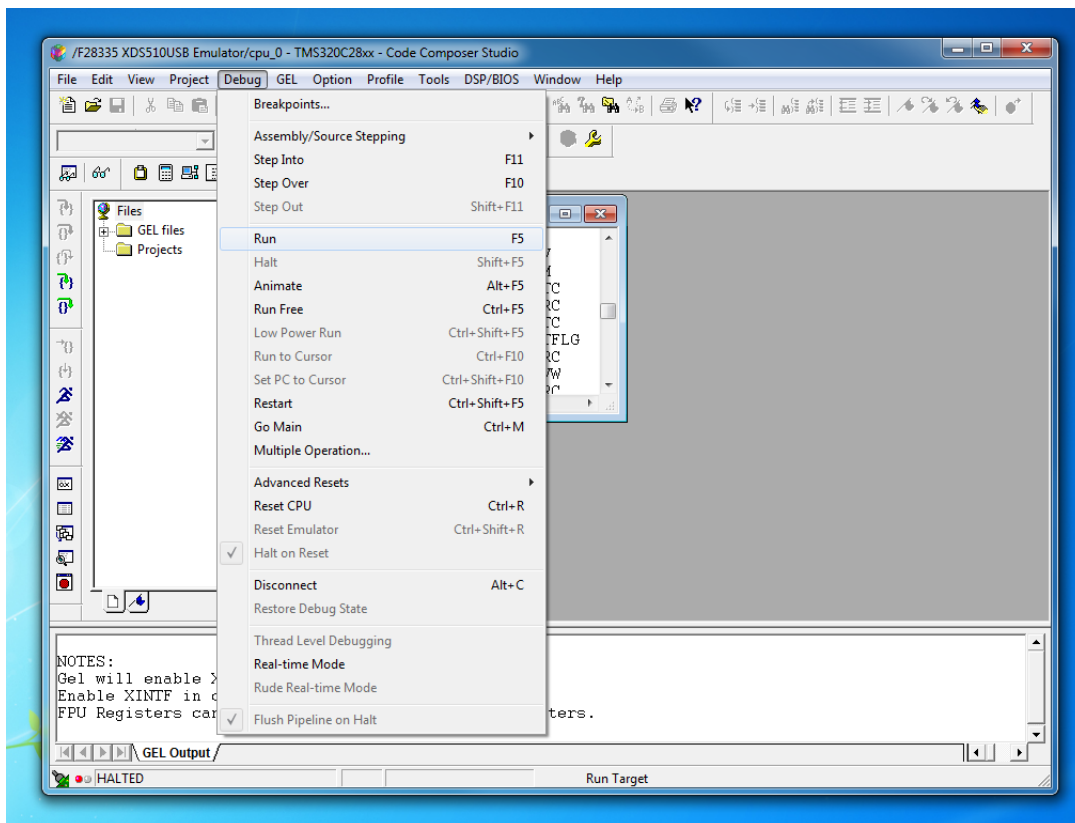
At this point the Bootloader should be communicating with the Downloader Utility. Be sure to download the Bootloader image into the "Bootloader EEPROM" target during this session so that the use of Code Composer and the JTAG emulator will *not* be necessary for subsequent downloads!

Warranty and Product Information

Limited Warranty

What does this warranty cover and how long does it last? This Limited Warranty is provided by Oztek Corp. ("Oztek") and covers defects in workmanship and materials in your OZSCR1000 controller. This Warranty Period lasts for 18 months from the date of purchase at the point of sale to you, the original end user customer, unless otherwise agreed in writing. You will be required to demonstrate proof of purchase to make warranty claims. This Limited Warranty is transferable to subsequent owners but only for the unexpired portion of the Warranty Period. Subsequent owners also require original proof of purchase as described in "What proof of purchase is required?"

What will Oztek do? During the Warranty Period Oztek will, at its option, repair the product (if economically feasible) or replace the defective product free of charge, provided that you notify Oztek of the product defect within the Warranty Period, and provided that through inspection Oztek establishes the existence of such a defect and that it is covered by this Limited Warranty.

Oztek will, at its option, use new and/or reconditioned parts in performing warranty repair and building replacement products. Oztek reserves the right to use parts or products of original or improved design in the repair or replacement. If Oztek repairs or replaces a product, its warranty continues for the remaining portion of the original Warranty Period or 90 days from the date of the return shipment to the customer, whichever is greater. All replaced products and all parts removed from repaired products become the property of Oztek.

