



ispDOWNLOAD Cables

User's Guide

Features

- Support for all Lattice programmable products
 - 1.2V to 5V programming
 - Ideal for design prototyping and debugging
- Connect to multiple PC interfaces
 - USB (v.1.0, v.2.0)
 - PC Parallel Port
- Easy-to-use programming connectors
 - Versatile flywire, 2 x 5 (.100") or 1 x 8 (.100") connectors
 - 6 feet (2 meters) or more of programming cable length (PC to DUT)
- Lead-free/RoHS compliant construction

Figure 1. USB Cable – HW-USBN-2A (Parallel Cable - HW-DLN-3C Not Shown)



ispDOWNLOAD Cables

Lattice ispDOWNLOAD[®] Cable products are the hardware connection for in-system programming of all Lattice devices. After completion of the logic design and creation of a programming file with the Lattice Diamond[®], ispLEVER[®] Classic or PAC-Designer[®] software, the Lattice Diamond Programmer, or Lattice's ispVM[™] System software is used to control the programming of devices directly on the PC board. No additional components are required to program a device.

After you complete your logic design and create a programming file with the Lattice Diamond/ispLEVER development tools, you can use ispVM[™] System software or Diamond Programmer to program devices on your board. The ispVM System/Diamond Programmer software automatically generates the appropriate programming commands, programming addresses and programming data based on information stored in the programming file and parameters you set in ispVM/Diamond Programmer. Programming signals are then generated from the USB or parallel port of a PC and directed through the ispDOWNLOAD Cable to the device. No additional components are required for programming.

ispVM System/Diamond Programmer software is included with all Lattice design tool products and is available for download from the Lattice web site at www.latticesemi.com.

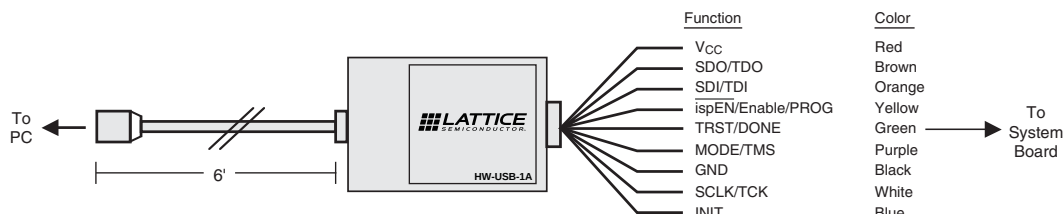
ispDOWNLOAD Cable Pin Definitions

The functions provided by the ispDOWNLOAD cables correspond with available functions on Lattice programmable devices. Since some devices contain different programming features, the specific functions provided by the ispDOWNLOAD cable may depend on the selected target device. ispVM System/Diamond Programmer software will automatically generate the appropriate functions based on the selected device. See Table 1 for an overview of the ispDOWNLOAD cable functions.

Table 1. ispDOWNLOAD Cable Pin Definitions

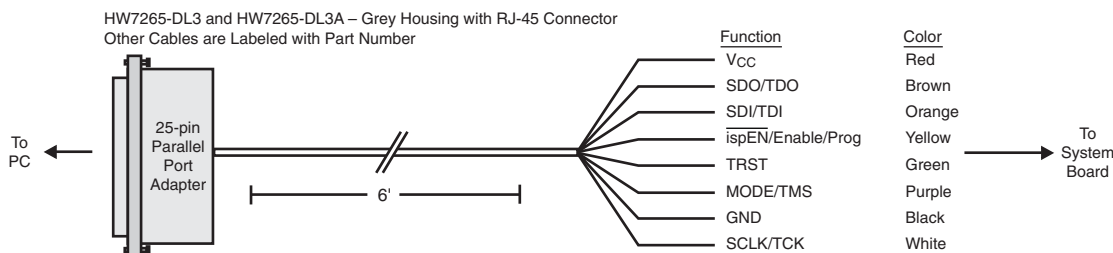
ispDOWNLOAD Cable Pin	Name	ispDOWNLOAD Cable Pin Type	Description
VCC	Programming Voltage	Input	Connect to V_{CC} or V_{CCJ} plane of the target device. Typical $I_{CC} = 10\text{mA}$. Your board design supplies the power for V_{CC} . <i>Note: This may not be the same as a target device's V_{CCO} plane.</i>
SDO/TDO	Test Data Output	Input	Used to shift data out via the IEEE1149.1 (JTAG) programming standard.
SDI/TDI	Test Data Input	Output	Used to shift data in via the IEEE1149.1 programming standard.
ispEN/Enable/PROG	Enable	Output	Enable device to be programmed.
TRST	Test Reset	Output	Optional IEEE 1149.1 state machine reset.
DONE	DONE	Input	DONE indicates status of configuration
MODE/TMS	Test Mode Select Input	Output	Used to control the IEEE1149.1 state machine.
GND	Ground	Input	Connect to ground plane of the target device
SCLK/TCK	Test Clock Input	Output	Used to clock the IEEE1149.1 state machine
INIT	Initialize	Input	Indicates that ORCA® device is ready for configuration.

