DDS EVB Manual

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Introduction

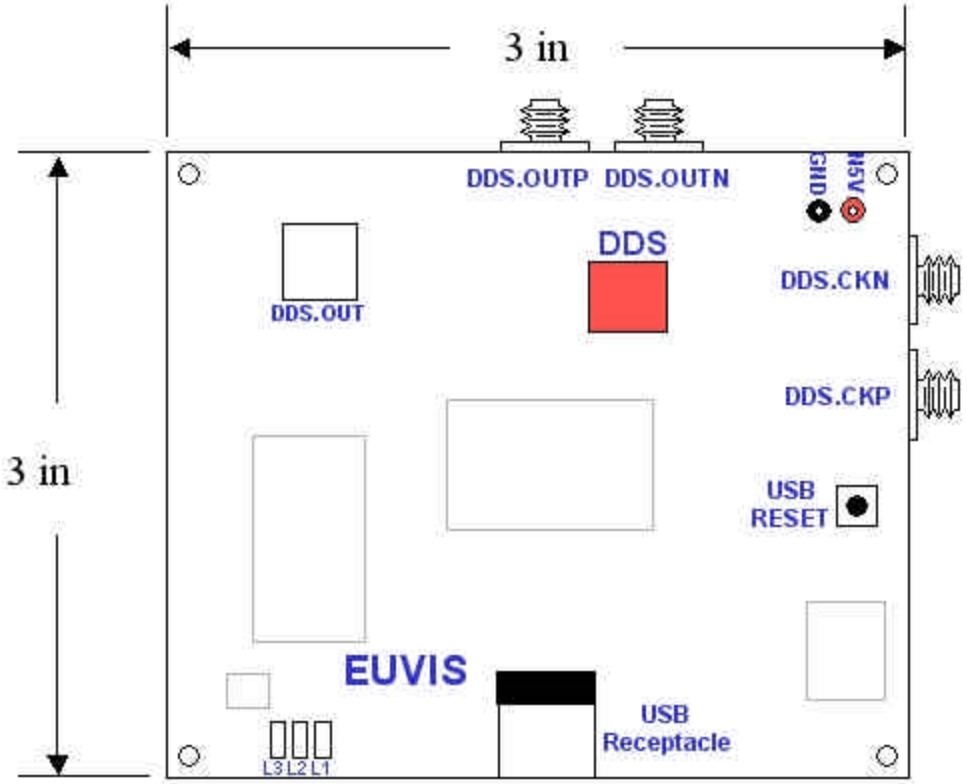
The evaluation boards are for users to evaluate the performance of the high-speed direct digital frequency synthesizer, Euvis DS85x. The inputs include 32-bit single-ended digital signals VIN0 ~ VIN31 for frequency control, reset signal RST for accumulator reset, strobe signal STRP to strobe the frequency control input, and a pair of differential clock signals. All the input signals except the clock signals are controlled by a PC through the USB interface. The clock input pair allows the clock source to be presented in either single-ended or differential form with SMA connectors. The outputs of the evaluation board consist of a pair of differential analog outputs OUTP/OUTN and the accumulator's carryout signal COUT.

The evaluation board features a USB-compliant interface through which a companion application program provides users convenient ways to control the DDS.

Key Features

- 32-bit frequency tuning word
- On chip DAC with 10 bit linearity
- Complementary analog waveform outputs with 50 O back terminations
- Carry bit RF output from phase accumulator
- Worst SFDR > 50 dBc (DC to 1-GHz Bandwidth) at a 2 GHz clock rate
- TTL/CMOS digital pattern control input
- Reset (RST) pin to initiate phase 0 starting state
- High speed strobe LVPECL or LVDS compliant inputs (STRP/N) to change DDS output frequency
- 64-pin QFN package

Board Diagram



Setup

Software Setup Windows XP

Requirements

- PC with USB 2.0 ports
- Windows XP SP3 operating system
- Microsoft .NET Framework 4.0

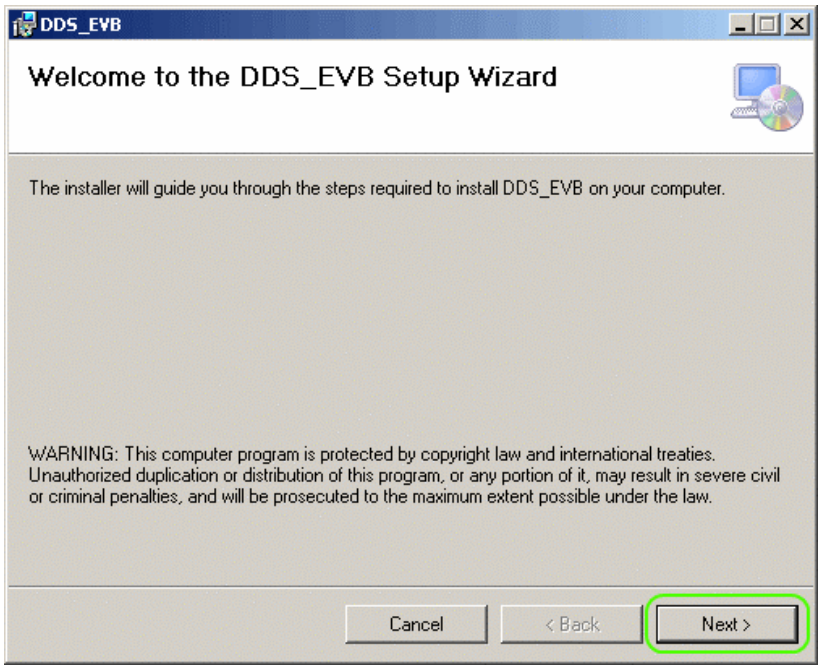
Setup

» If you do not have the Microsoft .NET Framework 4.0, please install it before installing the DDS EVB GUI application.

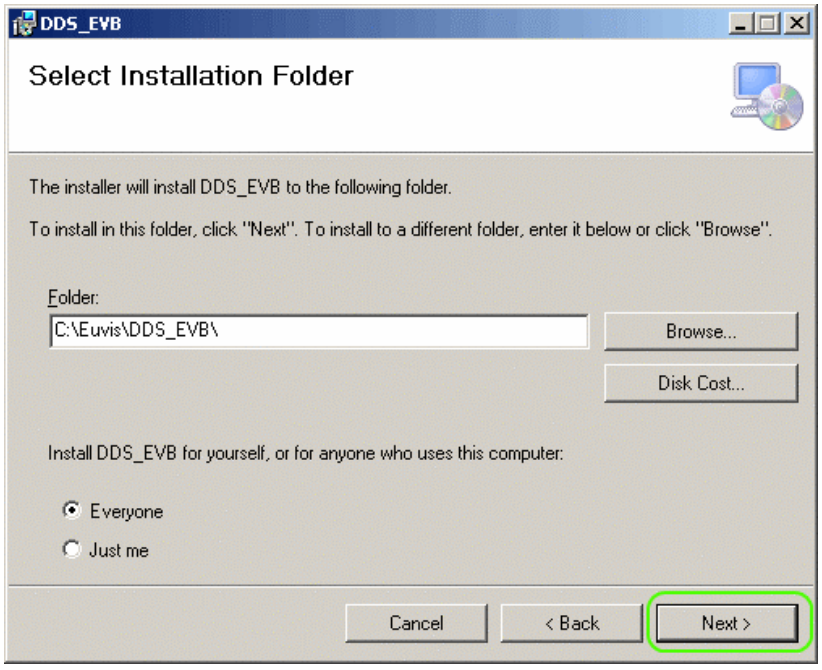
» When installing the DDS EVB GUI application, do not power up the DDS EVB board. You will power up the board after installation.

» To install the DDS EVB GUI application, go to the directory where you downloaded the installation files. Double click the **setup.exe** file. It is the icon with the box and CD without the monitor.

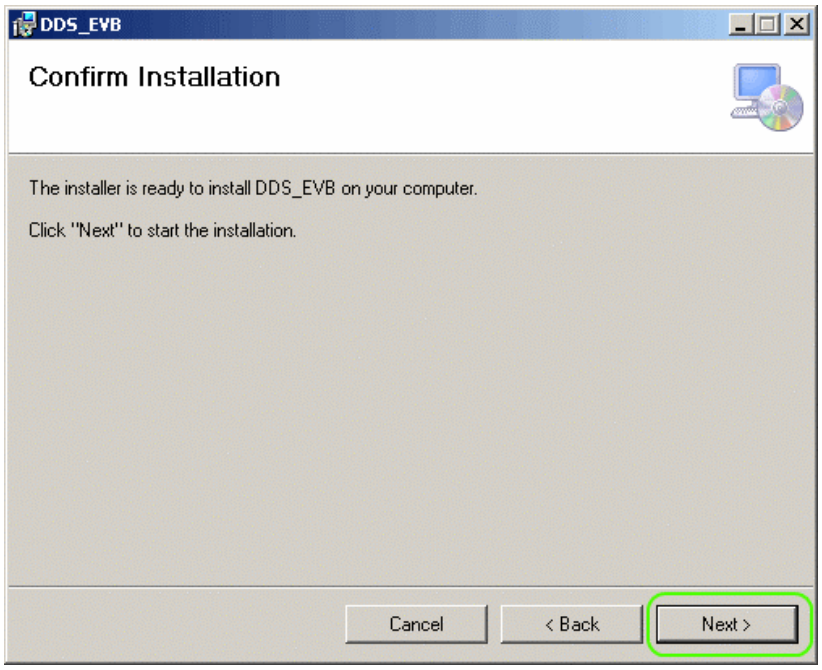
» Click on **Next** in the next window.



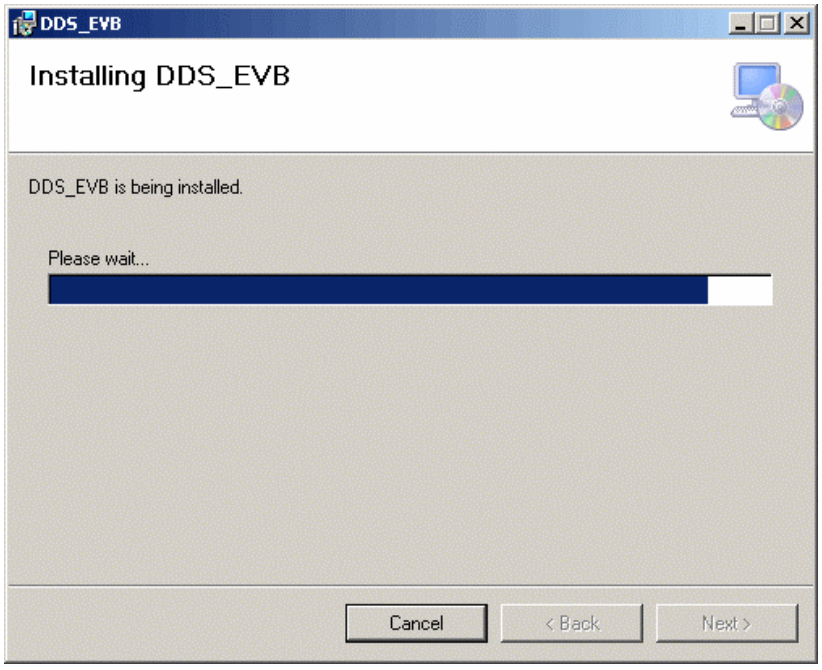
» You may choose another location to install the files or you can keep the default location. You can also choose to install for all users or for just the user you are currently logged in as. If you are satisfied with the settings, click on **Next**.



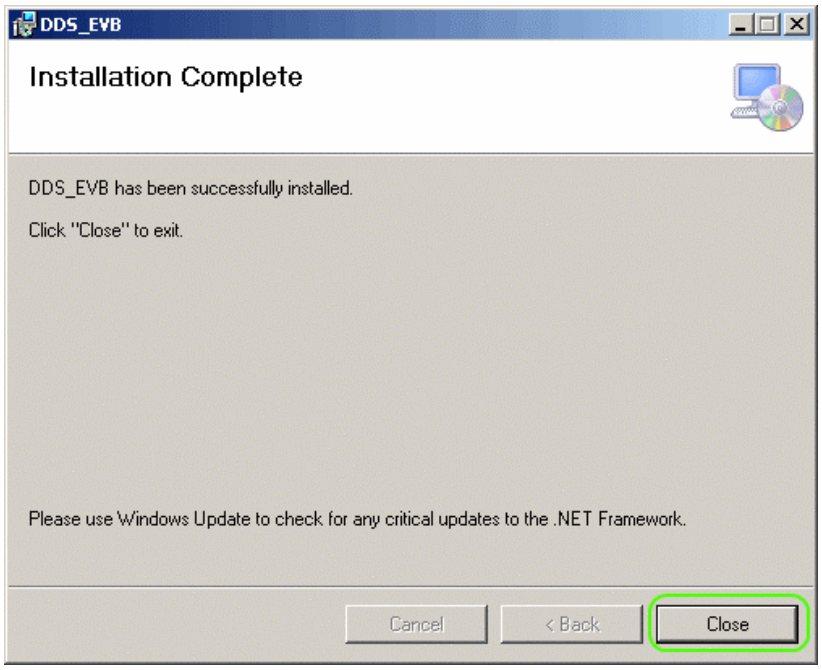
» Click on **Next** on the Confirm Installation screen.



» The installer will copy all necessary files into your system.

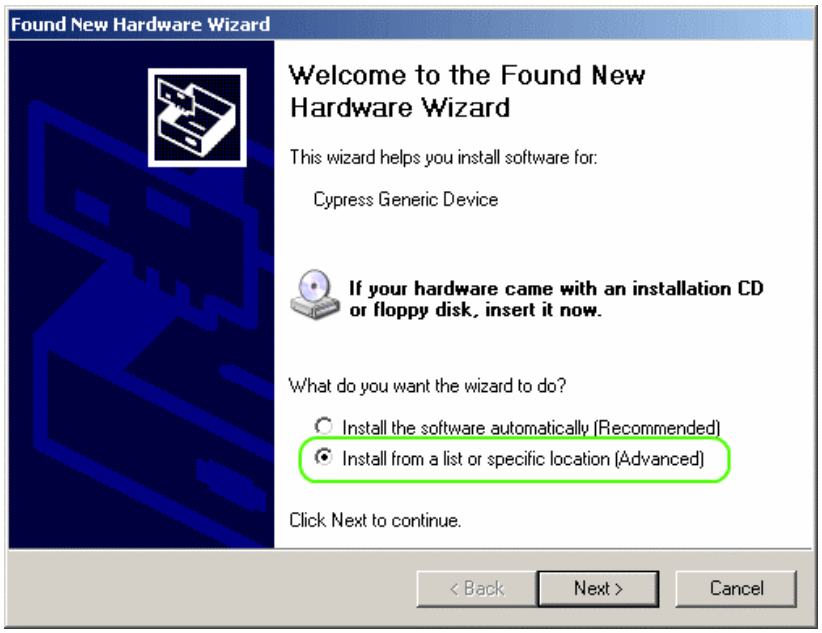


» After installation is complete, please click on **Close**.



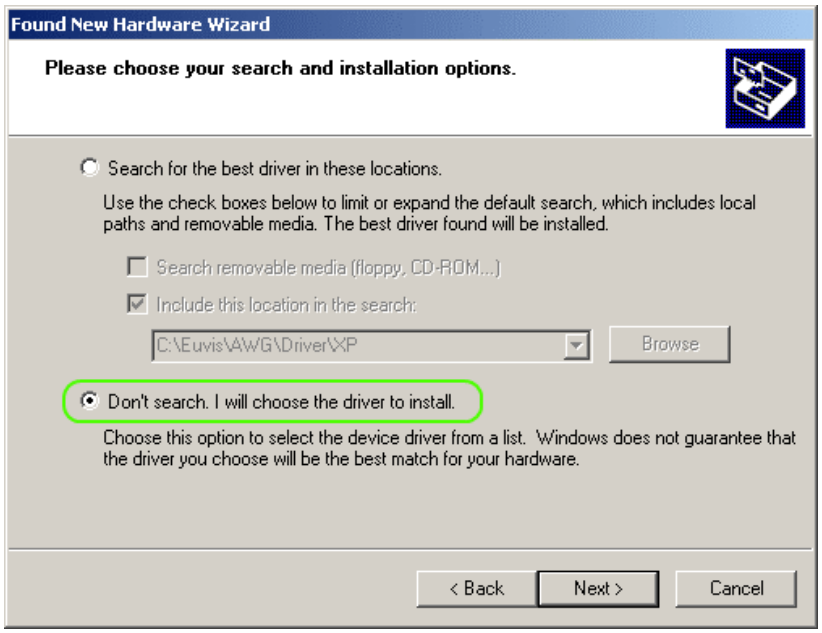
» You have now completed installing the DDS EVB GUI application. You will now need to power up the DDS EVB board in order to install the necessary software drivers. Please connect the DDS hardware to the computer with the USB cable.

» The operating system should detect the hardware within a few seconds and then present you with the "Found New Hardware Wizard" window. Click on the **Install from a list or specific location (Advanced)**.

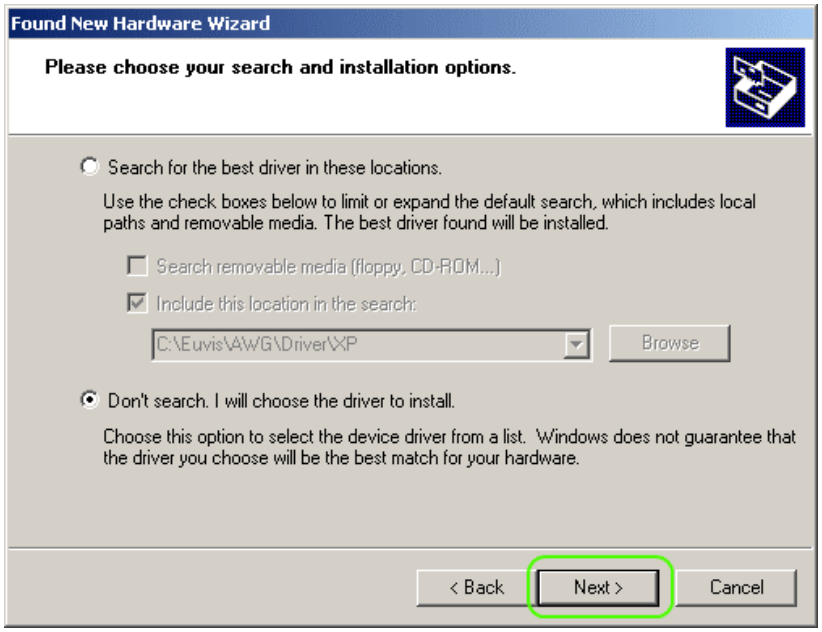


» Click on **Next**.