Oztek covers both parts and labor necessary to repair the product, and return shipment to the customer via an Oztek-selected non-expedited surface freight within the contiguous United States and Canada. Alaska, Hawaii and locations outside of the United States and Canada are excluded. Contact Oztek Customer Service for details on freight policy for return shipments from excluded areas.

How do you get service? If your product requires troubleshooting or warranty service, contact your merchant. If you are unable to contact your merchant, or the merchant is unable to provide service, contact Oztek directly at:

> USA
> Telephone: 603-546-0090
> Fax: 603-386-6366
> Email techsupport@oztekcorp.com

Direct returns may be performed according to the Oztek Return Material Authorization Policy described in your product manual.

What proof of purchase is required? In any warranty claim, dated proof of purchase must accompany the product and the product must not have been disassembled or modified without prior written authorization by Oztek. Proof of purchase may be in any one of the following forms:

• The dated purchase receipt from the original purchase of the product at point of sale to the end user
• The dated dealer invoice or purchase receipt showing original equipment manufacturer (OEM) status
• The dated invoice or purchase receipt showing the product exchanged under warranty

What does this warranty not cover? Claims are limited to repair and replacement, or if in Oztek's discretion that is not possible, reimbursement up to the purchase price paid for the product. Oztek will be liable to you only for direct damages suffered by you and only up to a maximum amount equal to the purchase price of the product. This Limited Warranty does not warrant uninterrupted or error-free operation of the product or cover normal wear and tear of the product or costs related to the removal, installation, or troubleshooting of the customer's electrical systems. This warranty does not apply to and Oztek will not be responsible for any defect in or damage to:

a) The product if it has been misused, neglected, improperly installed, physically damaged or altered, either internally or externally, or damaged from improper use or use in an unsuitable environment

b) The product if it has been subjected to fire, water, generalized corrosion, biological infestations, or input voltage that creates operating conditions beyond the maximum or minimum limits listed in the Oztek product specifications including high input voltage from generators and lightning strikes

c) The product if repairs have been done to it other than by Oztek or its authorized service centers (hereafter "ASCs")

d) The product if it is used as a component part of a product expressly warranted by another manufacturer

e) The product if its original identification (trade-mark, serial number) markings have been defaced, altered, or removed

f) The product if it is located outside of the country where it was purchased

g) Any consequential losses that are attributable to the product losing power whether by product malfunction, installation error or misuse.

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Product
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Return Material Authorization Policy

Before returning a product directly to Oztek you must obtain a Return Material Authorization (RMA) number and the correct factory "Ship To" address. Products must also be shipped prepaid. Product shipments will be refused and returned at your expense if they are unauthorized, returned without an RMA number clearly marked on the outside of the shipping box, if they are shipped collect, or if they are shipped to the wrong location.
When you contact Oztek to obtain service, please have your instruction manual ready for reference and be prepared to supply:

- The serial number of your product
- Information about the installation and use of the unit
- Information about the failure and/or reason for the return
- A copy of your dated proof of purchase

Return Procedure

Package the unit safely, preferably using the original box and packing materials. Please ensure that your product is shipped fully insured in the original packaging or equivalent. This warranty will not apply where the product is damaged due to improper packaging. Include the following:

- The RMA number supplied by Oztek clearly marked on the outside of the box.
- A return address where the unit can be shipped. Post office boxes are not acceptable.
- A contact telephone number where you can be reached during work hours.
- A brief description of the problem.

Ship the unit prepaid to the address provided by your Oztek customer service representative.

If you are returning a product from outside of the USA or Canada - In addition to the above, you MUST include return freight funds and you are fully responsible for all documents, duties, tariffs, and deposits.

Out of Warranty Service

If the warranty period for your product has expired, if the unit was damaged by misuse or incorrect installation, if other conditions of the warranty have not been met, or if no dated proof of purchase is available, your unit may be serviced or replaced for a flat fee. If a unit cannot be serviced due to damage beyond salvation or because the repair is not economically feasible, a labor fee may still be incurred for the time spent making this determination.

To return your product for out of warranty service, contact Oztek Customer Service for a Return Material Authorization (RMA) number and follow the other steps outlined in "Return Procedure".

Payment options such as credit card or money order will be explained by the Customer Service Representative. In cases where the minimum flat fee does not apply, as with incomplete units or units with excessive damage, an additional fee will be charged. If applicable, you will be contacted by Customer Service once your unit has been received.