Figure 2. ispDOWNLOAD Cable In-System Programming Interface for the PC (HW-USB-1A or HW-USB-2A)¹



1. Lattice PAC-Designer® software does not support programming with USB cables. To program ispPAC devices with these cables, use the ispVM System software/Diamond Programmer.

Figure 3. ispDOWNLOAD Cable In-System Programming Interface for the PC (HW-DLN-3C and Equivalents)¹



1. HW7265-DL3, HW7265-DL3A, HW-DL-3B, HW-DL-3C and HW-DLN-3C are functionally equivalent products.

Figure 3. ispDOWNLOAD Cable In-System Programming Interface for the PC (pDS4102-DL2 or pDS4102-DL2A)

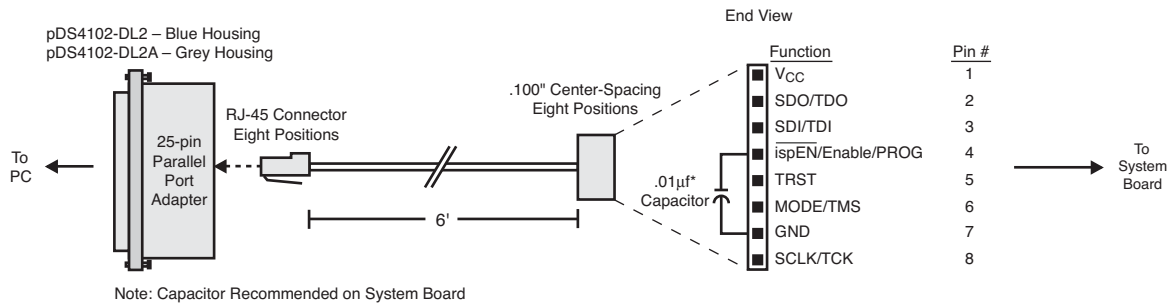
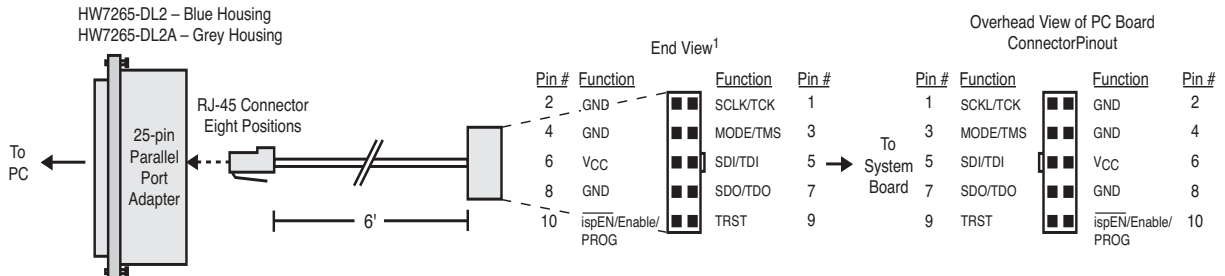


Figure 4. Figure 4. ispDOWNLOAD Cable In-System Programming Interface for the PC (HW7265-DL2 or HW7265-DL2A)



1. For reference purposes, the 2x10 connector on the HW7265-DL2 or HW7265-DL2A is equivalent to Tyco 102387-1. This will interface to standard 100-mil spacing 2x5 headers, or a 2x5 keyed, recessed male connector such as the 3M N2510-5002RB.

