# **USB BitJet Download Cable**

# **User Guide**



System Level Solutions, Inc. (USA) 14100 Murphy Avenue San Martin, CA 95046 (408) 852 - 0067

Product Version:1.0Document Version:1.0Document Date:August 2010

http://www.slscorp.com

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# About this Guide

### Introduction

This document familiarizes you with the contents of the USB BitJet that allows to configure the Altera FPGA.

Table below shows the revision history of this document.

Version	Date	Description
1.0	August 2010	First Publication

# How to Contact SLS

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## Typographic Conventions

The document uses the typographic conventions shown as below.

Visual Cue	Meaning
Bold Type with Initial Capital Letters	All Headings and Sub Headings Titles in a document are dis- played in bold type with initial capital letters; Example: Introduction, Hardware Setup, Software Setup
Bold Type with Italic Letters	All Definitions, Figure and Table Headings are displayed in Italics. Examples: Figure 1. USB BitJet Download Cable
1. 2.	Numbered steps are used in a list of items, when the sequence of items is important. such as steps listed in procedure.
• ■	Bullets are used in a list of items when the sequence of items is not important.
	The hand points to information that requires special attention.
CAUTION	The caution indicates required information that needs special con- sideration and understanding and should be read prior to starting or continuing with the procedure or process.
WARNING	The warning indicates information that should be read prior to starting or continuing the procedure or processes.
••••	The feet direct you to more information on a particular topic.

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# 1. Introduction



	The USB BitJet interfaces a USB port on a host computer to an Altera <sup>®</sup> FPGA mounted on a printed circuit board. The cable sends configuration data from the PC to a standard 10-pin header connected to the FPGA. You can use the USB BitJet to iteratively download configuration data to a system during prototyping or to program data into the system during production.
Device Support	<ul> <li>The USB BitJet allows you to program and configure Altera devices.</li> <li>Specifically, you can do the followings:</li> <li>Download configuration data to FPGA devices: <ul> <li>Stratix<sup>®</sup> series FPGAs</li> <li>Cyclone<sup>®</sup> series FPGAs</li> <li>MAX<sup>®</sup> series CPLDs</li> <li>Arria<sup>®</sup> series FPGAs</li> </ul> </li> <li>In-system programming of the following devices: <ul> <li>Serial configuration devices including EPCS1, EPCS4, EPCS16, EPCS64 and EPCS128 devices.</li> </ul> </li> <li>Perform Signal Tap<sup>®</sup> II logic analysis</li> <li>USB BitJet supports target systems using, 3.3 V LVTTL/LVCMOS and single-ended I/O standards from 1.5 V to 3.3 V.</li> </ul>
Power Requirements	<ul> <li>The USB BitJet requires the following power sources:</li> <li>5.0 V from the USB cable</li> <li>Between 1.5 V and 3.3 V from the target circuit board</li> </ul>
Software Requirements	The USB BitJet is available for Windows XP (32-bit and 64-bit) with service pack 2, Windows Vista (32-bit and 64-bit) and Windows 7 (32-bit and 64-bit) systems.

Use the Quartus<sup>®</sup> II software version 7.2 or later to configure your device.

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The USB BitJet download cable also supports the following:

- Quartus II Programmer (for programming and configuration)
- Quartus II SignalTap<sup>®</sup> II Logic Analyzer (for logic analysis)
- Quartus II Programmer (standalone version)
- Quartus II SignalTap II logic analyzer (standalone version)
- Quartus II v8.1 Service pack 1 is required to be installed in Quartus II v8.1.
- ® indicates registered mark of Altera products only.



# 2. USB BitJet Hardware and Software Setup

# Hardware Setup This section describes how to install and set up the USB BitJet for device configuration or programming. For plug and header dimensions, pin names, and operating conditions, see Chapter 3. "USB BitJet Download Cable Specifications". Connect your USB BitJet Download Cable to the circuit board as instructed below. Disconnect the power cable from the circuit board. Connect USB cable to the USB port on your PC and to the USB BitJet port. Connect the USB BitJet to the 10-pin header on the device board.

Figure 2-1. shows the USB BitJet and the circuit board connector.

Figure 2-1. USB BitJet Download Cable





To avoid USB BitJet, first unplug the cable from the 10-pin header on the target board before unplugging the cable from the USB port on your PC. It is safest to remove power first from the target board before unplugging the USB BitJet.

4. Reconnect the power cable to apply power to the circuit board.

### Software Setup

This section describes the following:

- Installing USB BitJet Driver on Windows XP systems
- Installing USB BitJet Driver on Windows Vista systems
- Installing USB BitJet Driver on Windows 7 systems
- Settings up USB BitJet hardware in Quartus II software

Before you begin the installation, verify that the USB BitJet drivers are located in *<USB BitJet Installation Path>\Drivers* directory.