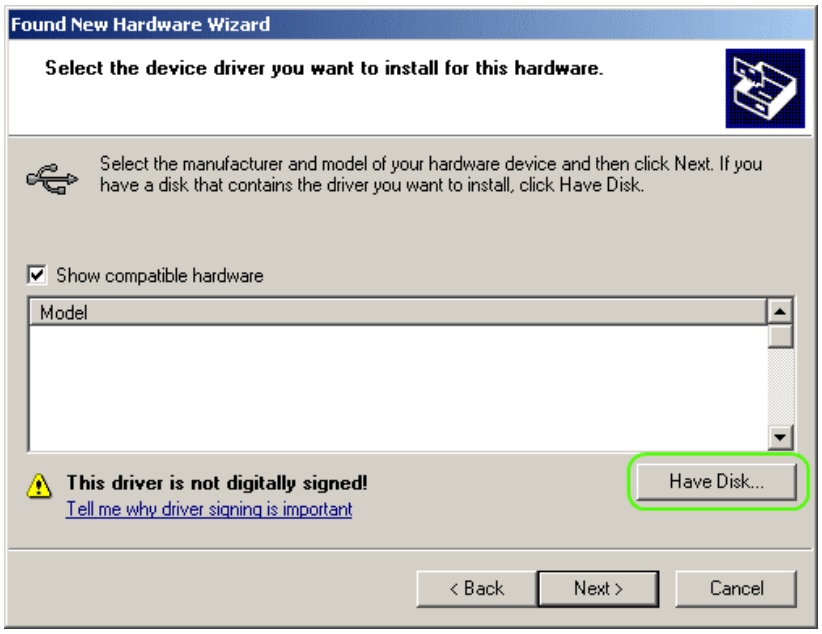
» Select the **Don't search. I will choose the driver to install** option.



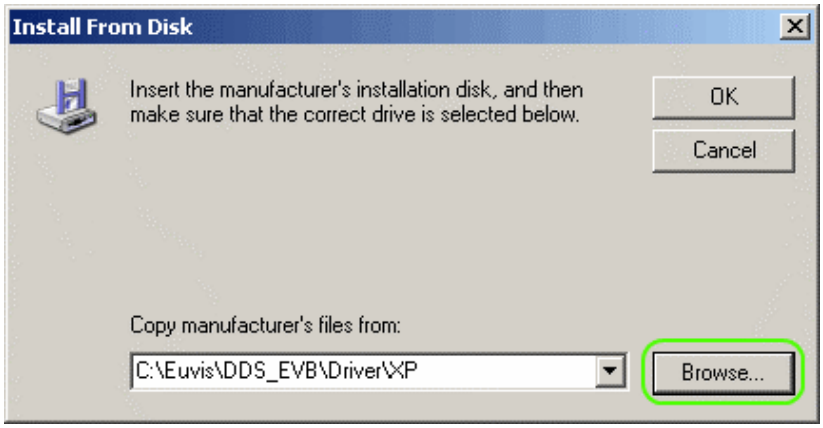
» Click on **Next**.



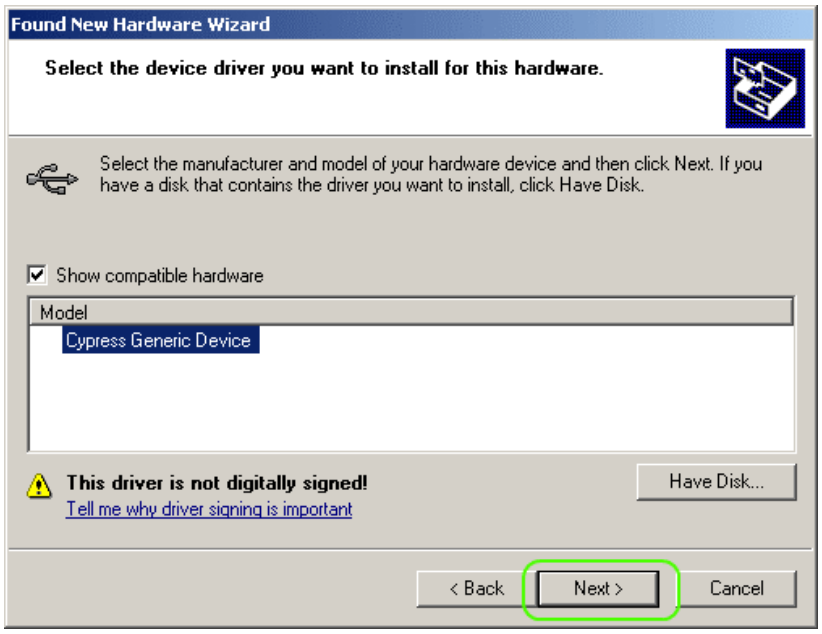
» Click on **Have Disk**.



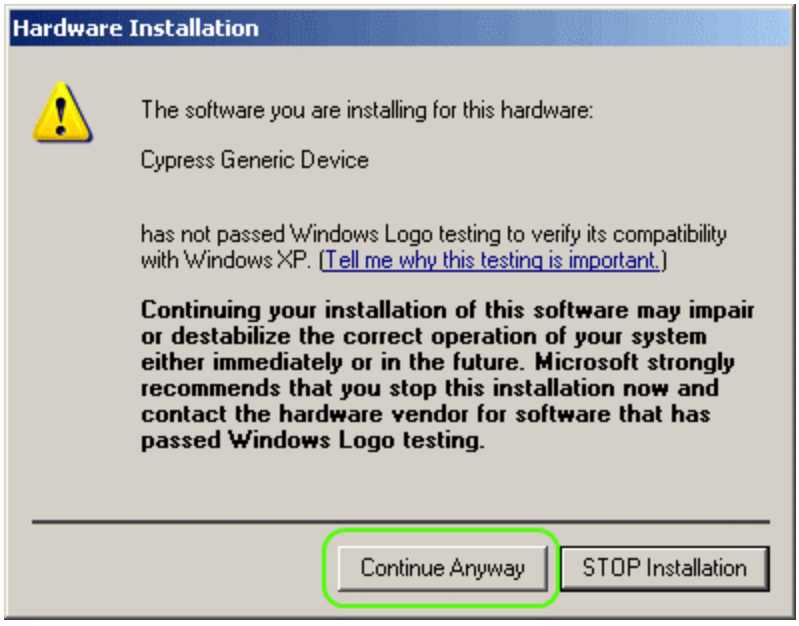
» The "Install From Disk" window will appear. Click on **Browse** and go to your DDS EVB driver folder which by default should be C:\Euvis\DDS_EVB\Driver\XP. Click on **OK** when you are finished.



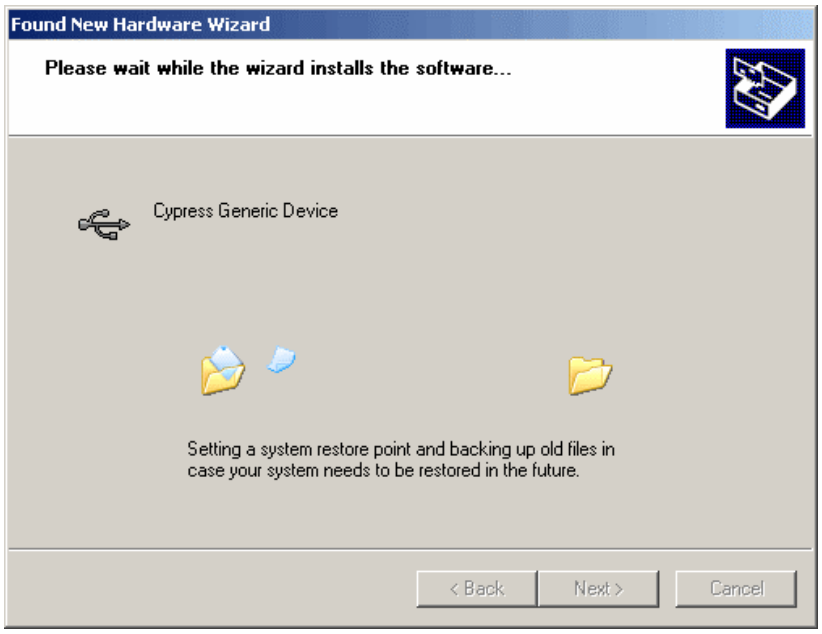
» "Cypress Generic Device" should show up under the Model list. Make sure that is selected and then click on **Next**.



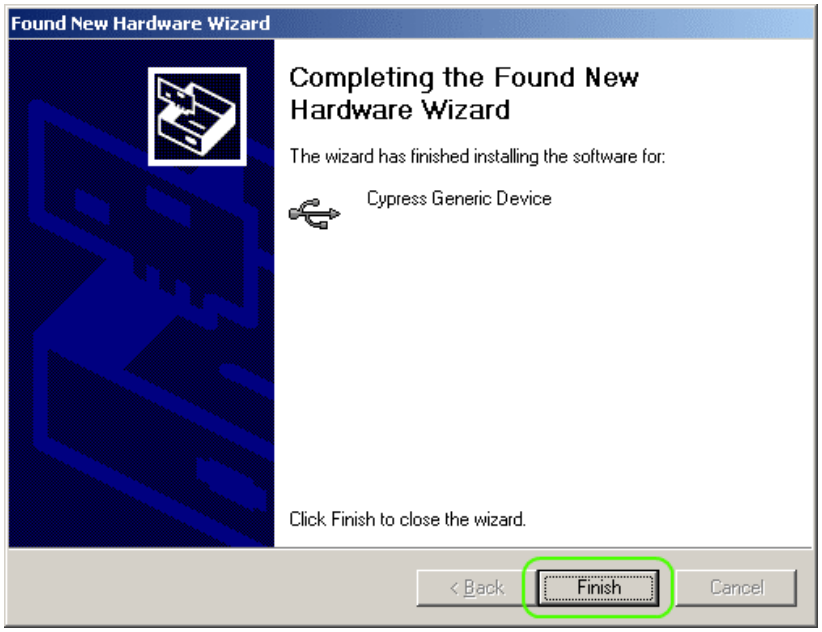
» Windows will now attempt to install the drive driver. It may pop out a window with a driver warning. Please click on **Continue Anyway** to continue driver installation.



» Windows will now install the device drivers.

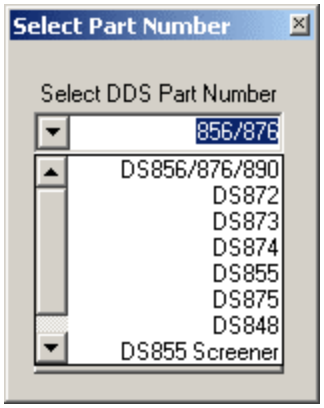


» When driver installation is complete, please click on **Finish**.

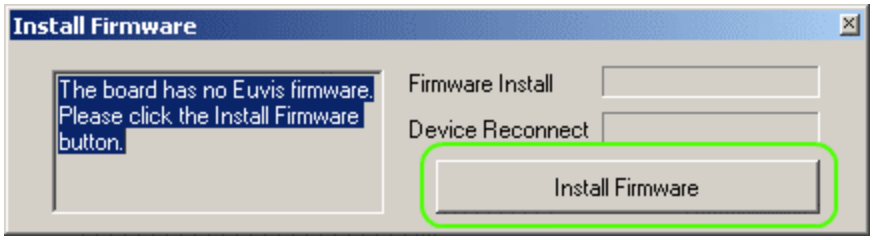


» To continue the driver installation process, please click on the "DDS_EVB" icon on your desktop or in the Start menu.

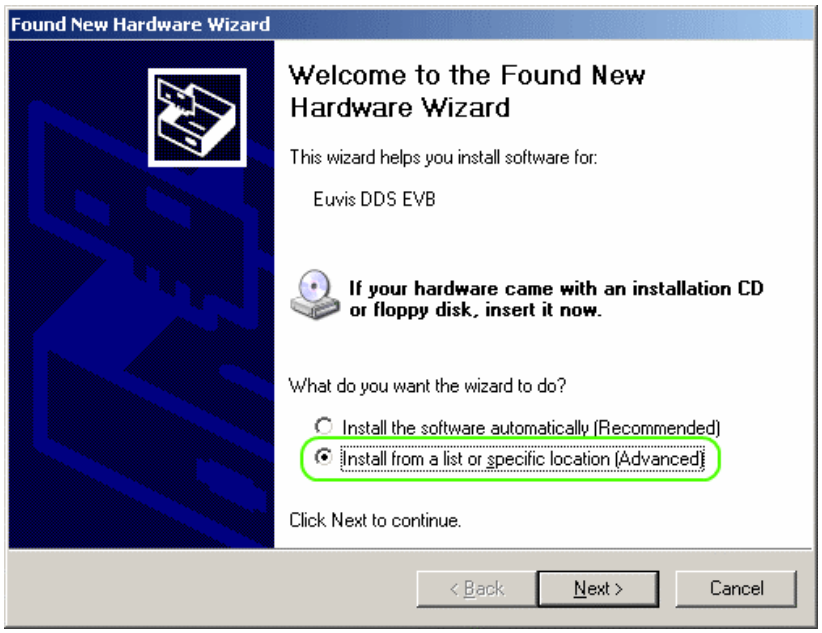
» Select the DDS chip that came with your DDS EVB board.



» The application will now attempt to install the firmware to the board. Click on **Install Firmware**.

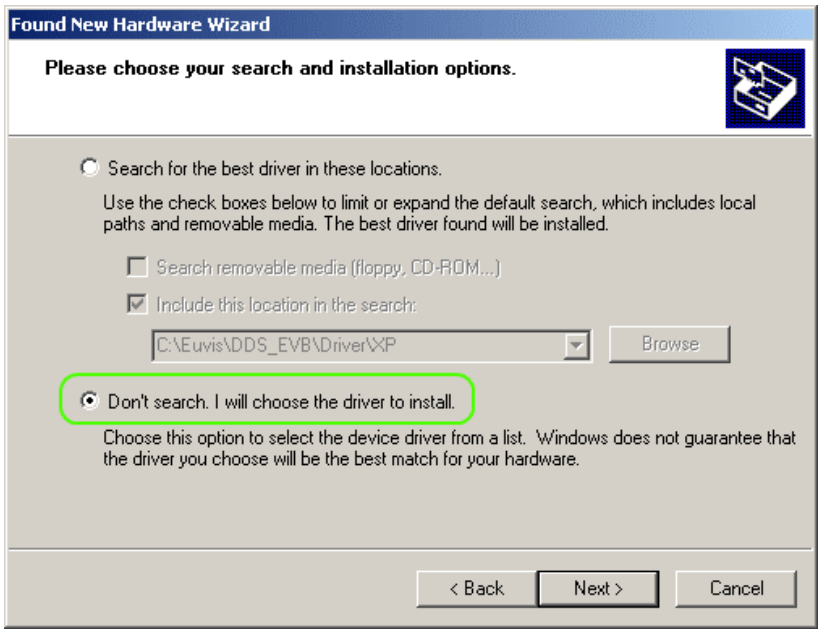


» During the firmware installation process, the operating system will prompt you to install the secondary drivers. Select the **Install from a list or specfic location (Advanced)** option.

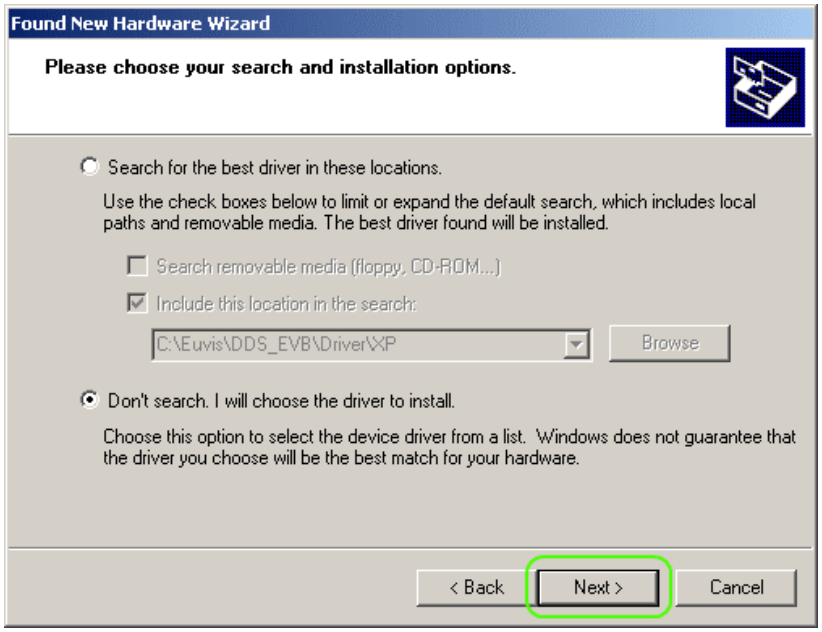


» Click on **Next**.

