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DLP[®] LightCrafter[™] 4500 Flash Programming Guide

This flash programming guide provides instructions on how to create a JTAG cable and use the flash programming tool to install the DLPR350 firmware on the DLP LightCrafter 4500.

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1 Overview

The DLP LightCrafter 4500 contains firmware, stored in flash memory, to initialize the onboard DLPC350 controller. If the firmware is compromised, or a blank flash memory module is installed, the memory must be programmed with the DLPR350 firmware. Without the firmware loaded, the DLPC350 cannot boot up or initialize the onboard USB port. The user must have access to the USB port to control the device using the DLP LightCrafter 4500 GUI.

1.1 System Requirements

The following list shows the minimum recommended system requirements for the DLP LightCrafter 4500 flash programming tool:

- PC with 1.4-GHz Pentium IV CPU or higher
- Windows® XP SP3 or higher
- Microsoft Visual C++® 2005 Redistributable
- Microsoft Visual C++ 2008 Redistributable
- 512 MB of RAM
- 20 MB of free hard-disk space
- USB port

1.2 Hardware Requirements

The user must create a JTAG boundary scan cable as described in Section 3. The cable requires a UM232H USB-to-serial adapter board that can be found on the FTDI Chip® development modules page.

The cable also requires a Molex[®] 51021-0600 connector that can be found on the Molex connector website.

A single 2-mm jumper is required during the flashing process. The jumper is not consumed.

2 Software Installation

2.1 DLP LightCrafter 4500 Flash Programmer And GUI Installation

Download the flash programming tool from the tool page. Extract the executable file from the downloaded JTAGFlashProgrammer_v^{***}.zip file and run it. Follow the on-screen prompts and select a convenient installation path for the program. The installer creates a shortcut to the tool in the start menu and on the desktop.

Download the LightCrafter 4500 GUI from the same tool page as above. Extract the executable file from the downloaded DLPLCR45000GUI-*.*.*-windows-installer.zip file and run it. Follow the on-screen prompts and select a convenient installation path for the program. The installer creates a shortcut to the tool in the start menu and on the desktop.

2.2 DLP LightCrafter 4500 Firmware Installation

Download the latest DLPR350 firmware version from the tool page. Extract the executable file from the downloaded DLPLCR4500GUI-***-******.zip file and run it. Follow the on-screen prompts and select a convenient installation path for the files. TI recommends using the default installation path.

2.3 Communication Interface Driver Installation

When using the DLP LightCrafter 4500 flash programming tool, the user must have a communication link established between the DLP LightCrafter 4500 and the computer running the tool. This allows the user to read and write to the flash memory from the computer. This connection is established through the JTAG cable created following this guide. The user needs to install device drivers for the USB-to-serial adapters from the FTDI Chip website. Choose and install the driver specific to the operating system on the computer.

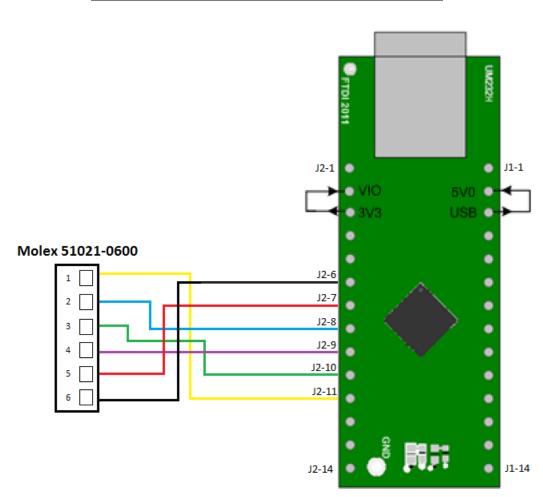


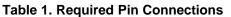
3 JTAG Boundary Scan Cable

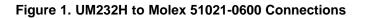
The UM232H USB-to-serial adapter must be connected to the JTAG port on the DLP LightCrafter 4500. Connecting the two devices requires the use of a Molex 51021-0600 connector. The user can either directly connect the header pins on the UM232H to the cable or create a board to host the UM232H. The required pin connections are shown in Table 1 and Figure 1.

NOTE: Two separate pairs of pins must be connected together to supply power to the UM232H from the computer's USB port.

UM232H-J2	Molex 51021-0600
6	6
7	5
8	2
9	4
10	3
11	1







4 Flash Programming Procedure

Populate J30 with a 2-mm jumper on the DLP LightCrafter 4500, as shown in Figure 2 and Figure 3.