### Installing USB BitJet Driver on Windows XP systems

This section describes how to install the USB BitJet driver on Windows XP 32/64-Bit systems.

To install the driver, follow the directions below:

- 1. Plug in the USB BitJet download cable to the PC.
- 2. On the Found New Hardware Wizard window, click Yes, this time only and then click Next to continue. See Figure 2-2.

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Figure 2-2. Found New Hardware Wizard Window (1)

**3.** Select **Install from a list or specific location (Advanced)** and click **Next** to continue. See Figure 2-3.

Figure 2-3. Found New Hardware Wizard Window (2)



**4.** Select **Don't search. I will choose the driver to install.** Click **Next.** See Figure 2-4.

Figure 2-4. Choosing Installation Options Window

ound New	Hardware Wizard
Please cł	noose your search and installation options.
🔿 Sea	arch for the best driver in these locations.
	e the check boxes below to limit or expand the default search, which includes local ns and removable media. The best driver found will be installed.
	Search removable media (floppy, CD-ROM)
	Include this location in the search:
	D:\TOOLS\SLS\SLS_USB_BitJetLite\Drivers\x32 💽 Browse
💿 Dor	n't search. I will choose the driver to install.
	uose this option to select the device driver from a list. Windows does not guarantee that driver you choose will be the best match for your hardware.
	< Back Next > Cancel

5. Select Universal Serial Bus controllers and click Next to continue. See Figure 2-5.





 Click on Have Disk button and browse to the location <USB BitJet Installation Path>\Drivers\(x32|x64) of the driver. Click OK. See Figure 2-6.

Figure 2-6. Install From Disk Window



7. Select SLS USB BitJet and click Next to continue. See Figure 2-7.

	install for this hardware.
Select the manufacturer and model of have a disk that contains the driver ye	f your hardware device and then click Next. If you ou want to install, click Have Disk.
~	
Show compatible hardware	
Model	
CLO LICE DOLLA	
SLS USB BitJet	
SLS USB Billiet	
SES USB Billiet	
2F2 O2R RING	
1 This driver is not digitally signed!	Have Disk
	Have Disk
This driver is not digitally signed!	Have Disk

Figure 2-7. Device Driver Selection Window

**8.** It will install the driver for the download cable. On successful driver installation you will see the windows as shown in Figure 2-8.

Figure 2-8. Finish Installation

Found New Hardware Wiz	ard
	Completing the Found New Hardware Wizard
	The wizard has finished installing the software for:
	SLS USB BilJet
	Click Finish to close the wizard.
	< Back Finisk Cancel

9. Click **Finish** to exit the New hardware Installation Wizard.

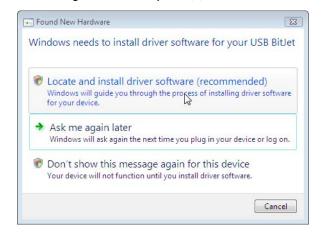
### Installing USB BitJet Driver on Windows Vista System

This section describes how to install the USB BitJet driver on Windows Vista systems.

To install the driver, follow the directions below:

- 1. Plug in the USB BitJet download cable to the PC.
- 2. On the Found New Hardware Wizard window, click Locate and install driver software to continue. See Figure 2-9.

Figure 2-9. Choosing Installation option (1)

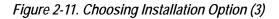


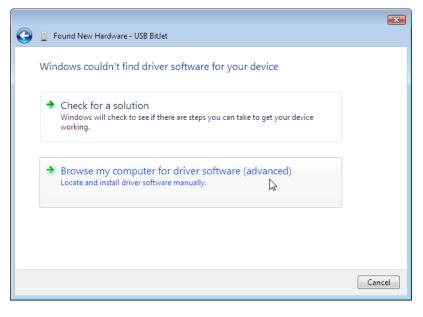
**3.** Click on **I don't have the disk. Show me other options** to continue. See Figure 2-10.



Figure 2-10. Choosing Installation Option (2)

4. Click on Browse my computer for driver software to continue. See Figure 2-11.





5. Select on **Browse** to the location *<USB BitJet Installation Path>* \**Drivers**\(**x32**|**x64**) of the driver. Click **OK.** See Figure 2-12.