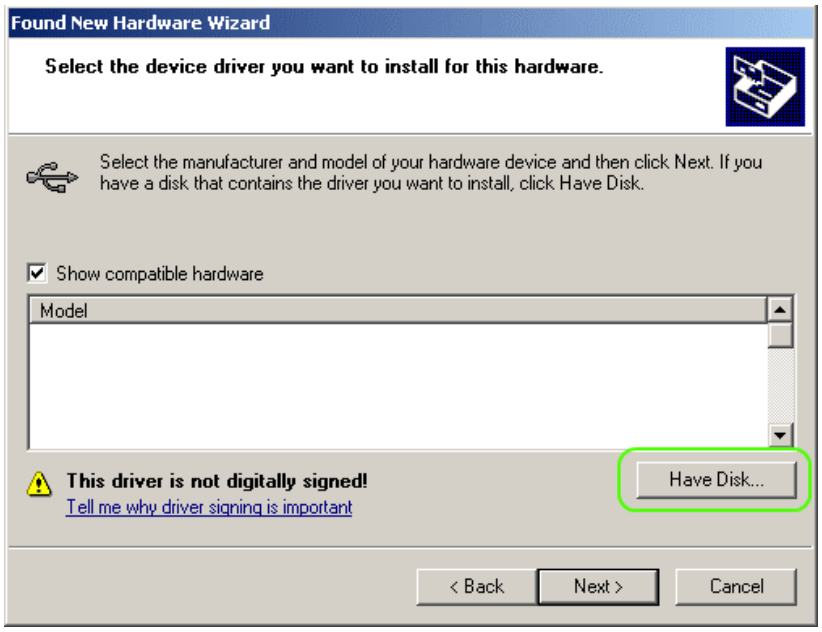
» Select the **Don't search. I will choose the driver to install** option.



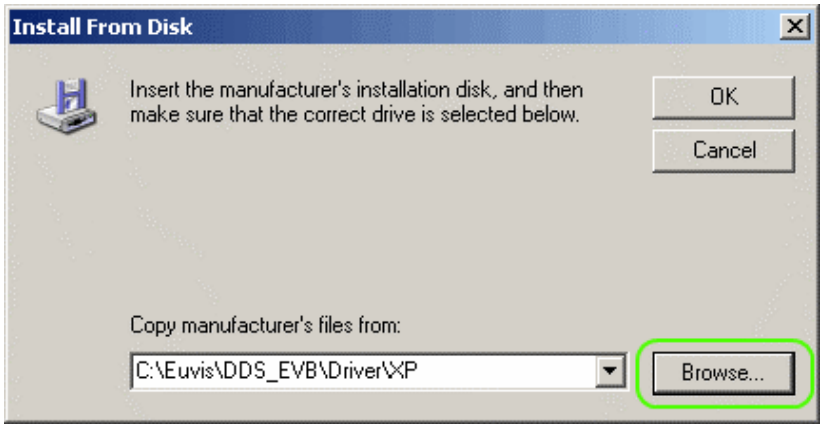
» Click on **Next**.



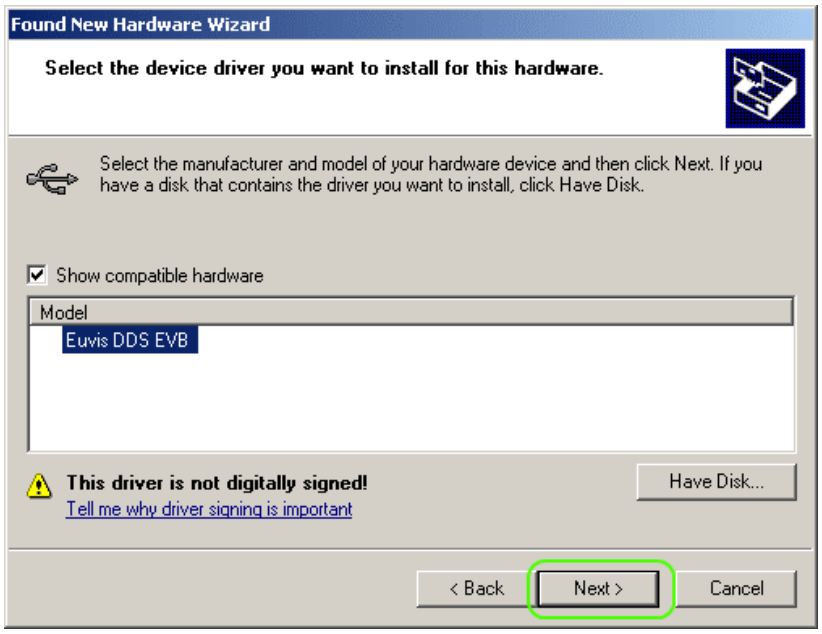
» Click on **Have Disk**.



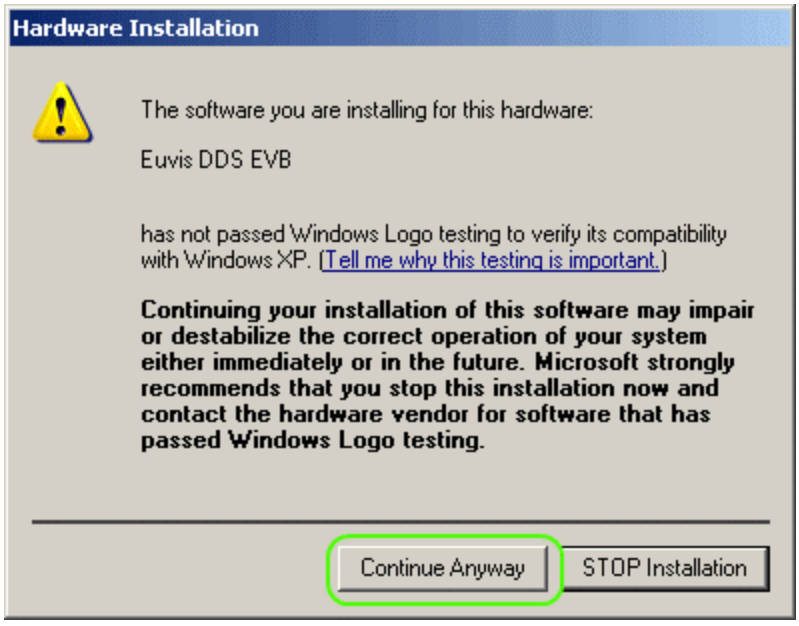
» The "Install From Disk" window will appear. Click on **Browse** and go to your DDS EVB driver folder which by default should be C:\Euvis\DDS_EVB\Driver\XP. Click on **OK** when you are finished.



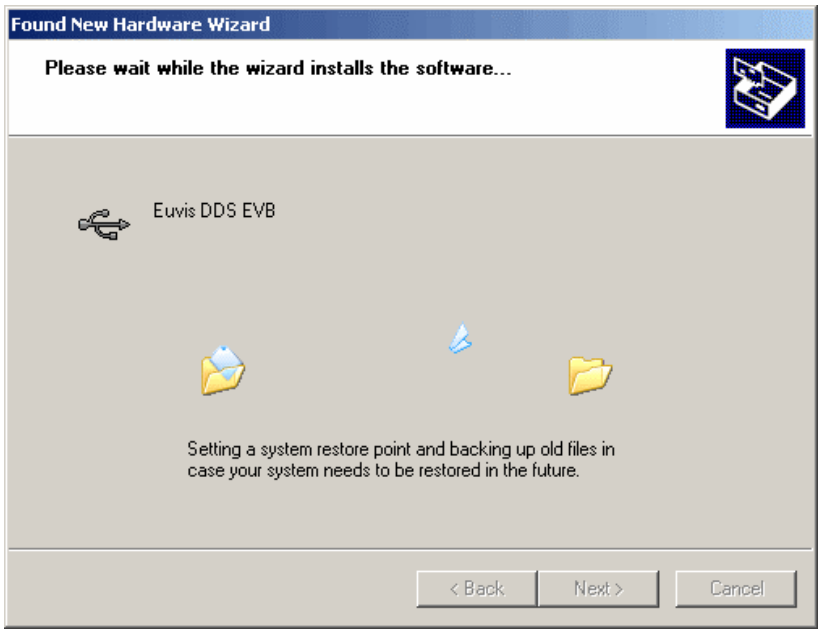
» "Euvis DDS EVB" should show up under the Model list. Make sure that is selected and then click on **Next**.



» Windows will now attempt to install the drive driver. It may pop out a window with a driver warning. Please click on **Continue Anyway** to continue driver installation.

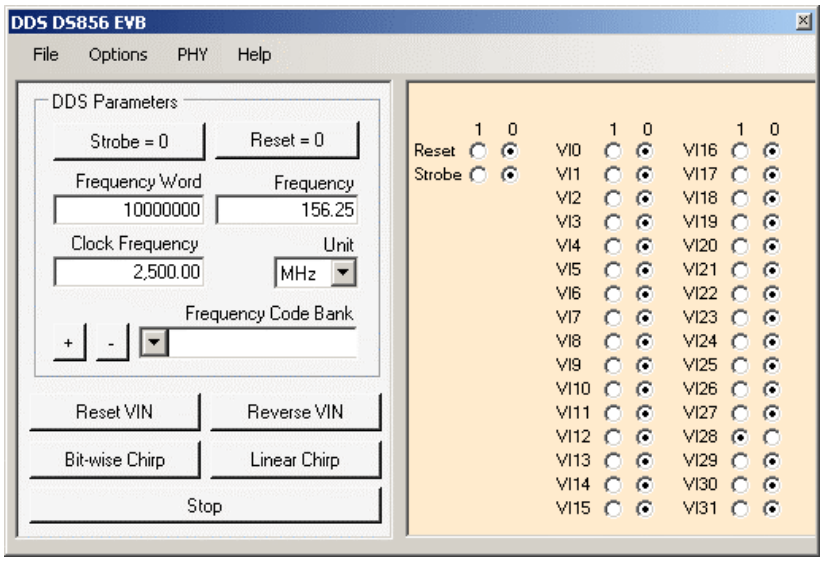


» Windows will now install the device drivers.



» When driver installation is complete, please click on **Finish**.

» After firmware and driver installation is complete the DDS EVB GUI should open. Depending on the length of time needed for firmware and driver instllation, you may need to restart the GUI.



Software Setup Windows 7

Requirements

- PC with USB 2.0 ports
- Windows 7 operating system
- Microsoft .NET Framework 4.0

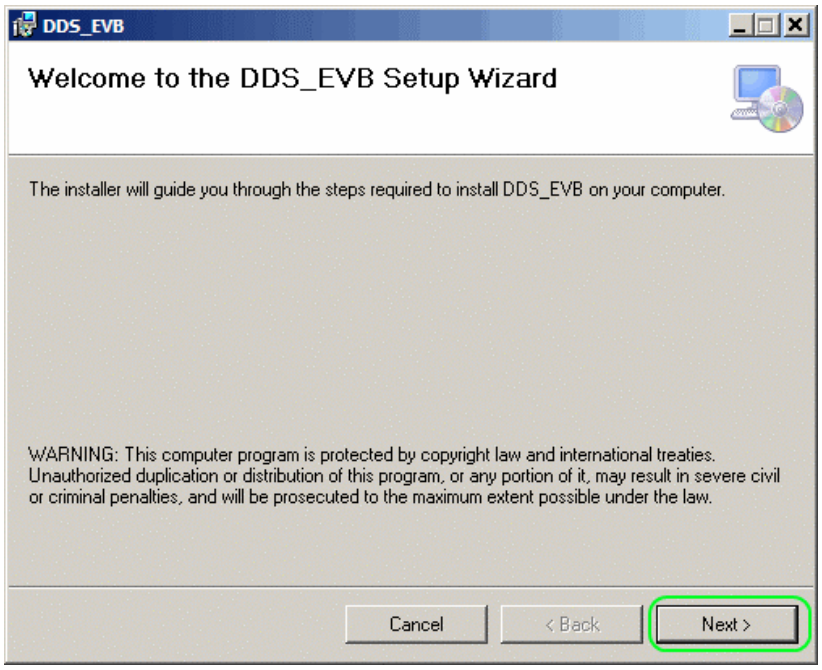
Setup

» If you do not have the Microsoft .NET Framework 4.0, please install it before installing the DDS EVB GUI application.

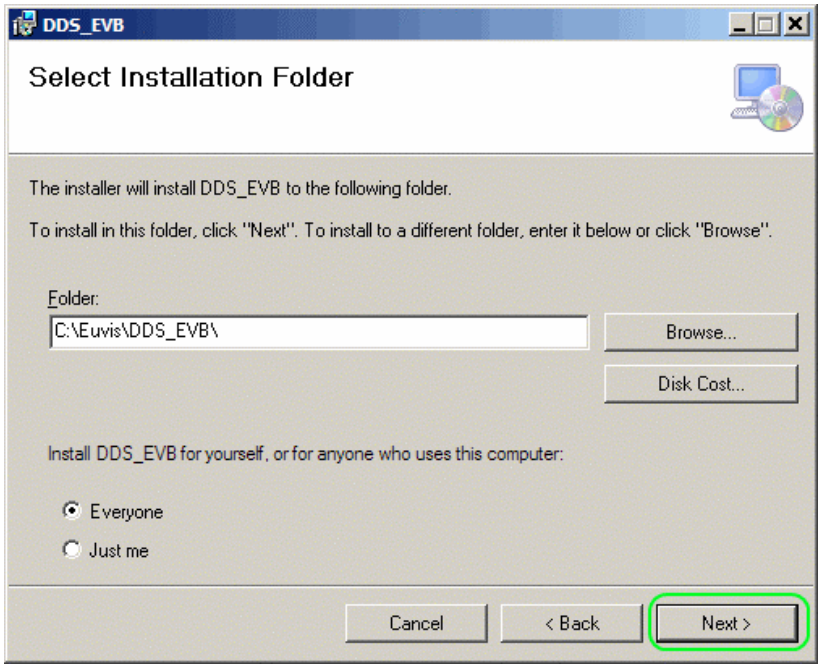
» When installing the DDS EVB GUI application, do not power up the DDS EVB board. You will power up the board after installation.

» To install the DDS EVB GUI application, go to the directory where you downloaded the installation files. Double click the **setup.exe** file. It is the icon with the box and CD without the monitor.

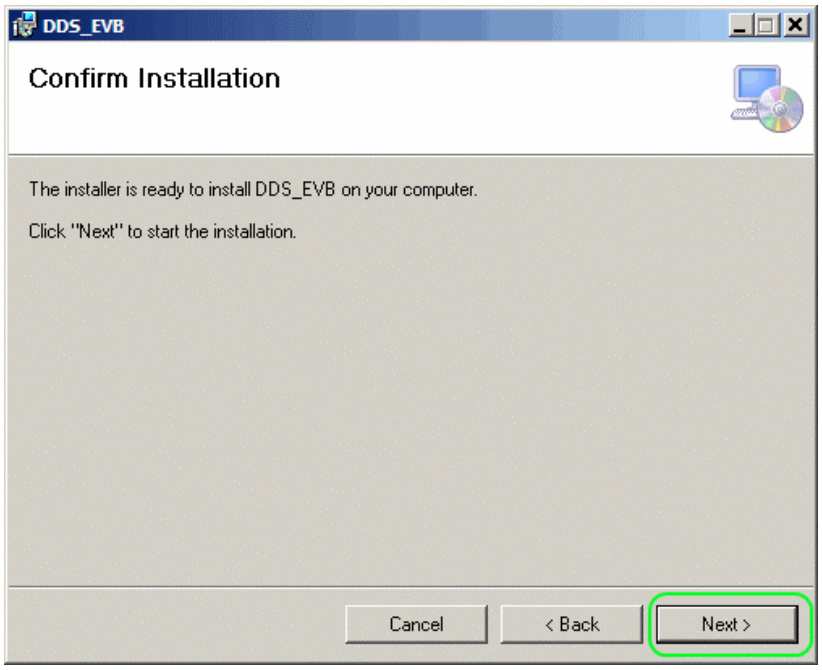
» Click on **Next** in the next window.



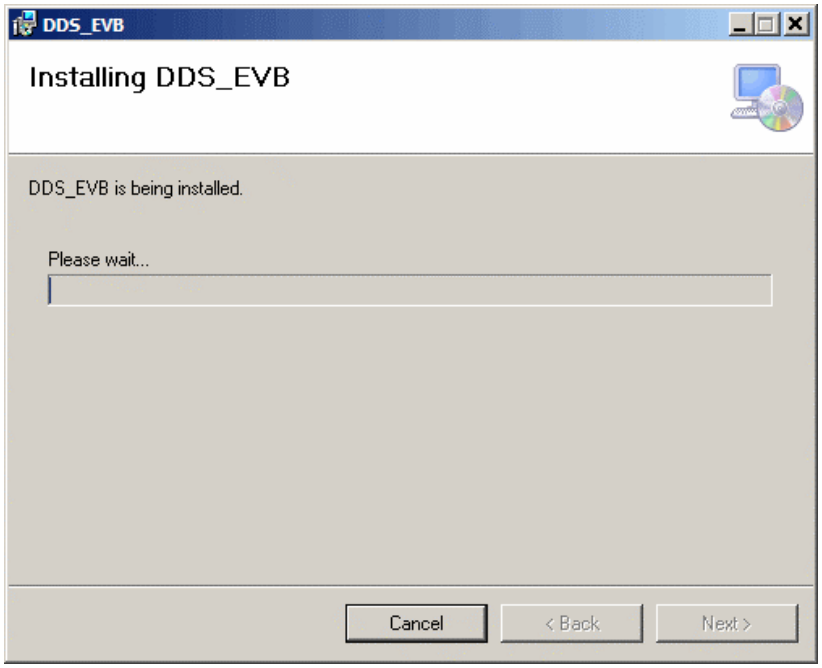
» You may choose another location to install the files or you can keep the default location. You can also choose to install for all users or for just the user you are currently logged in as. If you are satisfied with the settings, click on **Next**.



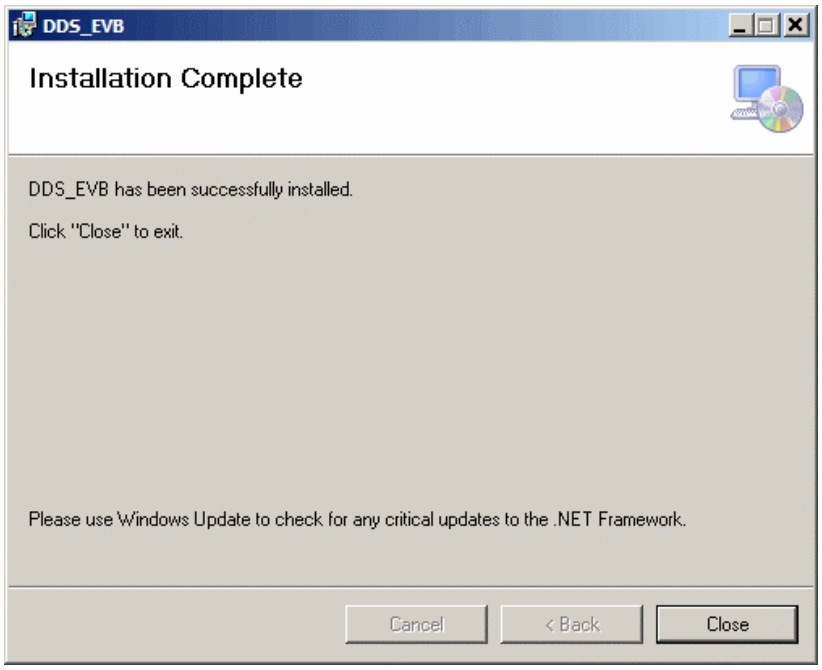
» Click on **Next** on the Confirm Installation screen.