Programming Software

ispVM System/Diamond Programmer is the preferred programming management software tool for all Lattice devices and download cables. The latest version of ispVM System software or the Lattice Diamond Programmer is available for download from the Lattice web site at www.latticesemi.com/software.

Target Board Design Considerations

A 4.7K pull-down resistor is recommended on the TCK connection of the target board. This pull-down is recommended to avoid inadvertent clocking of the TAP controller induced by fast clock edges or as V_{CC} ramps up. This pull-down is recommended for all Lattice programmable families.

For Lattice device families that feature low power, it is recommended to add a 500 ohm resistor between V_{CCJ} and GND during the programming interval when a USB ispDOWNLOAD cable is connected to a very low power board design. A FAQ is available that discusses this in more depth at:

www.latticesemi.com/support/faqs/details.cfm?id=2205

The JTAG programming port speed may need to be governed when using the ispDOWNLOAD cables connected to customer PCBs. This is especially important when there is long PCB routing or with many daisy-chained devices. The Lattice programming software can adjust the timing of TCK applied to the JTAG programming port from the cable. This low-precision port setting of TCK depends on many factors, including the PC speed and the type of cable used (parallel port, USB or USB2). This software feature provides an option to slow the TCK for debug or noisy environments. A FAQ is available that discusses this in more depth at:

www.latticesemi.com/support/faqs/details.cfm?id=974

The USB Download Cable can be used to program Power Manager or ispClock products with Lattice programming software. When using the USB cable with the Power Manager I devices, (POWR604, POWR1208, POWR1208P1), you must slow do TCK by a factor of 2. A FAQ is available that discusses this in more depth at:

www.latticesemi.com/support/faqs/details.cfm?id=306

Programming Flywire and Connection Reference

Refer to Table 2 when connecting a flywire download cable to systems that use the 1x8-position or 2x5-position connectors. For newer Lattice FPGA families, a 1x10 connector used in conjunction with the ispDOWNLOAD USB cable adds support for the DONE and INITN signals. Both of these signals are inputs to the cable, and can be used to help verify device configuration.

Table 2. Flywire Conversion Reference

Function	Flywire Cable	Wire Label	1x10 Connector	1x8 Connector	2x5 Connector
V _{CC} ¹	Red	VCC	1	1	6
TDO/SO/SPI_SO	Brown	TDO	2	2	7
TDI/SI/SPI_SI	Orange	TDI	3	3	5
ispEN ² /Enable/PROGRAMN/SN/SPI_SS_B	Yellow	ispEN/PROG	4	4	10
TRST ³ /CRESET_B	Green	TRST/DONE	5	5	9
TMS/MODE	Purple	TMS	6	6	3
GND	Black	GND	7	7	4 (2 and 8)
TCK ⁴ /SCLK/CCLK/SPI_SCK	White	TCK	8	8	1
DONE ³	Green	TRST/DONE	9		
INITN/CDONE	Blue	INITN	10		

- For devices that have a V_{CCJ} pin, the V_{CCJ} must be connected to the cable's V_{CC}, and a 0.1µF decoupling capacitor is required on V_{CCJ} close to the device. Please refer to the device data sheet to determine if the device has a V_{CCJ} pin.
- For older Lattice ISP devices, a 0.01µF decoupling capacitor is required on ispEN/ENABLE of the target board.
- The TRST and DONE pin is multiplexed on the ispDOWNLOAD USB cable. If the device TRST signal is available on the board, connect the USB flywire TRST/DONE wire to TRST. If the device DONE signal is available on the board (or if both TRST and DONE are available), connect the USB flywire TRST/DONE wire to DONE. Please make sure the correct setting is selected in ispVM/Diamond Programmer (Options, Cable and I/O Port Setup). This will tell ispVM/Diamond Programmer whether the TRST/DONE cable is used as a TRST or a DONE signal.
- A 4.7K pull-down resistor is recommended on TCK of the target board.

Table 3 lists the recommend pin connections. Please contact Lattice technical support for information on unlisted device families. (e-mail: techsupport@latticesemi.com, phone: 1-800-LATTICE).