Browse for driv	Browse For Folder Select the folder that contains drivers for your hardware.	3
C:\Program Files\:	Reference Assemblies         SLS         SLS_USB_BitJet         Bin         Docs         Dirivers         x52         x64	se

Figure 2-12. Browsing Driver Installation Directory

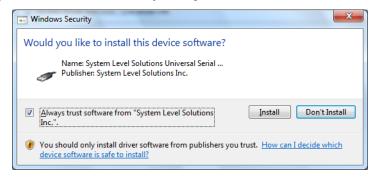
6. Click Next to install the driver. See Figure 2-13.

G	Found New Hardware - USB BitJet	
	Browse for driver software on your computer	
	Search for driver software in this location: C:\Program Files\SLS\SLS_USB_BitJet\Drivers\x32	Biowse
	☑ Include subfolders	
		Next Cancel

Figure 2-13. Driver Installation Directory Selection

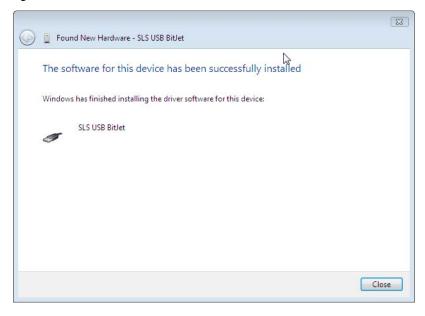
 Windows security dialog box pop up. Check on "Always trust software from "System Level Solutions, Inc." and click Install. See Figure 2-14.

Figure 2-14. Windows Security Dialog Box



8. Click on Close to exit Hardware Installation Wizard. See Figure 2-15.

### Figure 2-15. Finish Installation



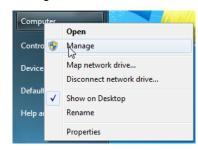
### Installing USB BitJet Driver on Windows 7 Systems

This section describes how to install the USB BitJet driver on Windows 7 systems.

To install the driver, follow the directions below:

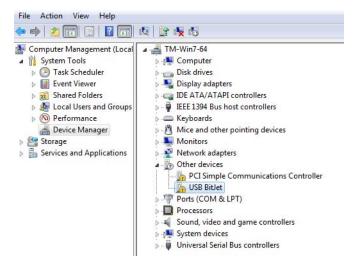
- 1. Plug in the USB BitJet download cable to the PC.
- 2. Right click on My Computer. Select Manage option. See Figure 2-16.

Figure 2-16. Device Manager selection



**3.** Select **Device Manager**. It will list all drivers of all devices. See Figure 2-17.

Figure 2-17. Device Manager Window



4. Expand Other devices option. Right click on USB BitJet and click on Update Driver Software...option. See Figure 2-18.

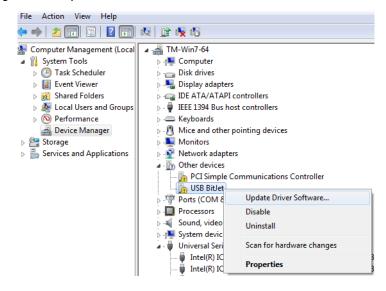


Figure 2-18. Update Driver Software Selection

5. On the Update Driver Software wizard, select **Browse my computer** for driver software. See Figure 2-19.

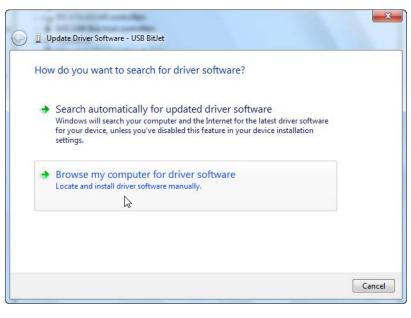


Figure 2-19. Update Driver Software Wizard

6. Click on **Browse** and browse to the location *<USB BitJet Installation Path>\Drivers\(x32|x64)* of the driver. Click OK. See Figure 2-20.

Browse for driv	Select the folder that contains drivers for your hardware.	
Search for driver so C:\Program Files Include subfold	SLS_USB_BitJet	
→ Let me pie	iii x32 iii x64 ▷iiii TechSmith ▼ Folder: x32	
This list will s software in t		river

Figure 2-20. Browsing Driver Installation Directory

7. Click Next to install the driver. See Figure 2-21.

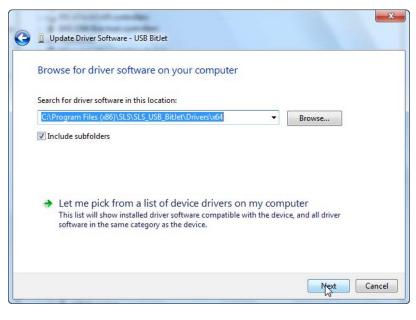
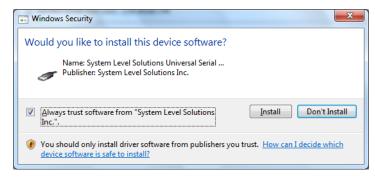


Figure 2-21. Driver Installation Directory Selection

 Windows security dialog box pop up. Check on "Always trust software from "System Level Solutions, Inc." and click Install. See Figure 2-22.