» The installer will copy all necessary files into your system.

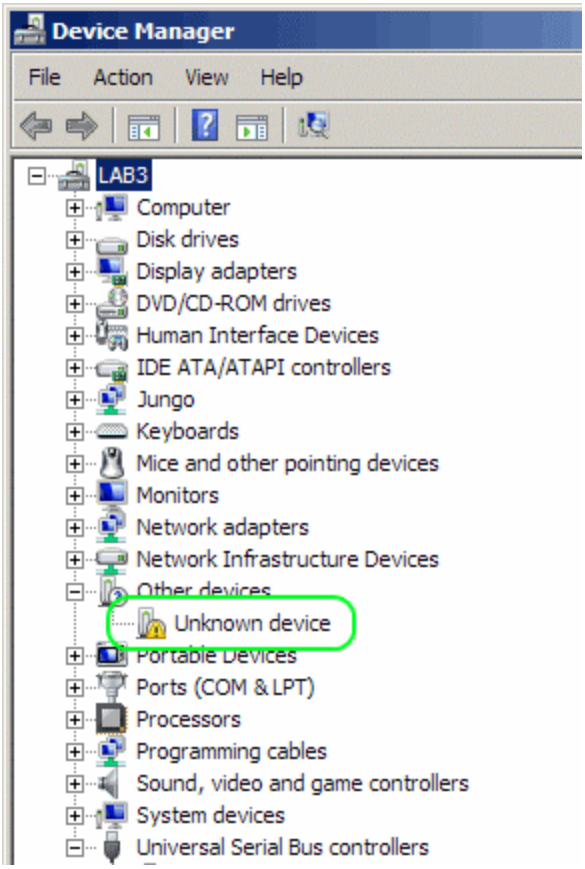


» After installation is complete, please click on **Close**.

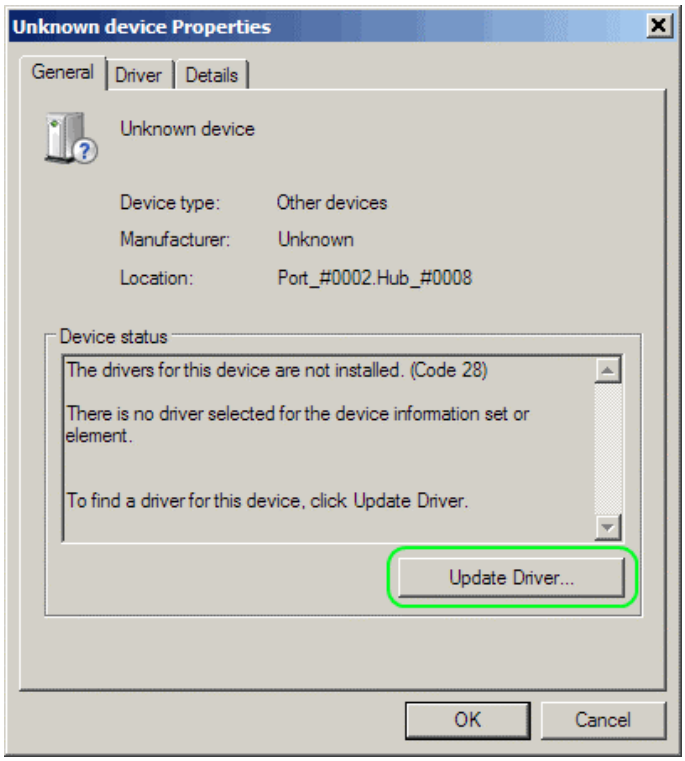


» You have now completed installing the DDS EVB GUI application. You will now need to power up the DDS EVB board in order to install the necessary software drivers. Please connect the DDS hardware to the computer with the USB cable.

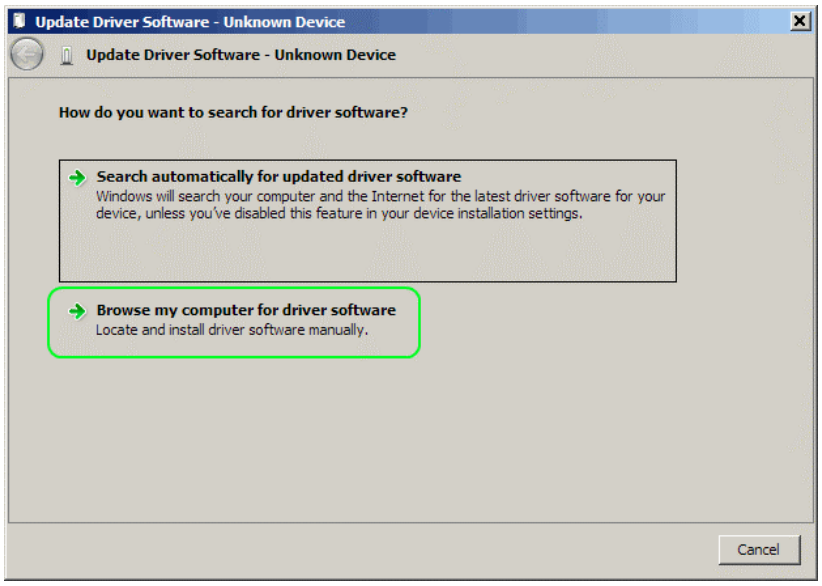
» When the DDS EVB is connected to the computer, Windows will attempt to automatically install the drivers. You will need to go into the Device Manager and manually install the drivers. There should be an "Unknown Device" listed under "Other device". Double click "Unknown device".



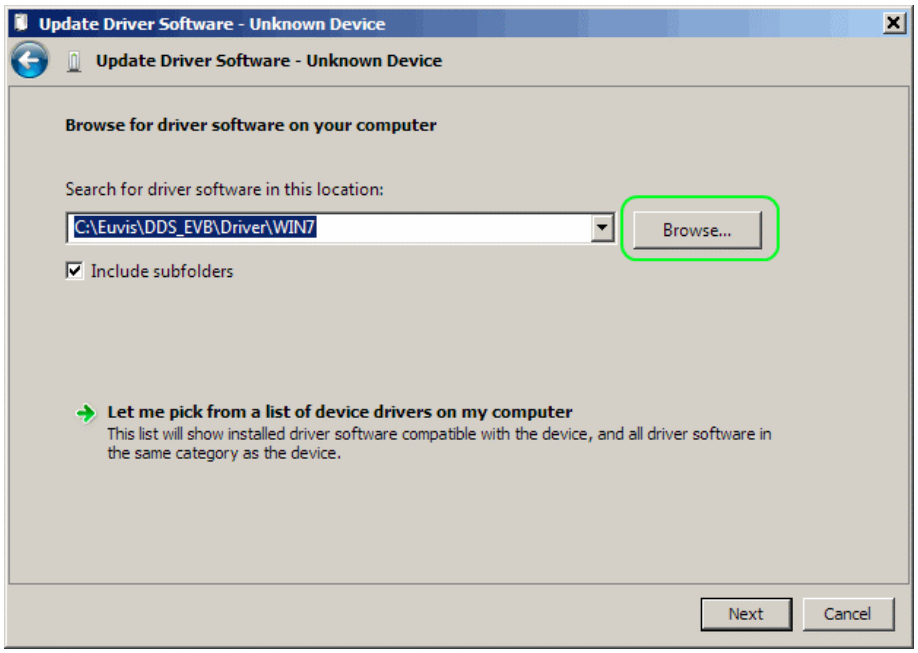
» This should bring up the "Unknown device Properties" window. Click on **Update Driver**.



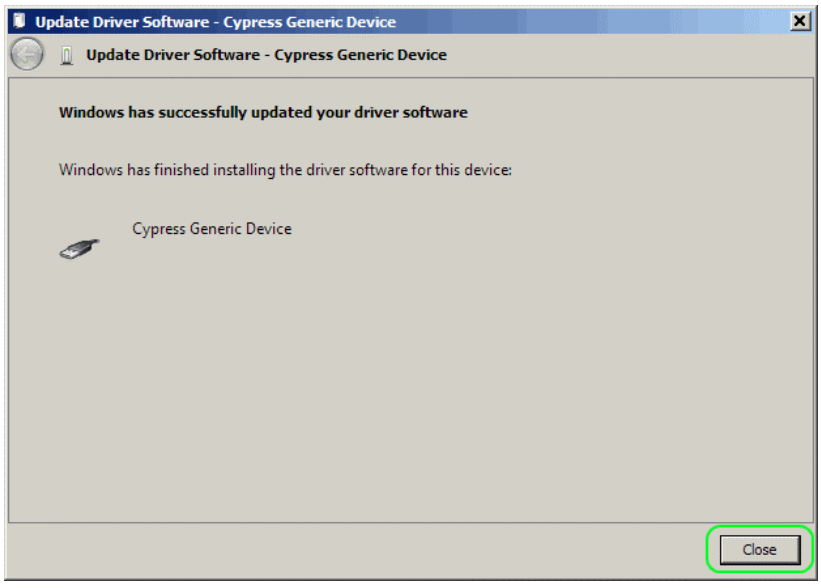
» Click on the **Browse my computer for driver software** option.



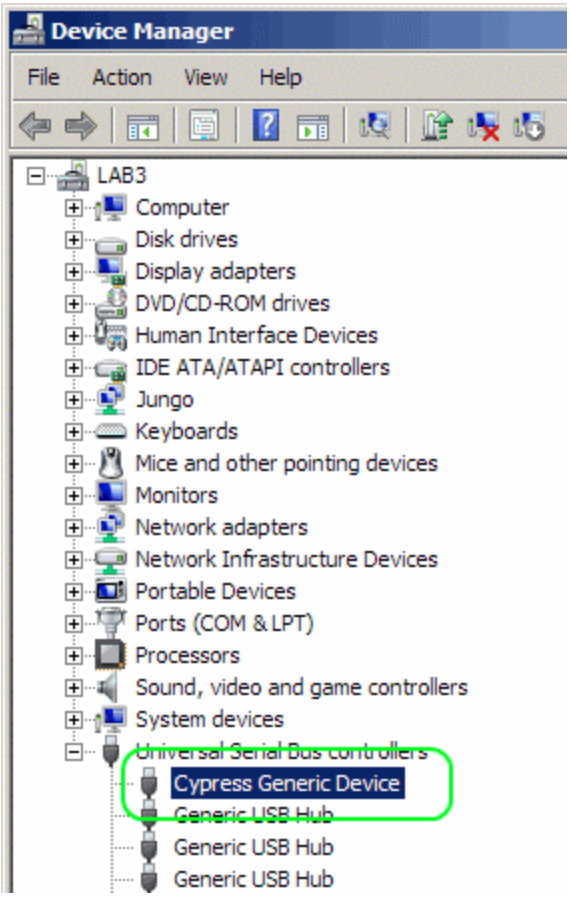
» Click on **Browse** and go to your DDS EVB driver folder which by default should be C:\Euvis\DDS_EVB\Driver\WIN7. Click on **Next** when you are finished.



» Windows will now install the driver and display the following window. Click on **Close**

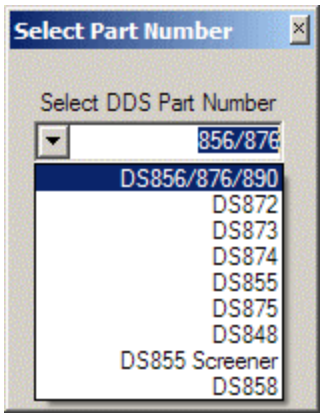


» In Device Manager, you should see "Cypress Generic Device" listed under "Universal Serial Bus controllers".

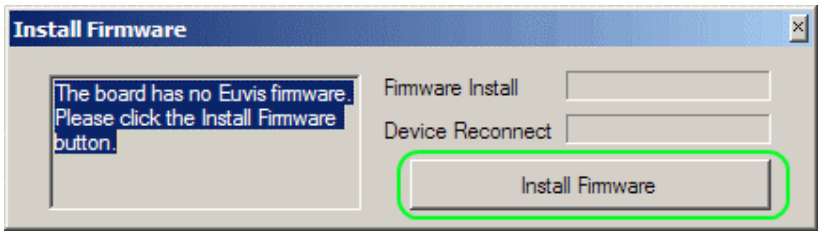


» To continue the driver installation process, please click on the "DDS_EVB" icon on your desktop or in the Start menu.

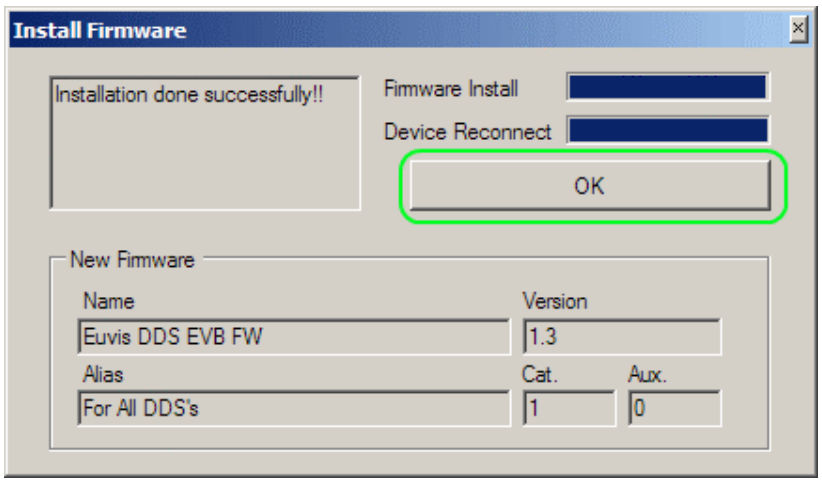
» Select the DDS chip that came with your DDS EVB board.



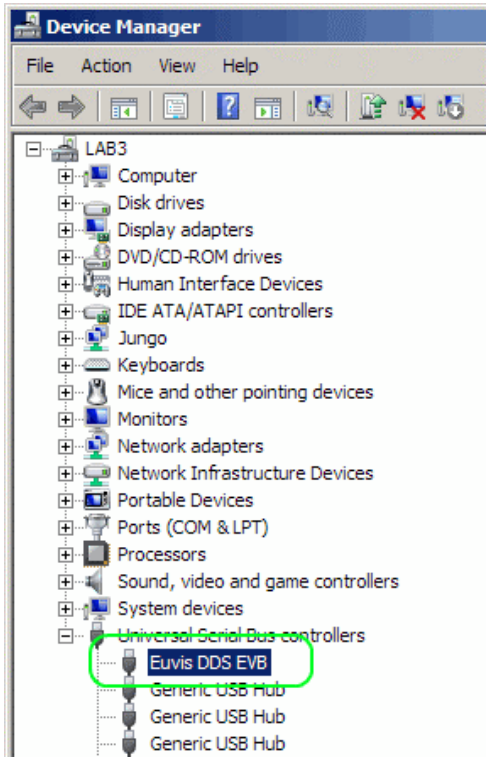
» The application will now attempt to install the firmware to the board. Click on **Install Firmware**.



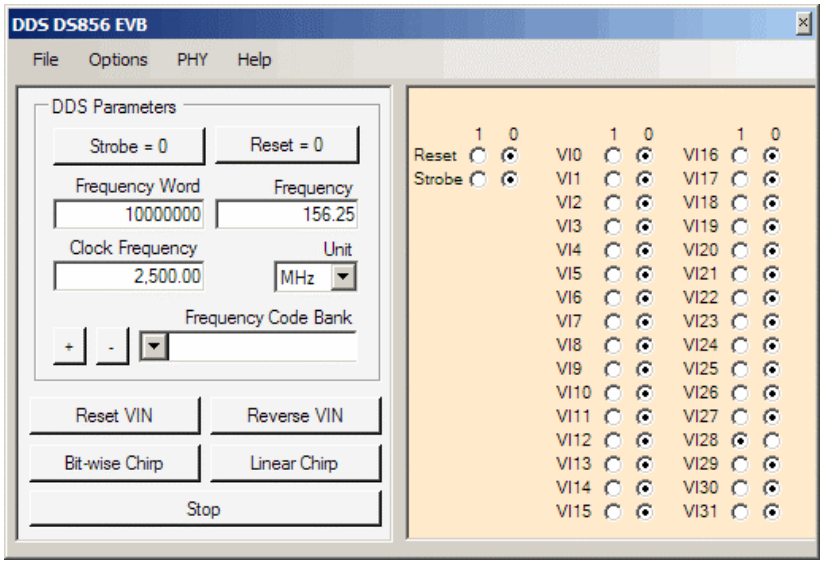
» During the firmware installation process, the operating system will also install the secondary drivers automatically. You will see the following window when both firmware and driver have been installed successfully. Click on **OK**.



» In Device Manger, you should be able to see "Euvis DDS EVB" under "Universal Serial Bus controllers.



» The DDS EVB GUI should now open. Depending on the length of time needed for firmware and driver instllation, you may need to restart the GUI for proper functionality.