Table 3. Recommended Pin Connections

Device Family	TDI	TDO	TMS	TCK	ispEN/PROG ^{1,6}	TRST ² /DONE ^{3,6}	INITN ^{3,6}	VCC	GND
LatticeECP3™	Mandatory	Mandatory	Mandatory	Mandatory	Optional	Optional	Optional	Mandatory	Mandatory
LatticeECP2M™/LatticeECP2™	Mandatory	Mandatory	Mandatory	Mandatory	Optional	Optional	Optional	Mandatory	Mandatory
LatticeECP™/LatticeEC™	Mandatory	Mandatory	Mandatory	Mandatory	Optional	Optional	Optional	Mandatory	Mandatory
LatticeXP2™	Mandatory	Mandatory	Mandatory	Mandatory	Optional	Optional	Optional	Mandatory	Mandatory
LatticeXP™	Mandatory	Mandatory	Mandatory	Mandatory	Optional	Optional	Optional	Mandatory	Mandatory
LatticeSC™/LatticeSCM™	Mandatory	Mandatory	Mandatory	Mandatory	Optional	Optional	Optional	Mandatory	Mandatory
ICE40™	Mandatory	Mandatory	N/A	Mandatory	Mandatory	Recommended	Recommended	Mandatory	Mandatory
MachXO2™	Mandatory	Mandatory	Mandatory	Mandatory	N/A	N/A	N/A	Mandatory	Mandatory
MachXO™	Mandatory	Mandatory	Mandatory	Mandatory	N/A	N/A	N/A	Mandatory	Mandatory
ORCA®/FPSC	Mandatory	Mandatory	Mandatory	Mandatory	Optional	Optional	Optional	Mandatory	Mandatory
ispXPGA®	Mandatory	Mandatory	Mandatory	Mandatory	N/A	N/A	N/A	Mandatory	Mandatory
ispXPLD™	Mandatory	Mandatory	Mandatory	Mandatory	N/A	N/A	N/A	Mandatory	Mandatory
ispMACH® 4000	Mandatory	Mandatory	Mandatory	Mandatory	N/A	N/A	N/A	Mandatory	Mandatory
ispMACH/ispLSI® 5000	Mandatory	Mandatory	Mandatory	Mandatory	N/A	N/A	N/A	Mandatory	Mandatory
MACH®4A ⁴	Mandatory	Mandatory	Mandatory	Mandatory	N/A	N/A	N/A	Mandatory	Mandatory
ispGDx2™	Mandatory	Mandatory	Mandatory	Mandatory	N/A	N/A	N/A	Mandatory	Mandatory
ispClock™	Mandatory	Mandatory	Mandatory	Mandatory	N/A	N/A5	N/A	Mandatory	Mandatory
Platform Manager™	Mandatory	Mandatory	Mandatory	Mandatory	N/A	Optional ⁵	N/A	Mandatory	Mandatory
Power Manager/Power Manager II	Mandatory	Mandatory	Mandatory	Mandatory	N/A	Optional ⁵	N/A	Mandatory	Mandatory

Table 3. Recommended Pin Connections (Continued)

Device Family	TDI	TDO	TMS	TCK	ispEN/PROG ^{1,6}	TRST ² /DONE ^{3,6}	INITN ^{5,6}	VCC	GND
ispPAC [®]	Mandatory	Mandatory	Mandatory	Mandatory	N/A	N/A	N/A	Mandatory	Mandatory

1. Refer to the ispDOWNLOAD Cable ispEN Pin section below for detailed information on connecting the ispEN/ENABLE pin.
2. Refer to the ispDOWNLOAD Cable TRST Pin section below for detailed information on connecting the TRST pin.
3. The DONE and INITN signals are only available on the ispDOWNLOAD USB cable. These signals are inputs to the cable and can be used to help verify device configuration.
4. Please refer to the device data sheet. Not all packages have the ENABLE or TRST pin.
5. When using PAC-Designer[®] software to program ispPAC devices, do not connect this pin.
6. When using these connections, be sure to select the correct settings in the Cable and I/O Port Setup dialog in the ispVM System/Diamond Programmer software.

Connecting the ispDOWNLOAD Cable

The target board must be un-powered when connecting, disconnecting, or reconnecting the ispDOWNLOAD Cable. Always connect the ispDOWNLOAD Cable's GND pin (black wire), before connecting any other JTAG pins. Failure to follow these procedures can result in damage to the target programmable device.

ispDOWNLOAD Cable TRST Pin

Connecting the board TRST pin to the cable TRST pin is not recommended. Instead, connect the board TRST pin to Vcc. If the board TRST pin is connected to the cable TRST pin, instruct ispVM/Diamond Programmer to drive the TRST pin high as follows:

1. Select the **Options** menu item.
2. Select **Cable and I/O Port Setup**.
3. Check the **TRST/Reset Pin Connected** checkbox.
4. Select the **Set High** radio button.