Figure 2-22. Windows Security Dialog Box



9. Click on Close to exit Update Driver Software Wizard. See Figure 2-23.

### Figure 2-23. Finish Installation



# Setting up USB BitJet hardware in the Quartus II software

Use the following steps to set up the USB BitJet hardware in the Quartus II software:

- 1. Start the Quartus II software.
- 2. Choose Tools>Programmer.
- **3.** Click **Hardware Setup**. The Hardware Setup dialog box is displayed. See Figure 2-24.

### Figure 2-24. Hardware Setup

a <b>rdware Setup</b> Hardware Settings   JTAG Setting Select a programming hardware hardware setup applies only to th	setup to use whe		devices. This programming	
Currently selected hardware:	USB-BitJet [U		J	•
Hardware USB-BitJet	Server	Port USB-0	Add Hardware	
USD'DIMEL	Loca	038-0	Remove Hardware	
,				
			Close	•

- **4.** From the drop-down menu, select **USB-BitJet** [**USB-0**]. See Figure 2-24.
- 5. Click **Close** to exit Hardware Setup dialog box.
- 6. In the Mode list, select the desired mode to program in Programmer Window. Table 2-1 describes each programming mode.

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The USB BitJet supports the Joint Test Action Group (JTAG), Passive Serial Programming and Active Serial modes.

Table 2-1. Programming Modes				
Mode	Mode Description			
Joint Test Action Group (JTAG)	Programs or configures all Altera devicessupported by Quartus II software, excluding FLEX 6000.			
In-Socket Programming	Not supported by USBs-BitJet			
Passive Serial Programming	Configures all Altera devices supported by Quartus II software excluding MAX 3000 and MAX 7000 devices.			
Active Serial Programming	Programs a single EPCS1, EPCS4, EPCS16 and EPCS64 serial configura- tion device.			

For more information about programming devices and creating secondary programming files, refer to *Programming & Configuration* chapter of the Introduction to Quartus II Manual.



# 3. USB BitJet Download Cable Specifications

# USB BitJet Connections

The USB BitJet cable has a USB universal plug that connects to the PC USB port, and a 10-pin female plug that connects to the circuit board. Data is downloaded from the USB port on the PC through the USB BitJet cable to the circuit board via the connections discussed in this section.

### **Voltage Requirements**

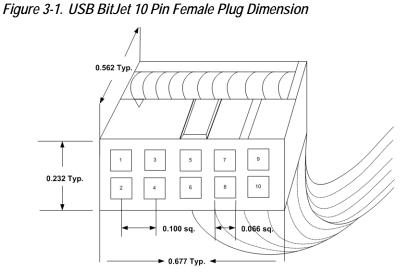
The USB BitJet VCC (TRGT) pin must be connected to a specific voltage for the device being programmed. It supports maximum VCC (TRGT) of 3.3 V. Connect pull-up resistors to the same power supply as the USB BitJet  $V_{CC(TRGT)}$ . See Table 3-1.

Table 3-1. Typical USB BitJet V <sub>CC(TRGT)</sub> Pin Voltage Requirements					
Device Family	USB BitJet V <sub>CC</sub> Voltage Required				
MAX <sup>®</sup> II devices	As specified by $V_{CCIO}$ of Bank 1				
MAX 7000AE and MAX 3000A devices	3.3 V				
MAX 7000B devices	2.5 V				
Cyclone and Cyclone II devices	As specified by $V_{CCIO}$				
Cyclone III devices	As specified by $V_{\mbox{\scriptsize CCA}}$ or $V_{\mbox{\scriptsize CCIO}}$				
Cyclone <sup>®</sup> IV devices	V <sub>CCA</sub>				
Stratix devices	As specified by $V_{CCSEL}$				
Stratix II, Stratix III, Stratix <sup>®</sup> IV, Arria <sup>TM</sup> II GX and Arria GX devices	V <sub>CCPD</sub>				
EPC2 devices	3.3 V				
EPC4, EPC8 and EPC16 devices	3.3 V				
EPCS1, EPCS4, EPCS16, EPCS64 and EPCS128 devices	3.3 V				

Table 3-1. Typical USB BitJet V<sub>CC(TRGT)</sub> Pin Voltage Requirements

### **USB BitJet Plug Connection**

The 10-pin female plug connects to a 10-pin male header on the circuit board containing the target device. Figure 3-1. shows the dimension of the female plug.