Hardware Setup

Requirements

- -5V power supply capable of 1 A current
- Clock source
- Spectrum Analyzer
- Oscilloscope

Setup

DC Connections

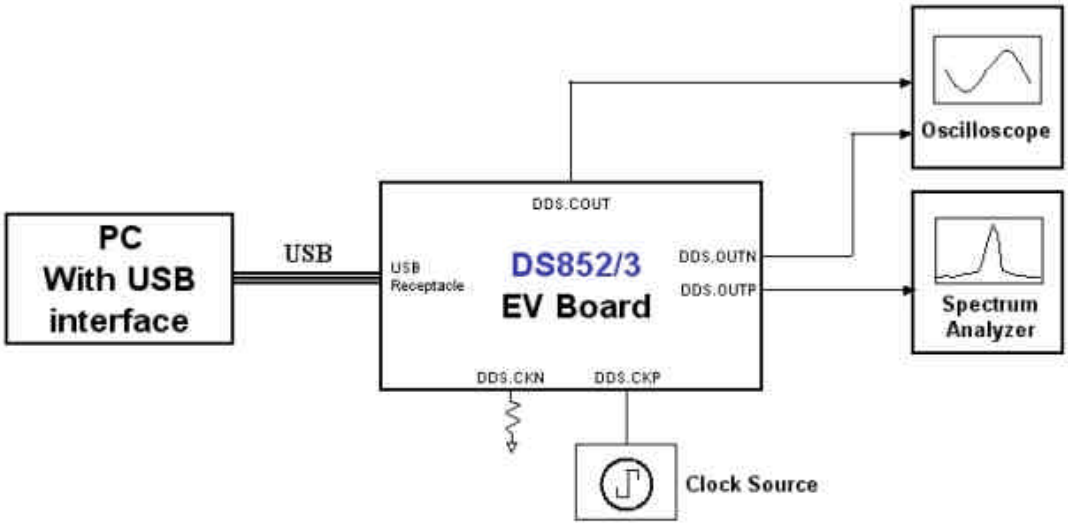
- -5 V Supply
  - Connect the –5V power supply output to the N5V pin on the board.
  - N5V uses a red DC pin and is located on the top right side of the board.
- Ground Supply
  - Connect the ground to the GND pin next to the N5V pin.
  - GND uses a black DC pin and is also located on the top right side of the board
- **DO NOT** connect to the P33V (+3.3 V) DC pin. This is for the USB controller but it will be self powered through the USB cable.

RF/SMA Connections

- Clock Input
  - Set clock DC level to ground or use a DC block for AC coupling.
  - Feed the clock to board at DDS.CKP located on the right edge of the board.
  - Terminate DDS.CKN with a 50 O termination
- RF Outputs
  - Connect DDS.OUTP to the Spectrum Analyzer
  - Connect DDS.OUTN to the Oscilloscope

» Using the USB A to B cable, connect the DDS device to the computer. Both LEDs "L1" and "L2" should light up.

Testing Setup Block Diagram



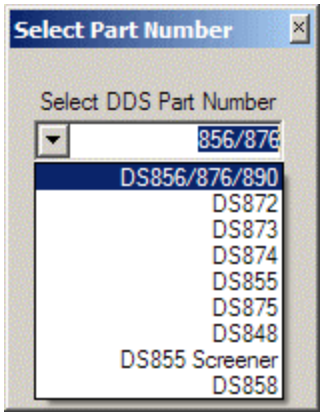
Operation

Firmware

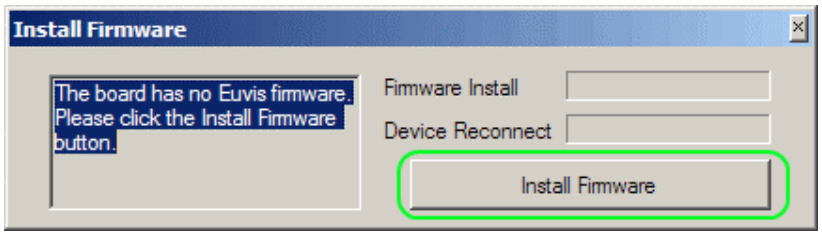
» Since the EV board does not come with its own ROM, after the initial firmware installation the firmware will need to be reinstalled if the USB cable is disconnected or if the computer is restarted. Once the firmware is installed, you may close the program and reopen it as many times as you want without reinstalling the firmware provided that you do not disconnect the USB cable or restart the computer.

» On the desktop, double click the application **DDS_EV**.

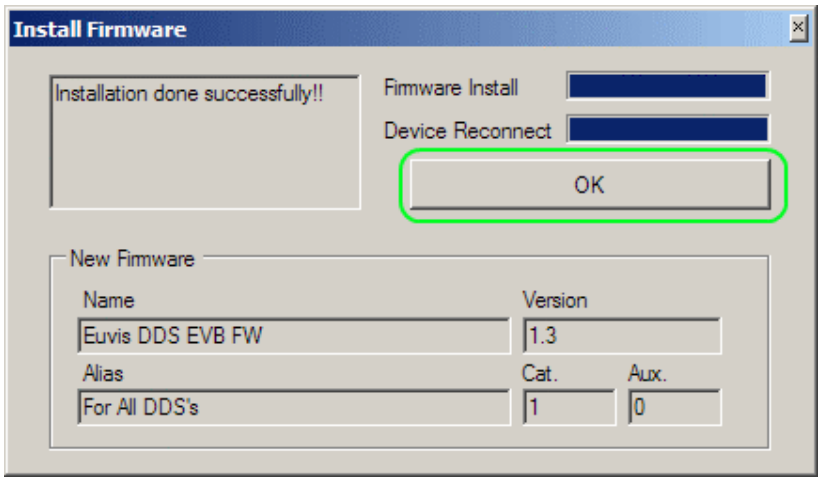
» Select the DDS chip that came with your board in the drop down list.



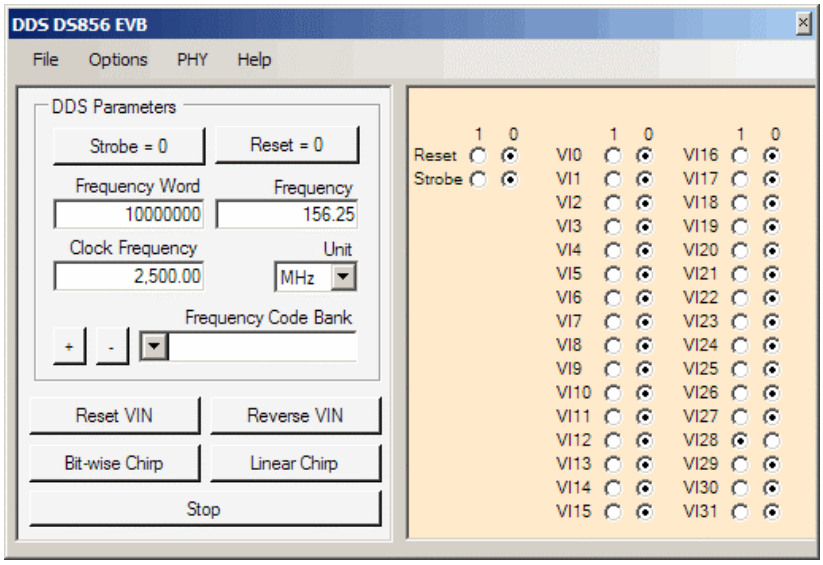
» The Install Firmware window will pop up. Click on **Install Firmware**.



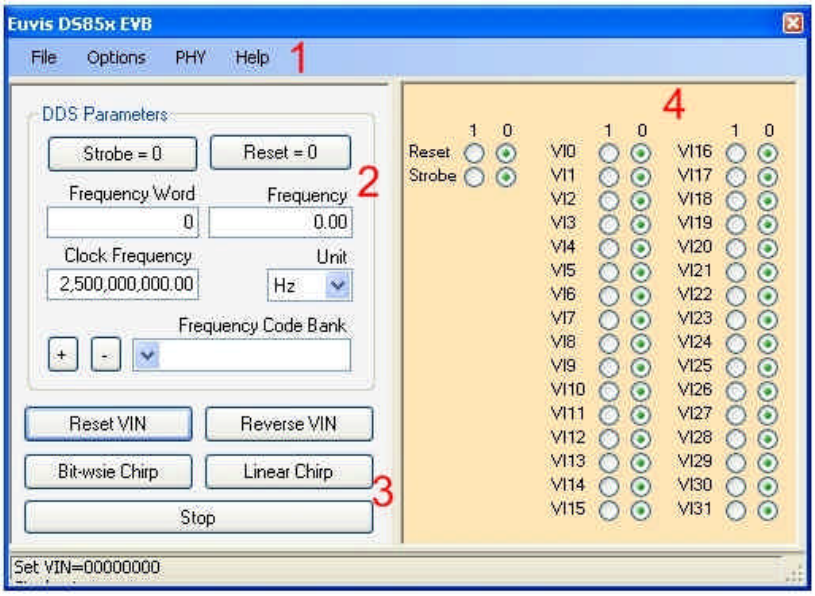
» The installer will copy the firmware onto the board's memory. Wait until both progress bars are 100%. Click on **OK** when installation is complete.



» The DDS EVB GUI application window should now open.

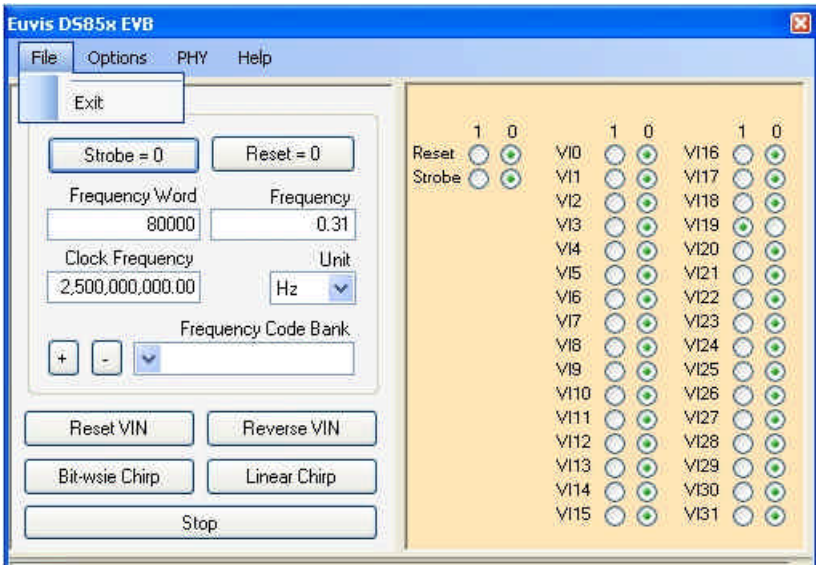


Application Window



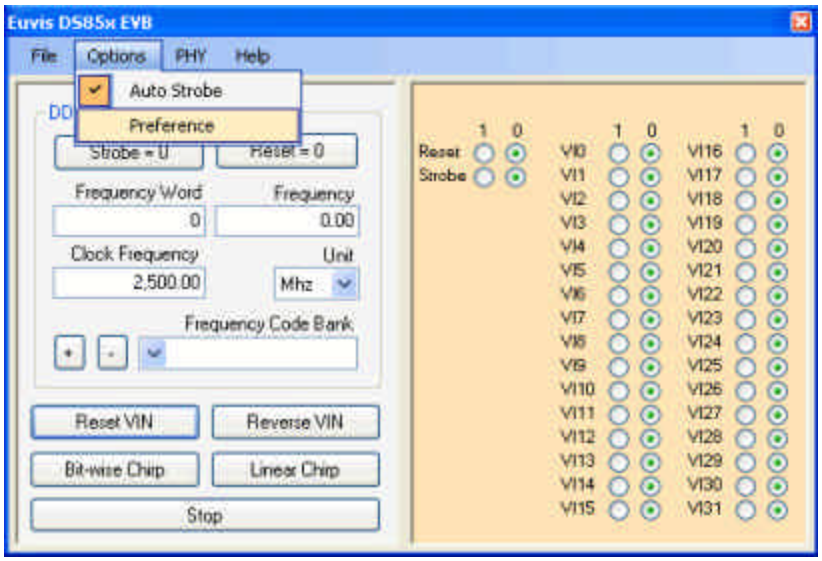
1. Menus
   2. DDS Parameters
   3. Advanced Options
   4. Bit Select

Menu : File



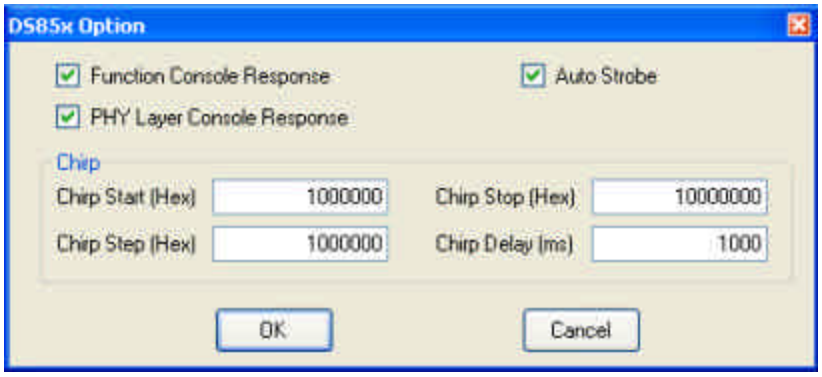
Exit - exits the program

Menu : Options



Auto Strobe - automatically updates output after user changes frequency. When this option is not selected, user will have to manually strobe in frequency changes using the "Strobe" button.

Preferences - brings up the Preferences window:



Function Console Response - when this is enabled, the program will write to a log file called "ds85x_evb.log". The program writes all instructions that are sent to the DDS board in the log file. When disabled, the program will not write to the log file.

PHY Layer Response - when this is enabled, the program will write to the same log file above all information it gets from the DDS board.

Auto Strobe - same as the Auto Strobe described above. When this is enabled, the program automatically updates output after user changes frequency. When this option is not enabled, user will have to manually strobe in frequency changes using the "Strobe" button.

Chirp Start - specifies the starting frequency of the Linear Chirp. You will have to enter the frequency word in hexadecimal format.

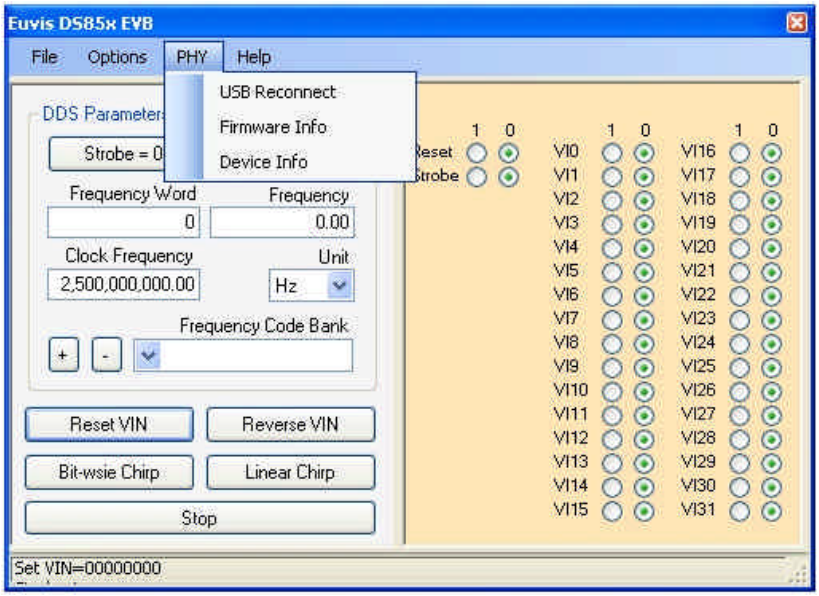
Chirp Stop - specifies the stop frequency of the Linear Chirp. You will have to enter the frequency word in hexadecimal format.

Chirp Step - specifies the step frequency of the Linear Chirp. You will have to enter the frequency word in hexadecimal format.

Chirp Delay specifies the delay between each frequency step. Specified in milliseconds.

NOTE: You can change the linear chirp parameters while the board is running a linear chirp. When you click on OK after you have made your changes, the board will instantly register the change and will chirp according to the new settings.

Menu : PHY



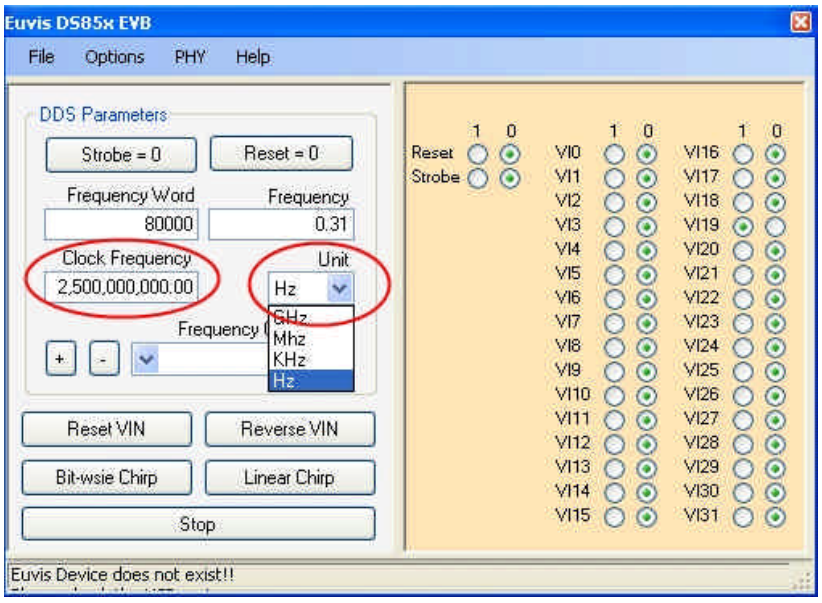
USB Reconnect - reconnects USB

Firmware Info - gives information about the firmware

Device Info - gives information about the DDS board

Changing Frequency

IMPORTANT: Please be sure that the **Clock Frequency** and the **Unit** matches the clock frequency of your input. The board cannot detect the input frequency so any wrong clock signal input will result in wrong signal output.