If the proper option is not selected, the TRST pin will be driven low by ispVM/Diamond Programmer. Consequently, the BSCAN chain will not work because the chain will be locked into RESET state.

ispDOWNLOAD Cable $\overline{\text{ispEN}}$ Pin

The following pins should be grounded:

- BSCAN pin of the 2000VE devices
- ENABLE pin of MACH4A3/5-128/64, MACH4A3/5-64/64 and MACH4A3/5-256/128 devices.

However, the user has the option of having the BSCAN and ENABLE pins driven by the $\overline{\text{ispEN}}$ pin from the cable. In this case, ispVM/Diamond Programmer must be configured to drive the $\overline{\text{ispEN}}$ pin low as follows:

1. Select the **Options** menu item.
2. Select **Cable and I/O Port Setup**.
3. Check the $\overline{\text{ispEN}}$ /BSCAN Pin Connected checkbox.
4. Select the **Set Low** radio button.

Table 4. ispDOWNLOAD Cable Feature Summary

Feature	HW-USBN-2A	HW-USB-2A	HW-USB-1A	HW-DLN-3C	HW7265-DL3, HW7265-DL3A, HW-DL-3B, HW-DL-3C	HW7265-DL2	HW7265-DL2A	PDS4102-DL2	PDS4102-DL2A
USB	X	X	X						
PC-Parallel				X	X	X	X	X	X
1.2V Support	X	X							
1.8V Support	X	X	X	X	X		X		X
2.5-5.0V Support	X	X	X	X	X	X	X	X	X
2x5 Connector	X	X	X	X	X	X	X		
1x8 Connector	X	X	X	X	X			X	X
Flywire	X	X	X	X	X				
Lead-free Construction	X			X					
Available for order	X			X					

Each ispDOWNLOAD Cable ships with two small connectors that help you keep the flywires organized. The following manufacturer and part number is one possible source for equivalent connectors:

- 1x8 Connector (e.g. Samtec SSQ-108-02-T-S)
- 2x5 Connector (e.g. Samtec SSQ-105-02-T-D)

The ispDOWNLOAD Cable flywire or headers are intended to connect to standard 100-mil spacing headers (pins spaced 0.100 inch apart). Lattice recommends a header with length of 0.243 inches or 6.17 mm. Though, headers of other lengths may work equally well.

Ordering Information

Description	Ordering Part Number	China RoHS Environment-Friendly Use Period (EFUP)
ispDOWNLOAD cable (USB). Contains 6' USB cable, flywire connectors, 8-position (1x8) adapter and 10-position (2x5) adapter, lead-free, RoHS compliant construction.	HW-USBN-2A	
ispDOWNLOAD cable (PC only). Contains parallel port adapter, 6' cable, flywire connectors, 8-position (1x8) adapter and 10-position (2x5) adapter, lead-free, RoHS compliant construction.	HW-DLN-3C	

Note: Additional cables are described in this document for legacy purposes only, these cables are no longer produced. The cables currently available for order are fully equivalent replacement items.

Technical Support Assistance

Hotline: 1-800-LATTICE (North America)
+1-503-268-8001 (Outside North America)
e-mail: techsupport@latticesemi.com
Internet: www.latticesemi.com