Dimensions are shown in inches. Spacing between pin centers is 0.1 inches.

Table 3-2. identifies the 10-pin female plug pin names and the corresponding programming mode.

Table .	Table 3-2. USB BitJet Female Plug Signal Names & Programming Modes							
Pin	AS Mode		PS Mode		JTAG Mode			
1	DCLK	Clock signal	DCLK	Clock signal	TCK	Clock signal		
2	GND	Signal ground	GND	Signal ground	GND	Signal ground		
3	CONF_DONE	Configuration done	CONF_DONE	Configuration done	TDO	Data from device		
4	VCC (TRGT)	Target power supply	VCC (TRGT)	Target power supply	VCC (TRGT)	Target power supply		
5	nCONFIG	Configuration control	nCONFIG	Configuration control	TMS	JTAG state machine		

Table	Table 3-2.       USB BitJet Female Plug Signal Names & Programming Modes							
Pin	Pin AS Mode		PS Mode		JTAG Mode			
6	nCE	Cyclone chip enable		No connect		No connect		
7	DATAOUT	Active serial data out	nSTATUS	Configuration status	—	No connect		
8	nCS	Serial configuration device chip select		No connect	_	No connect		
9	ASDI	Active serial data in	DATA0	Data to device	TDI	Data to device		
10	GND	Signal ground	GND	Signal ground	GND	Signal ground		

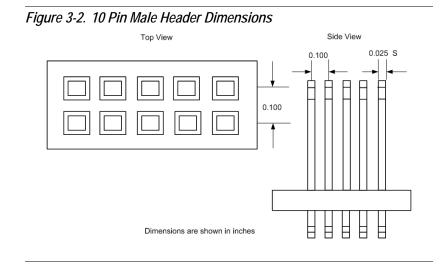
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The circuit board must supply  $V_{CC(TRGT)}$  and ground to the USB BitJet cable for the I/O drivers.

### **Circuit Board Header Connection**

The circuit board's 10-pin male header, which connects to the USB BitJet cable's 10-pin female plug, has two rows of five pins. These pins are connected to the device's programming or configuration pins. Figure 3-2. shows the dimensions of a typical 10-pin male header.

Although a 10-pin surface mount header can be used for the JTAG, AS or PS download cable, Altera recommends using a through-hole connector because of the repeated insertion and removal force needed.



### **Operating Conditions**

Table 3-3. and Table 3-4. summarize the maximum ratings, recommended operating conditions and DC operating conditions for the USB BitJet cable.

Table 3-3.       USB BitJet Cable Absolute Maximum Ratings						
Symbol	Parameter	Conditions	Min	Мах	Unit	
V <sub>CC(TRGT)</sub>	Target supply voltage	With respect to ground	-0.3	4.6	V	
V <sub>CC(USB)</sub>	USB supply voltage	With respect to ground	-0.3	6.0	V	
l <sub>l</sub>	Input current	TDO or dataout	-10.0	10.0	mA	
I <sub>O</sub>	Output current	TCK, TMS, TDI, nCS, nCE	-50.0	50.0	mA	

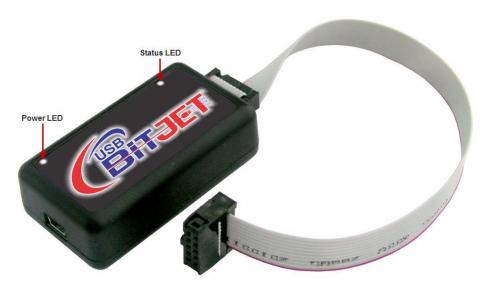
Table 3-4. USB BitJet Cable Recommended Operating Conditions

Symbol	Parameter	Conditions	Min	Max	Unit
V <sub>CC(TRGT)</sub>	Target supply voltage, 3.3 V operation		3.0	3.6	V
	Target supply voltage, 2.5 V operation		2.375	2.625	V
	Target supply voltage, 1.8 V operation		1.72	1.89	V
	Target supply voltage, 1.5 V operation		1.43	1.57	V

### **LED Indication**

The USB BitJet is having LED for the power and process status indication. The LED on the USB connector side is used for power indication and LED on 10x2 connector side is used for process status indication. Figure 3-3. shows the Power LED and Status LED on the USB BitJet.





While programming the device the Status LED will continuously blink and as the process gets completed, it becomes OFF. The power LED will remain ON until the USB cable is connected to the hardware.