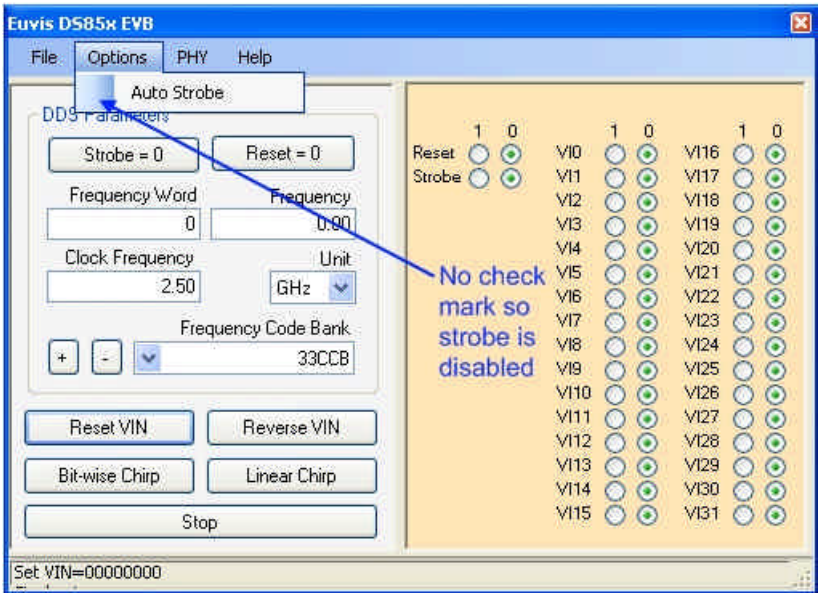


NOTE: The Unit selection will affect the resolution of the frequency selected. The lower the Unit, the higher the resolution you will be able to select for the output frequency. For example if Unit was "Hz" and user enters "57915" as the Frequency, then the output frequency is 57,914.88 Hz which is a 0.12 Hz difference from the desired frequency. Now if the user were to change Unit to "KHz" and then enters "57.915" as the Frequency, then the output frequency is 57.91 Khz which is a 5 Hz difference from the desired frequency.

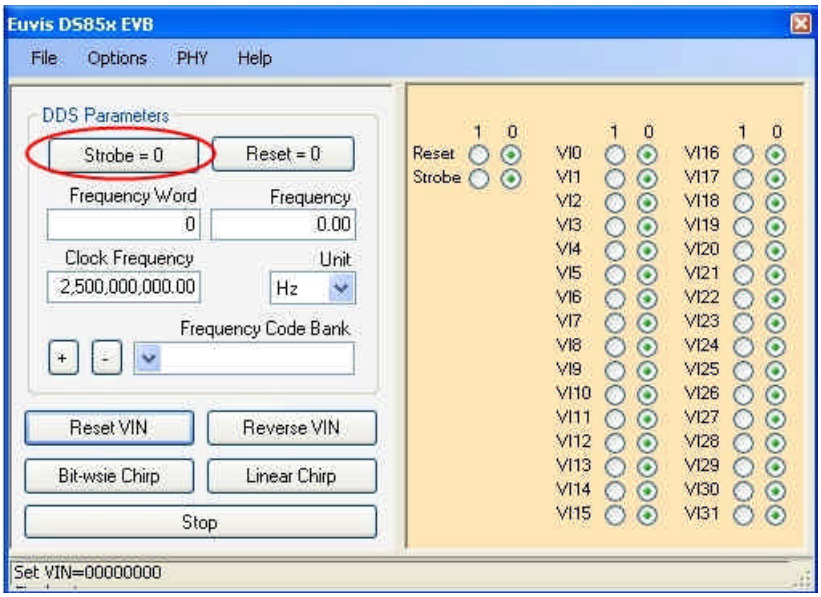
NOTE: The maximum output frequency is half of the clock frequency. So if the clock is 2.5 GHz, then the maximum output frequency is 1.25 GHz. If you enter a frequency that is more than half the input clock frequency, the real output frequency will be: Input Clock Frequency - User Defined Frequency. For example if the input clock was 2.5 GHz (max output frequency 1.25 GHz) and the user enters 1.95 Ghz in the Frequency box then the output frequency will be 2.5 - 1.95 = 0.55 GHz or 550 MHz.

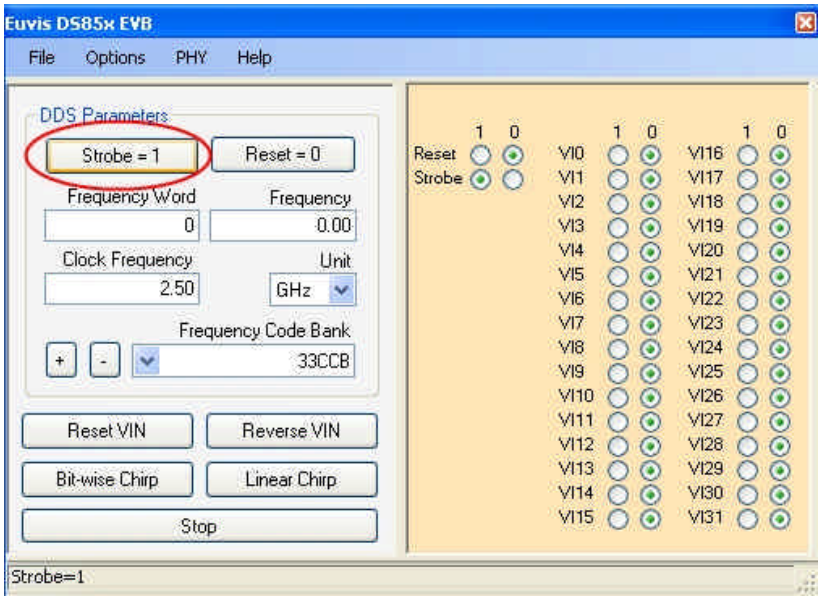
Strobe

This button is only useful when **Auto Strobe is off**.



When Auto Strobe is off, when the user changes either the Frequency Word box, Frequency box or the individual bits, the changes will not be automatically sent to the board. Instead, the user will have to click on **Strobe = 0** to set Strobe high then click **Strobe = 1** to set Strobe low again.





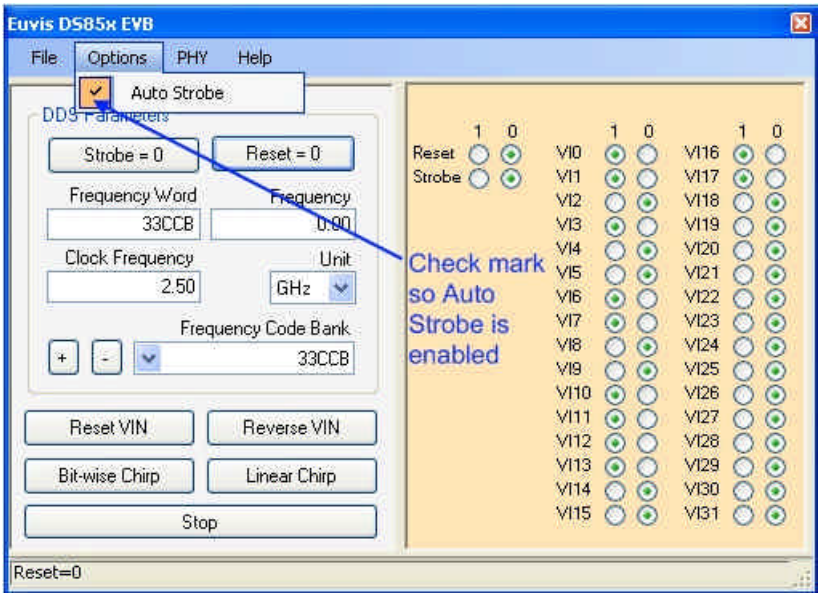
After this sequence, the user data will be strobed to the board. Only through the Strobe high-low sequence will the data be updated to the board when Auto Strobe is off.

Reset

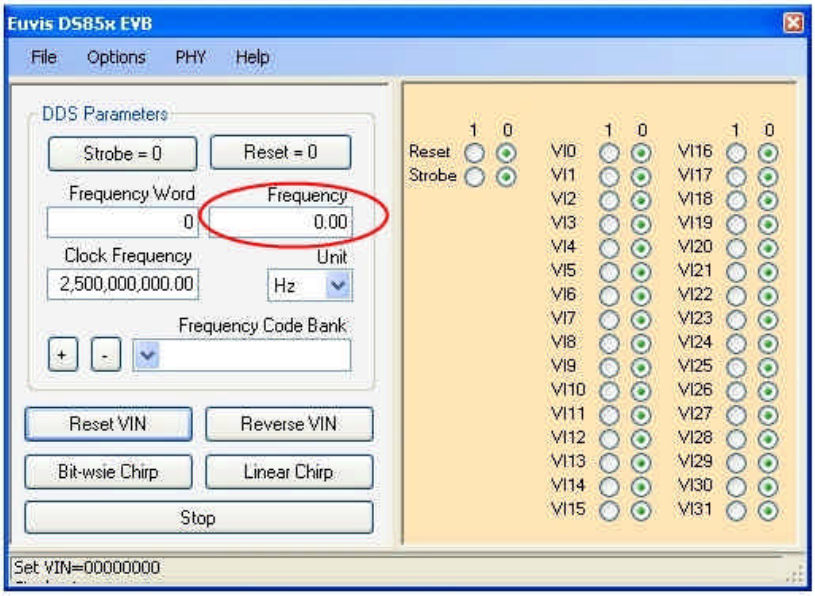
When Reset is set to 0, the board functions normally and outputs the desired frequency. When Reset is set to 1, there is no output.

Changing Frequency With Auto Strobe On

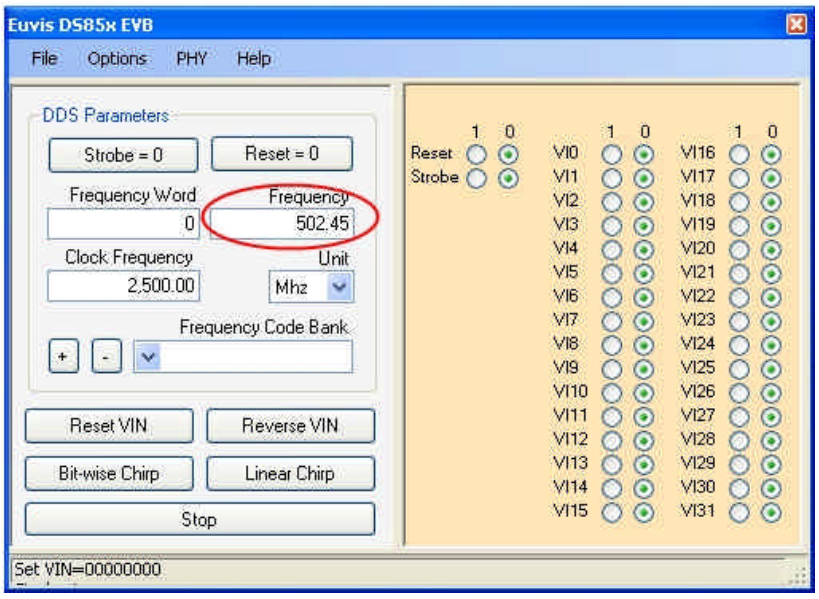
There are three ways to change the frequency. First make sure that **Auto Strobe is on**.



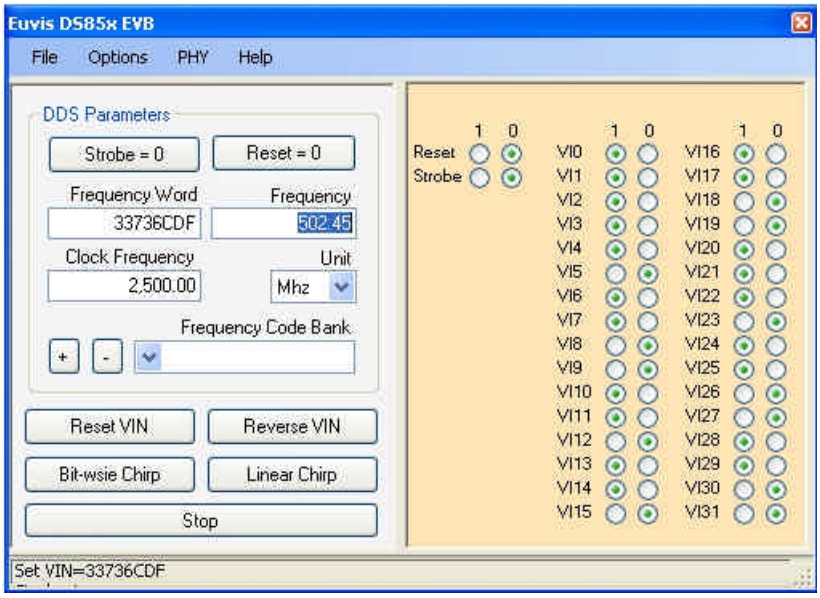
1. Change frequency by changing the Frequency box.



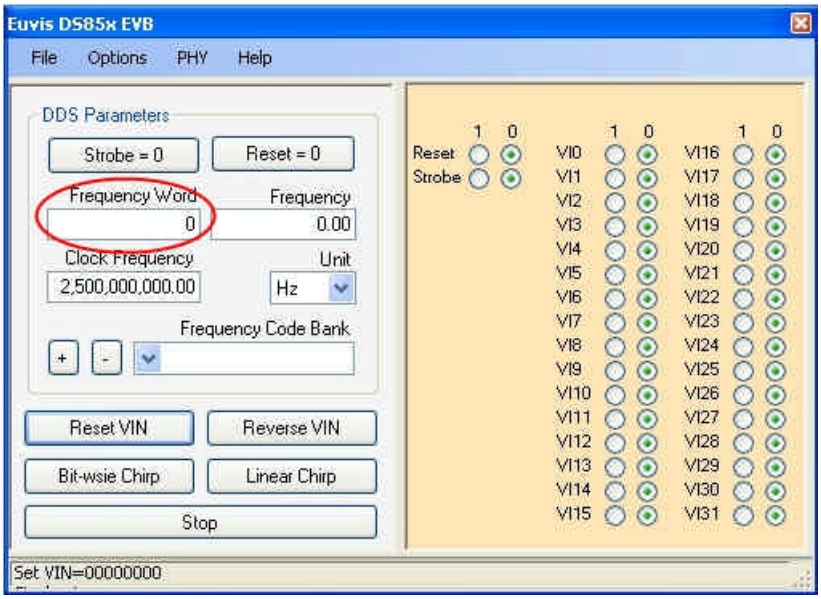
» To change the frequency, make sure that the Unit is correct then simply enter the desired frequency in the Frequency box. After typing the number press Enter to register the change to the program.



» Since Auto Strobe is enabled, the output will be automatically changed.

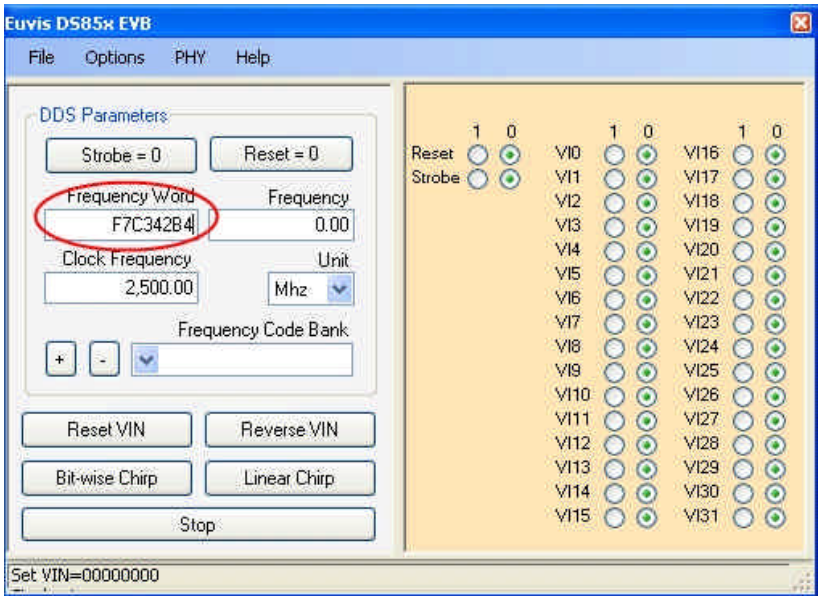


2. Change frequency by changing the Frequency Word box.

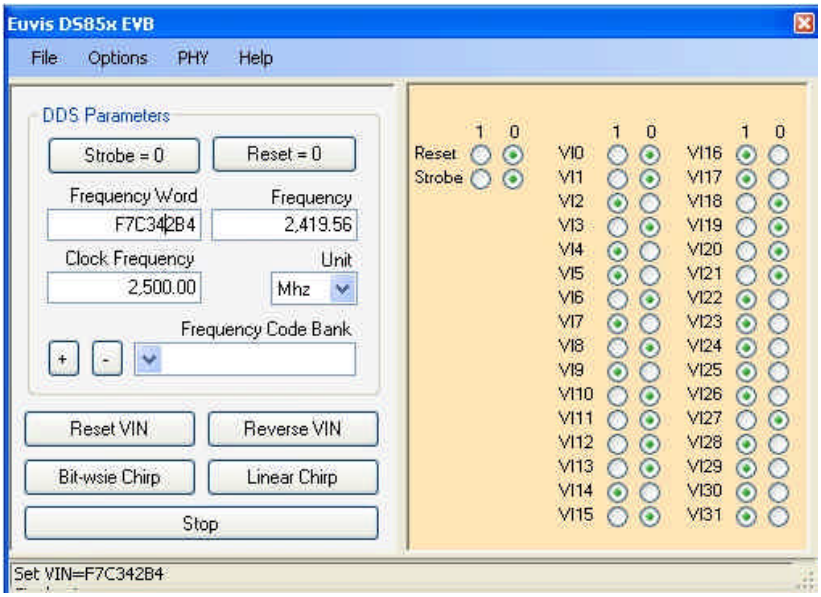


» Make sure that the Unit is correct then enter the frequency word in hexadecimal. Since there are 32 bits, there are 8 hexadecimal digits with each hexadecimal digit representing every 4 bits of the frequency word. The leftmost hex digit in the frequency word represents the most significant bits while the rightmost hex digit represents the least significant bits.