Revision History

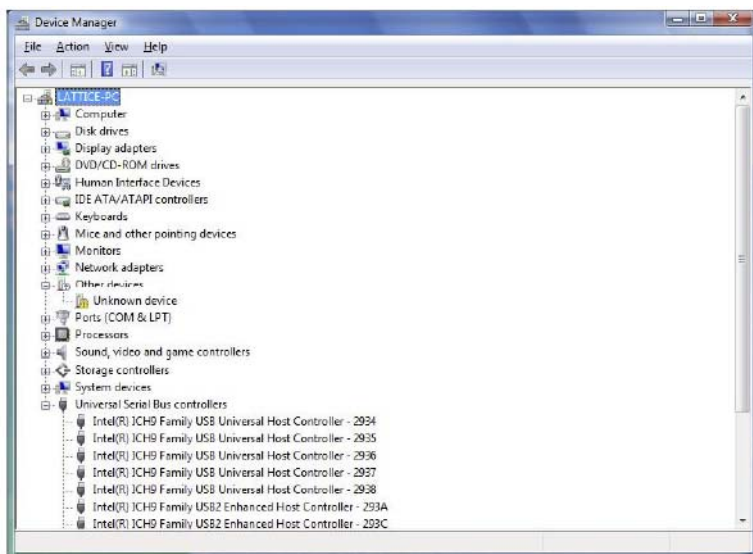
Date	Version	Change Summary
—	—	Previous Lattice releases.
July 2009	24.1	Added Target Board Design Considerations text section.
		Added Programming Flywire and Connection Reference section heading.
October 2009	24.2	Added information related to the physical specifications of the flywire connectors.
November 2011	24.3	Document transferred to user's guide format.
		Added Figure USB Cable – HW-USBN-2A.
		Updated Recommend Cable Connections table for MachXO2 devices.
		Updated Target Board Design Considerations section.
		Added Appendix A.
February 2012	24.4	Updated document with new corporate logo.
October 2012	24.5	Added iCE40 configuration port pin names to the Flywire Conversion Reference table.
		Added iCE40 information to Recommended Cable Connections table.

Appendix A. Troubleshooting the USB Driver Installation

It is essential that you install the drivers before connecting your PC to the USB cable. If the cable is connected before installing the drivers, Windows will try to install its own drivers that may not work.

If you have attempted to connect the PC to the USB cable without first installing the appropriate drivers, or have trouble communicating with the Lattice USB cable after installing the drivers, following the steps below:

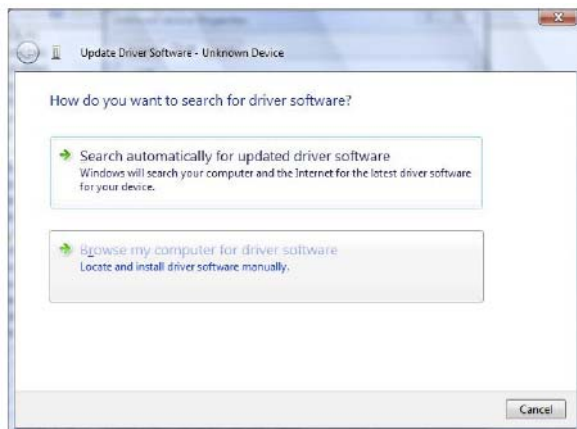
1. Plug in the Lattice USB cable. Choose **Start > Settings > Control Panel > System**. In the System Properties dialog box, click the **Hardware** tab and **Device Manager** button. Under Universal Serial Bus controllers, you should see Lattice USB ISP Programmer. If you do not see this, look for the Unknown Device with the yellow flag.