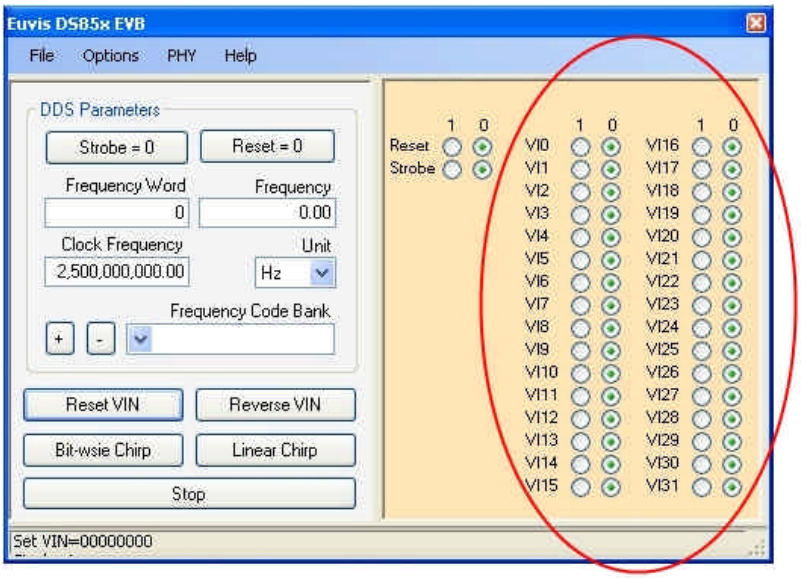
» After typing the frequency word press Enter to register the change to the program.



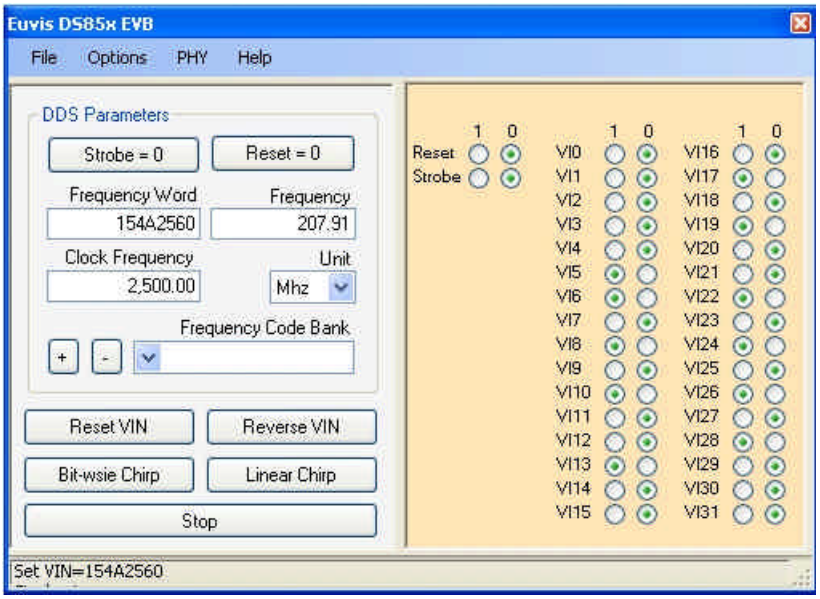
» Since Auto Strobe is enabled, the output will be automatically changed.



3. Change frequency by changing the individual bits.



» Make sure that the Unit is correct then manually switch on or off each bit to get the desired frequency word. The Frequency and the Frequency Word will reflect changes made by the user. Since Auto Strobe is enabled each time a bit is changed, the output is automatically updated.

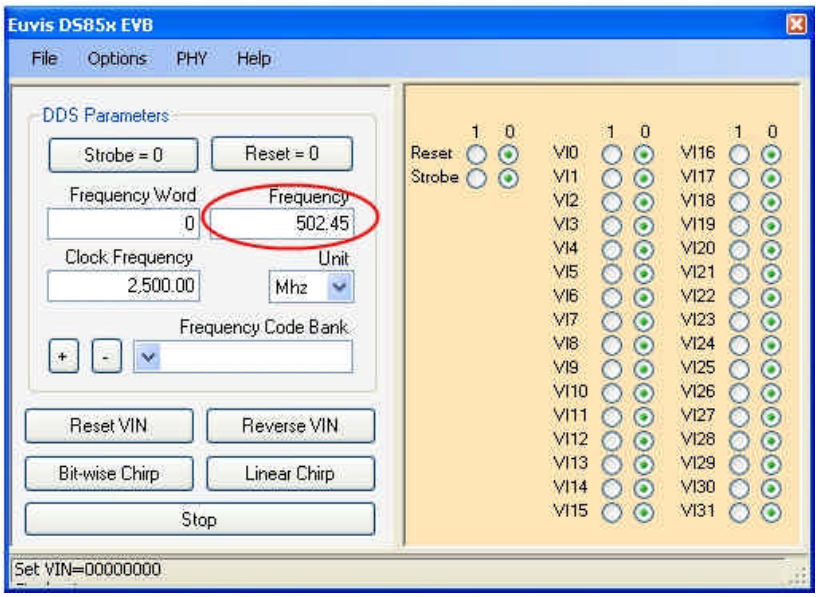


Changing the Frequency with Auto Strobe Off

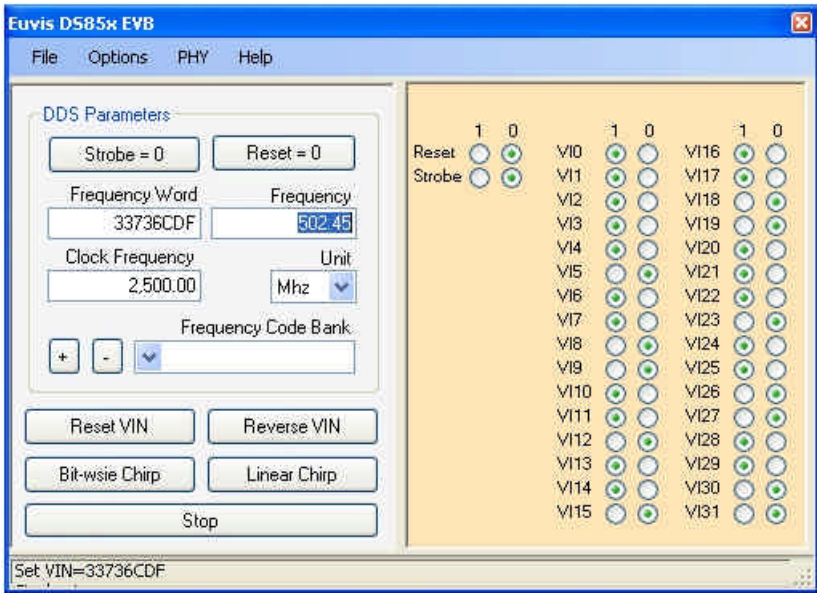
Changing the frequency with Auto Strobe off is exactly like changing the frequency with Auto Strobe on except that at the end of each change, you have to click on the **Strobe** twice.

As a demonstration, we will show you how to change the frequency with the Frequency box.

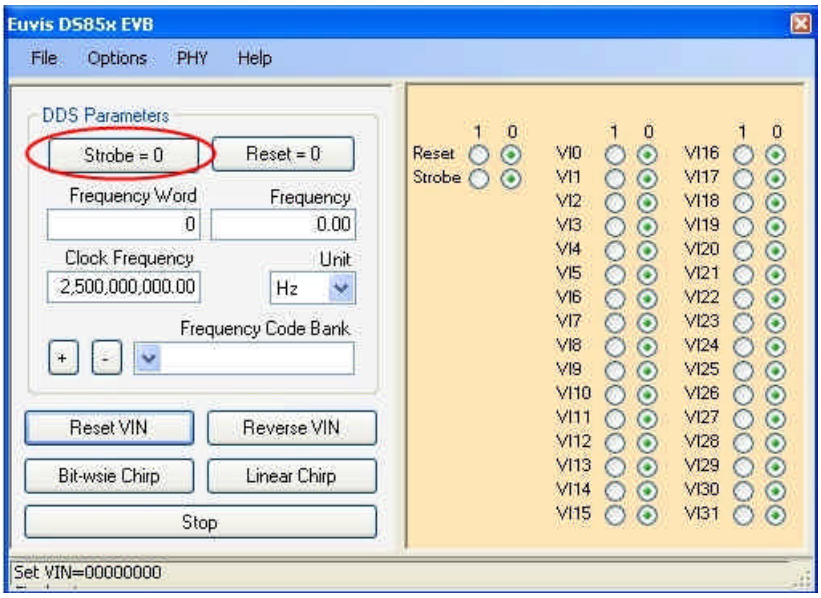
» First make sure that the Unit is correct then enter the desired value in the Frequency box.



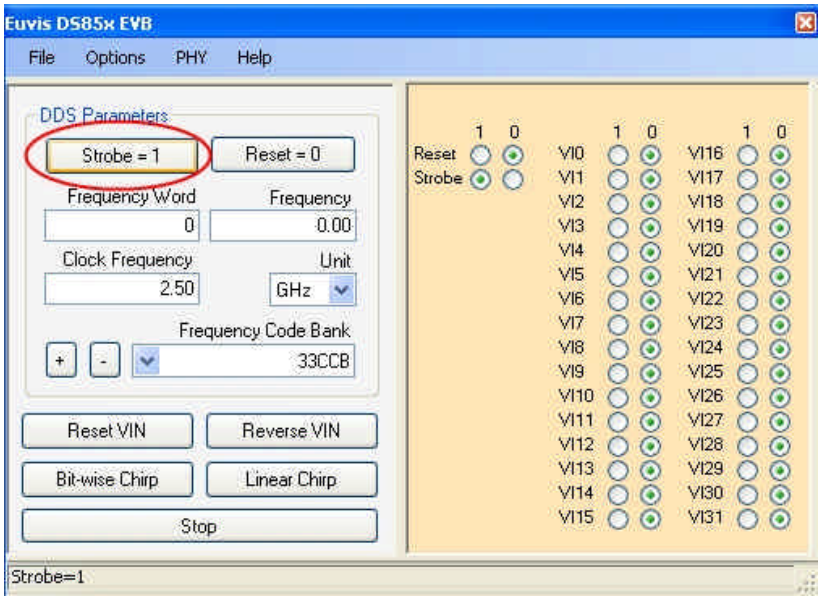
» Press Enter to register the change to the program.



» Now we need to strobe the changes to the board. Click on **Strobe = 0**.



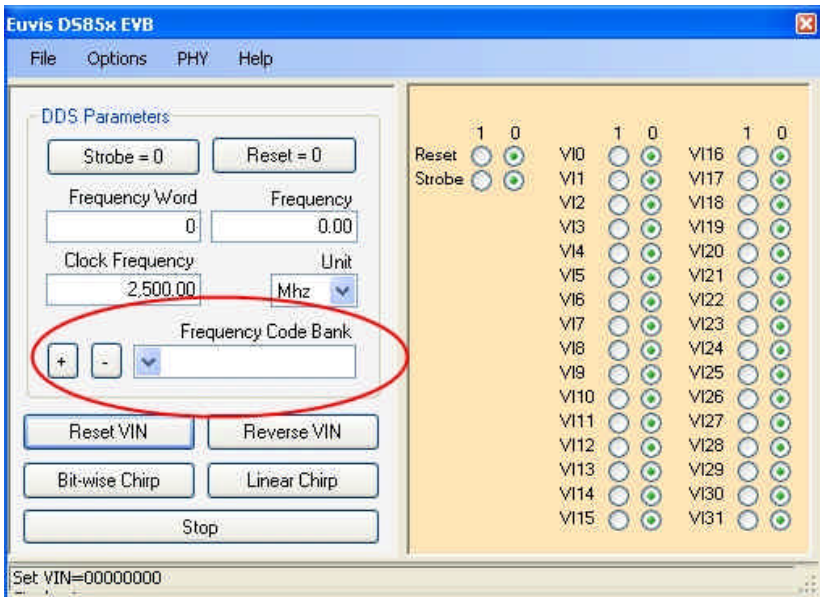
» Click on **Strobe = 1** again.



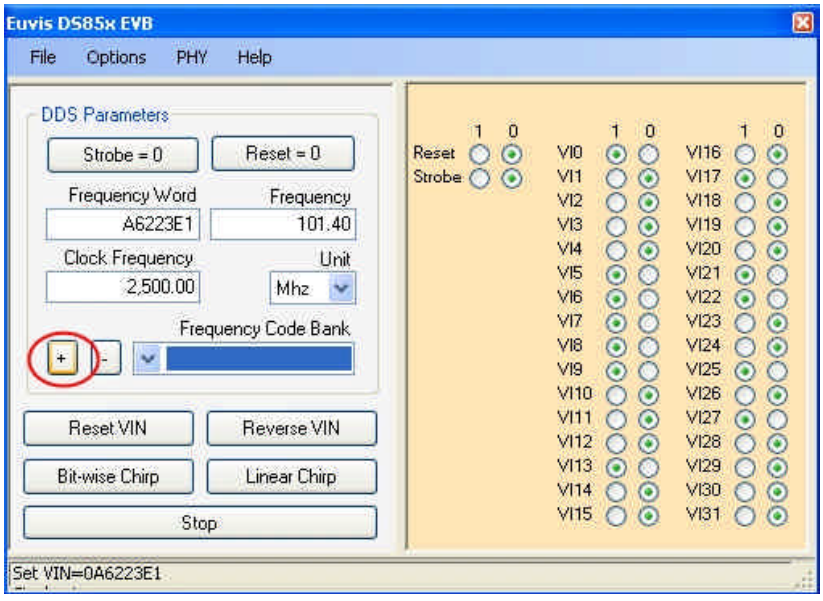
» The output should have changed. Changing frequency using the Frequency Word box and using the individual bits is similar to this. All you have to make sure is to click on the Strobe button **twice** after each change.

Frequency Code Bank

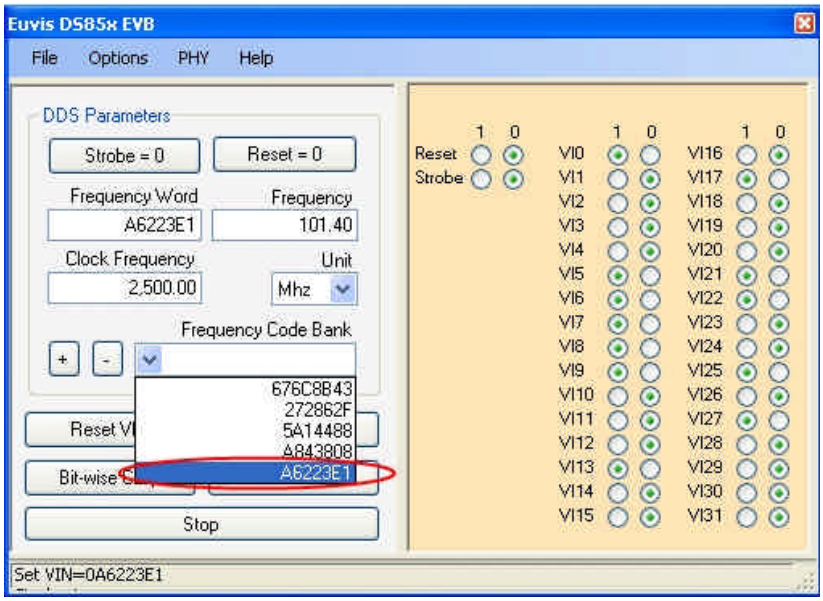
For convenience, we have included the Frequency Code Bank. This is a place to store frequencies which you have already entered.



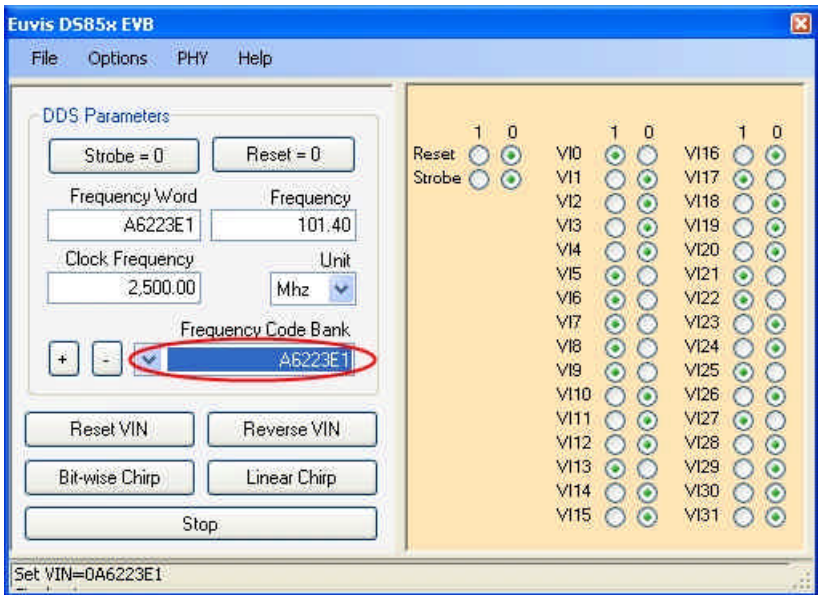
» To add a frequency, click on the "+" button.



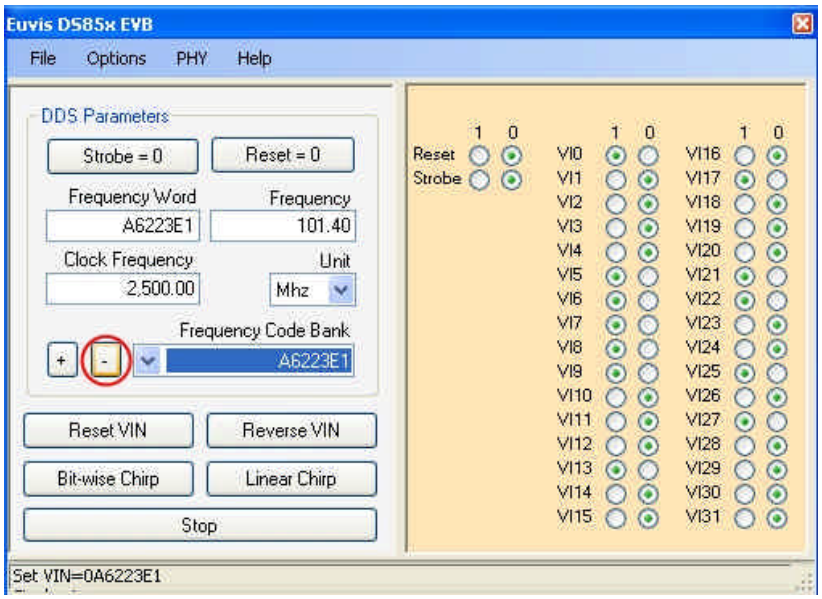
» The frequency word will now show up in the Frequency Code Bank.



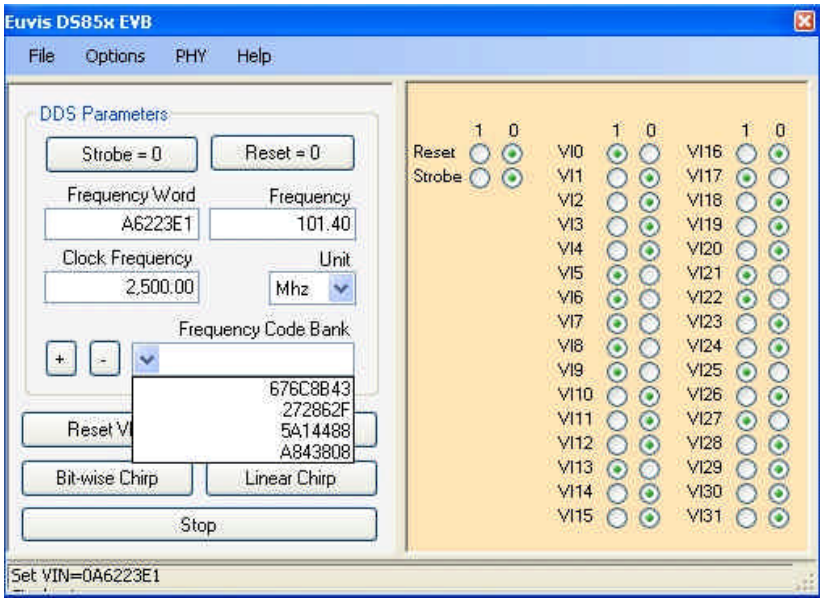
» To remove a frequency code word, click on the the drop-down list and select the frequency word you want to remove.



» Click the "-" button.

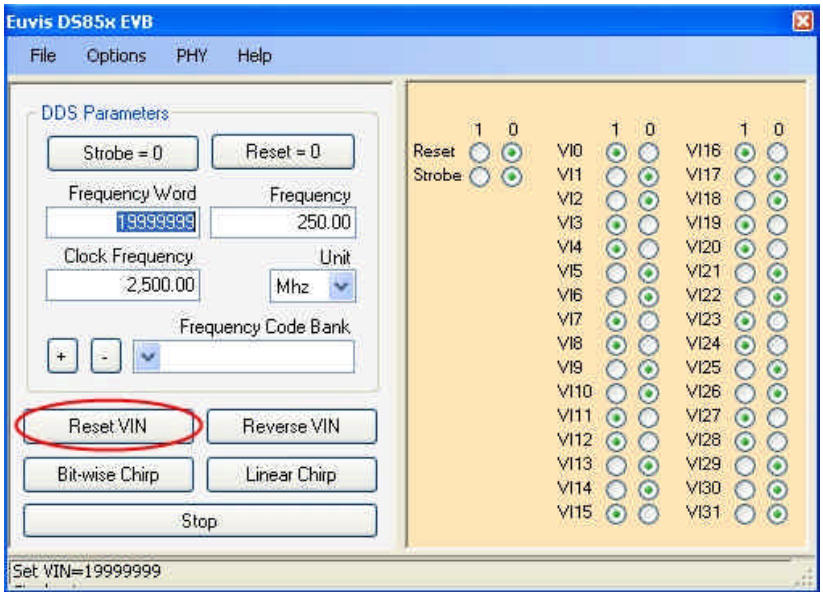


» The frequency is no longer in the Frequency Code Bank.

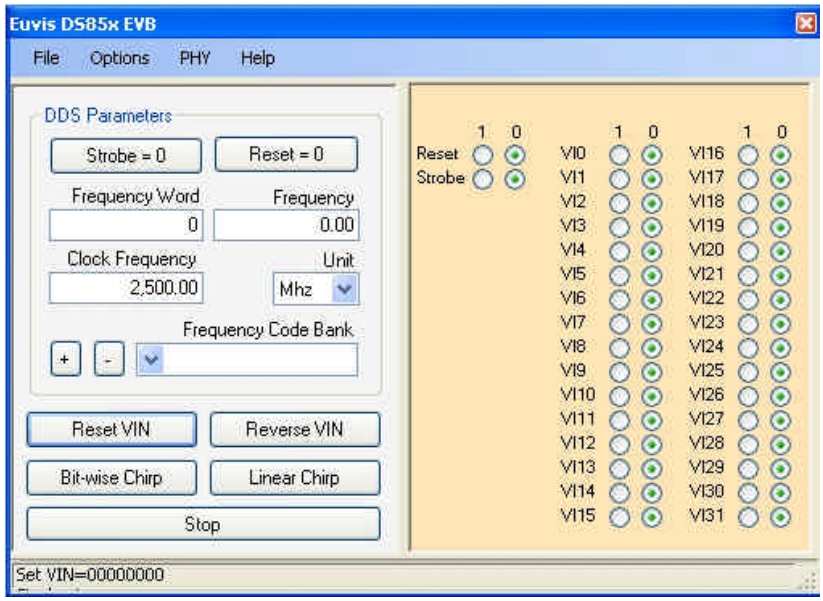


Advanced Options

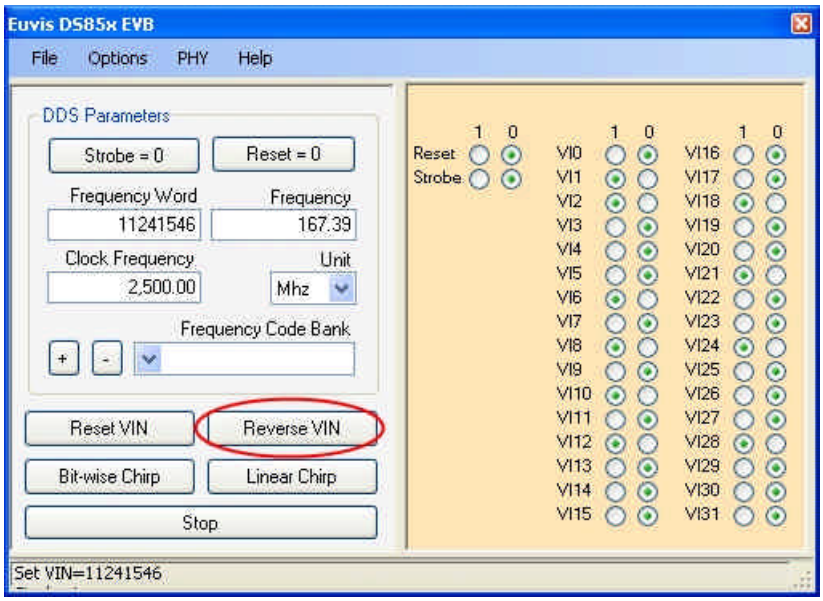
Reset VIN



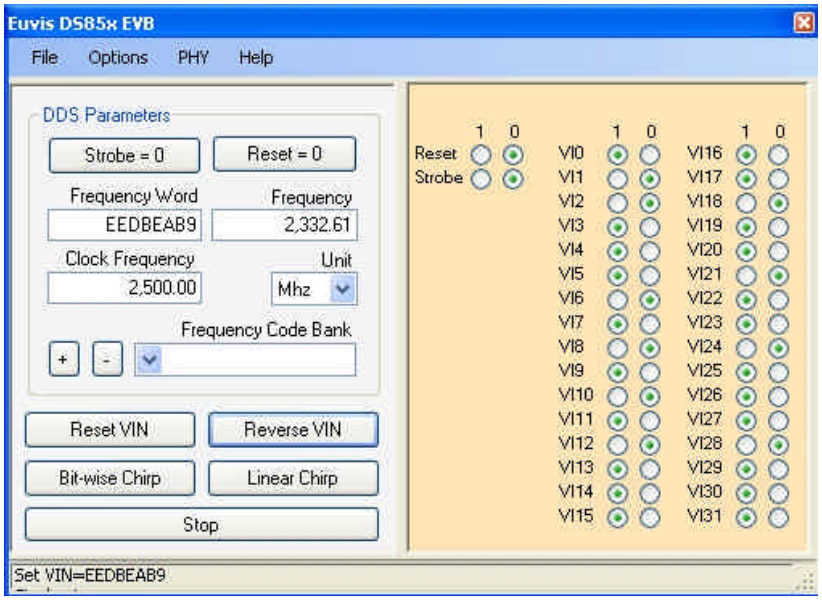
» Reset VIN changes all individual bits to "0".



Reverse VIN

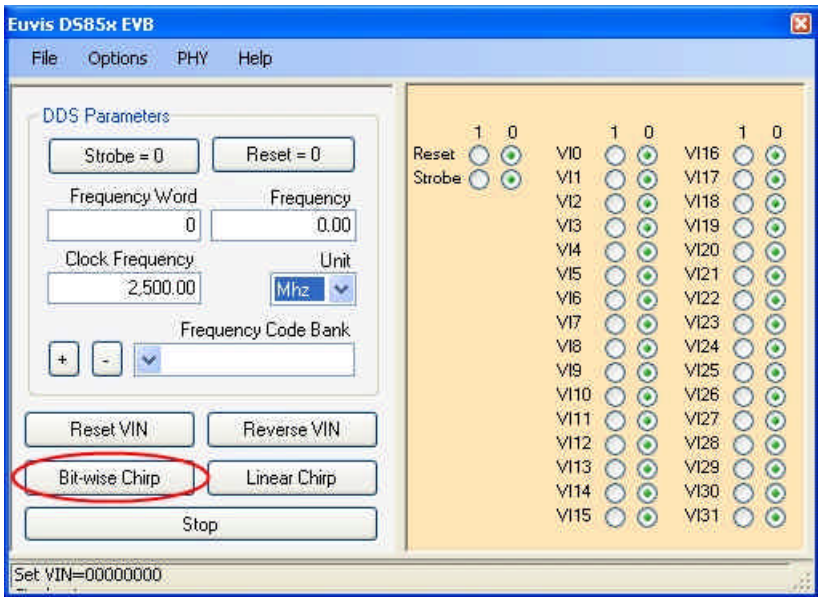


» Reverses all individual bits. If a bit was "0" then it will turn into "1" and if a bit was "1" then it will turn into "0".

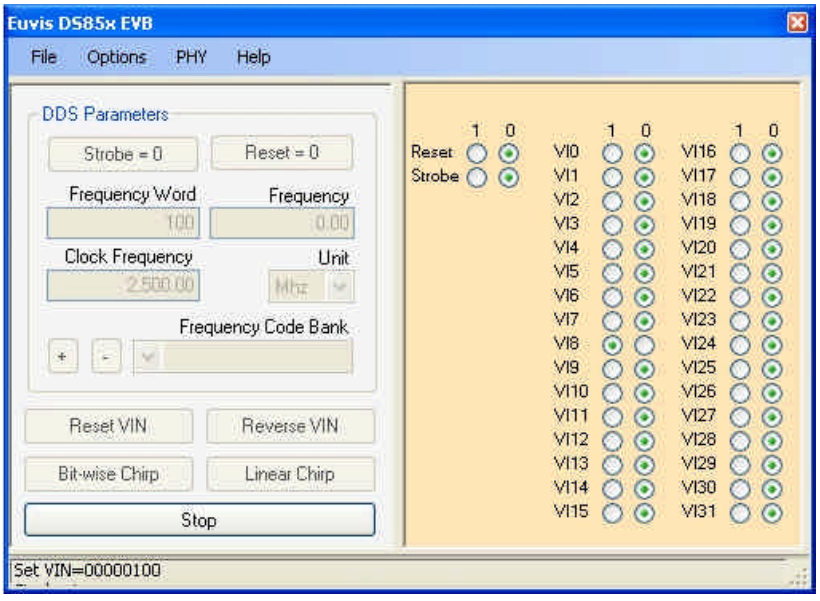


NOTE: Reversing the individual bits has no real effect on the real output frequency. Recall that the real output frequency of any frequency entered above half of the input frequency will actually be: Input Clock Frequency - User Defined Frequency. Instead of actually computing this, you can use the Reverse VIN button to get the real output frequency if you entered a frequency that is more than half the input clock frequency.

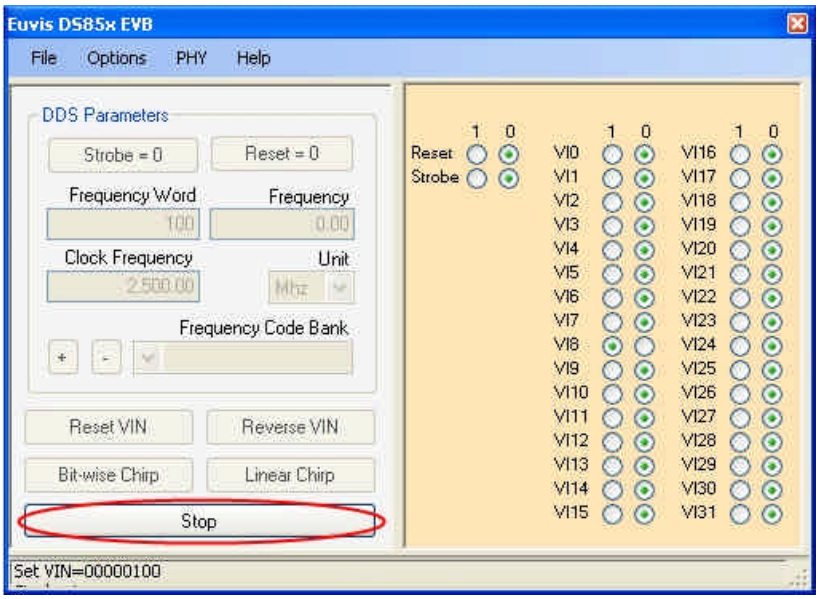
Bit-Wise Chirp



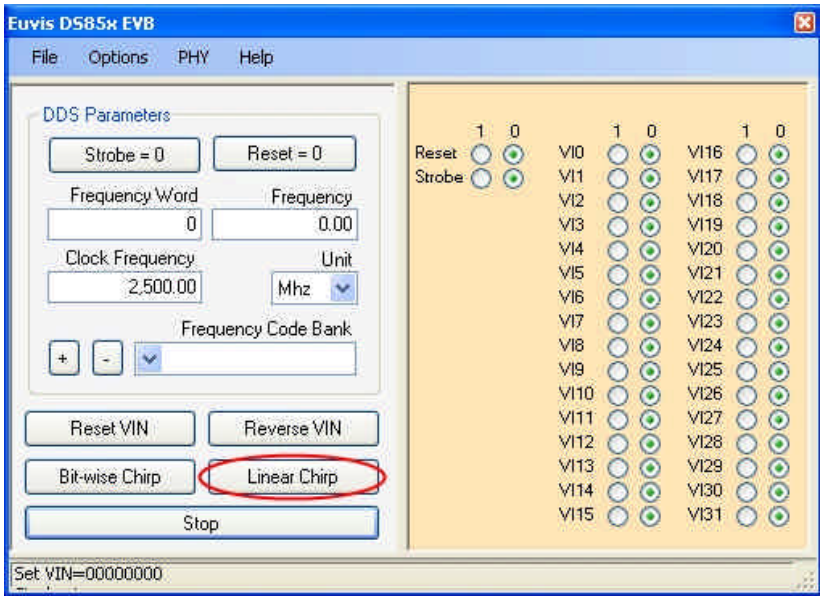
» Clicking on this button will initiate chirping by flipping on and off each of the 32 bits in the frequency word. Chirping will start with the least significant bit "VI0" and proceed all the way to the most significant bit "VI31".



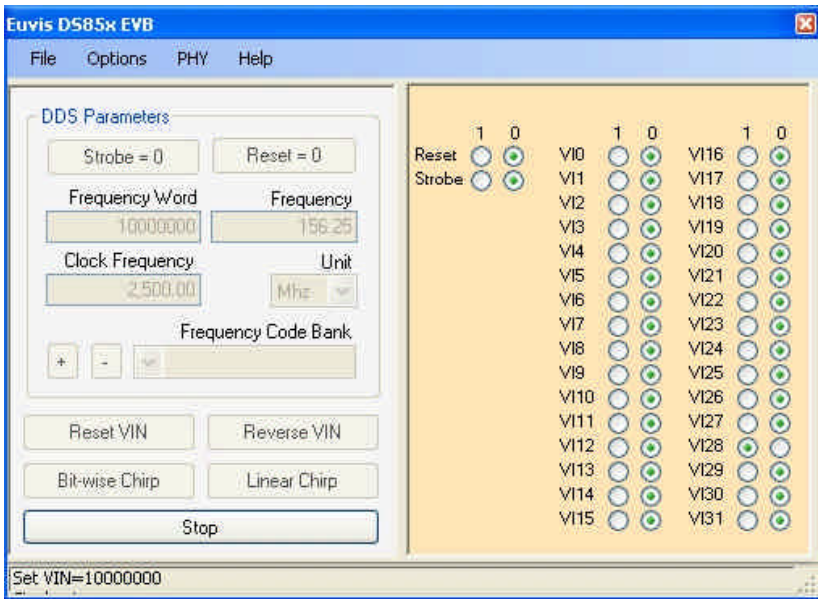
» You may stop the bitwise chirp at any time by clicking on **Stop**. After bitwise chirp stops, either by completing all the bits or by user intervention, the DDS parameters return to the frequency before the chirp was started.



Linear Chirp



» Clicking on this will initiate linear chirping. You may change linear chirping options by going to Preferences in the Options menu.



» You may stop either chirps at any time by clicking on **Stop**. After bitwise chirp stops, the DDS Parameters return to the frequency before the chirp was started.