2. Double click on the **Unknown Device** icon.

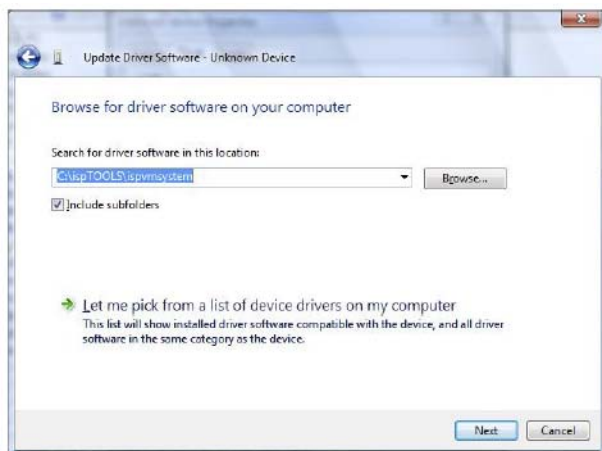


3. Click **Reinstall Driver**.

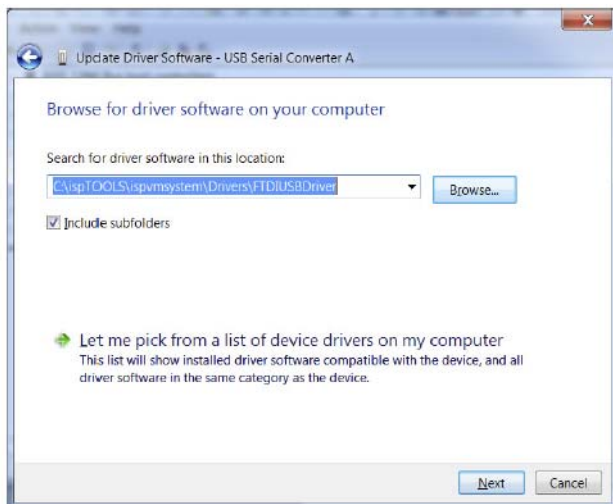


4. Select **Browse for driver software on your computer**.

For Lattice EzUSB Driver



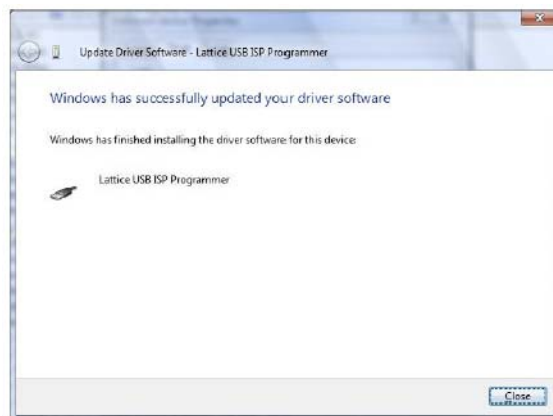
For FTDI FTUSB Driver



5. Browse to the **isptools\ispmvmsystem** directory for the Lattice EzUSB driver or the **isptools\ispmvmsystem\Drivers\FTDIUSBDriver** directory for the FTDI FTUSB driver. For Diamond installations, browse to **Iscc\diamond\data\vmdata\drivers**. Click **Next**.

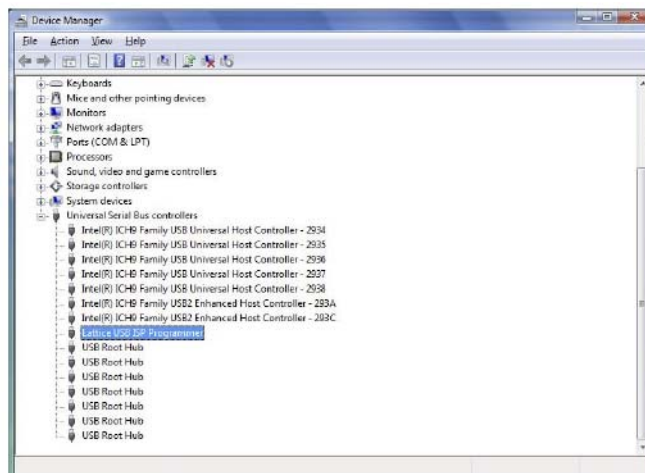


6. Select **Install this Driver software anyway**. The system will update the driver.

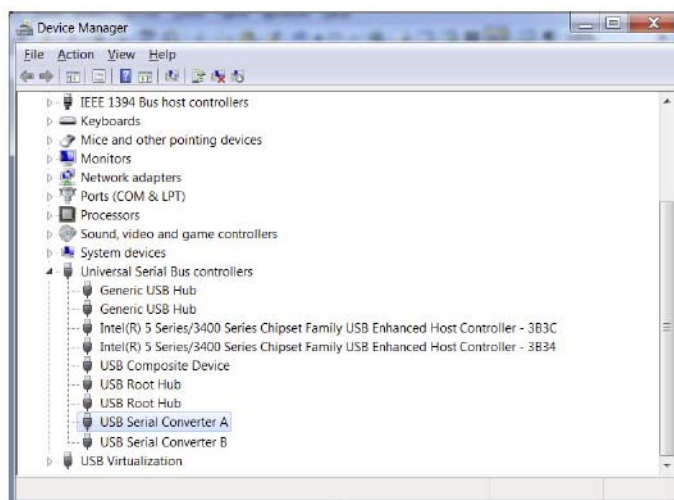


7. Click **Close** and finish installing the USB driver. Under **Control Panel >System >Device Manager > Universal Serial Bus Controllers** should include the following:

For the Lattice EzUSB Driver: Lattice USB ISP Programmer device installed.



For the FTDI FTUSB Driver: USB Serial Converter A and Converter B devices installed.



If you are experiencing problems or need additional information, contact Lattice Technical Support.