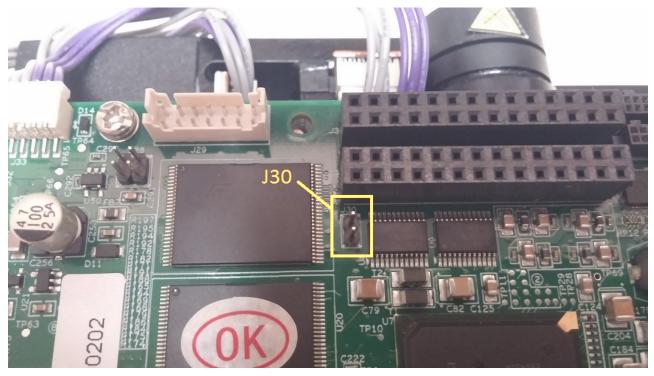


Figure 2. J30 Location on the DLP LightCrafter 4500

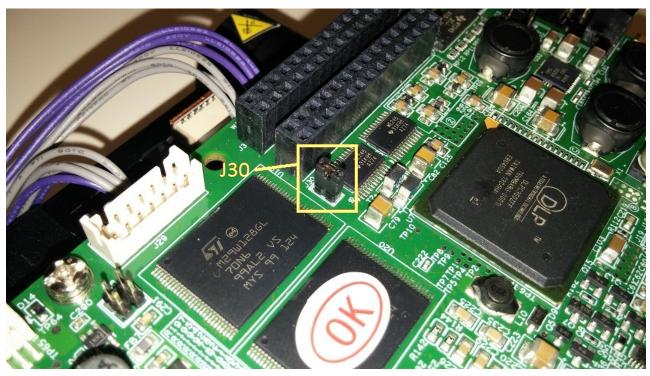


Figure 3. J30 Populated on the DLP LightCrafter 4500



Connect the appropriate power supply to the DLP LightCrafter 4500, as shown in Figure 4. The fan on the rear of the device turns on indicating the board is powered.

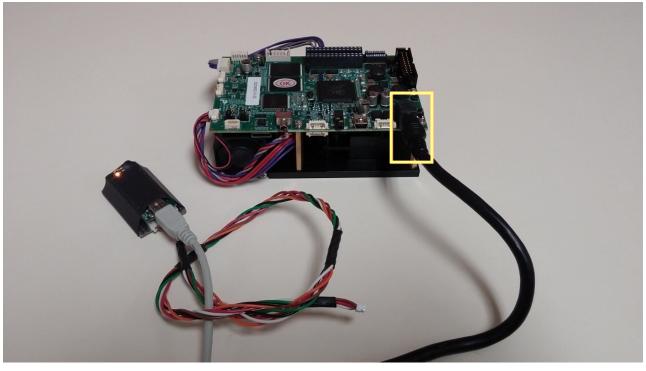


Figure 4. Power Supply Connected to the DLP LightCrafter 4500

Connect the JTAG cable to J25, located on the bottom side of the DLP LightCrafter 4500 board. Connect the UM232H to the computer with an appropriate USB cable, as shown in Figure 5.

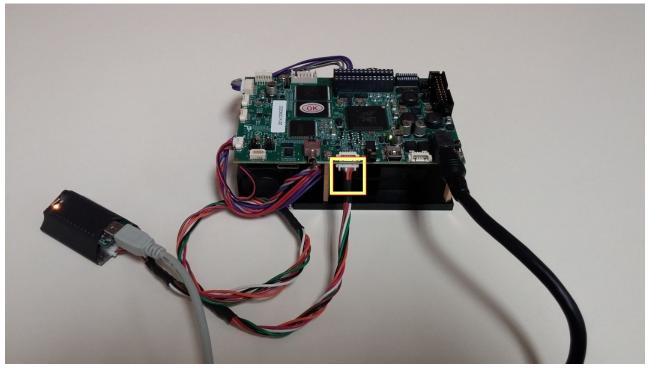


Figure 5. JTAG Cable Connected to the DLP LightCrafter 4500



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Start the flash programmer tool, FlashProgrammer.exe, as shown in Figure 6. Ignore any error messages about a missing board file for now.

JTAG Flash Programmer	
oard Flash Setting Help	
뿔 🍄 \mid 👁 🐜 📉 🎟 😳 🛛 💷 🔮 🕐 👛 🔺 🛛 🎖	
Board File:	
	Browse
Flash ImageT o Write:	
	Browse
Flash Image To Read:	Browse
Start Address (HEX): 0x00000000 Size (HEX): 0x00000000	
100% Complete	

Figure 6. JTAG Flash Programmer First Run



Click the **Browse** button next to the board file path. Select the board file called BoardFile.brd that installed in the flash programmer software tool folder. Figure 7 shows the **Browse** button and the selected board file path.

S JTAG Flash Programmer	
Board Flash Setting Help	
📴 🎬 🔍 🐜 🔌 🖼 🍳 💷 🕎 📥 🔺 💡	
Board File: C:\Users\a0225247\Desktop\JTAGFlashLoader\BoardFile.brd	Browse
Flash Image I o Write:	Browse
Flash Image To Read:	Browse
Start Address (HEX): 0x00000000 Size (HEX): 0x00000000	
100% Complete	
Ready	NUM //

Figure 7. Board File Selection in Flash Programmer Tool



Click the **Browse** button next to the flash image path. Select the flash image called DLPR350PROM_v****.bin that installed in the DLP LightCrafter 4500 firmware installation folder. Figure 8 shows the button and path.

pard Flash Setting Help	
뿔 🍄 👁 🗞 🖄 🖼 😳 📾 👰 🔺 🔺 🌹	
Board File:	
C:\Users\a0225247\Desktop\JTAGFlashLoader\BoardFile.brd	Browse
Flash ImageTo Write:	10 B
C:\Texas Instruments-DLP\DLPR350PR0M-2.0.0\DLPR350PR0M_v2.0.0.bin	Browse
Flash Image To Read:	
	Browse
Start Address (HEX): 0x00000000 Size (HEX): 0x00000000	
100% Complete	

NOTE: The third box (shown in Figure 8) does not need to be populated.

Figure 8. Firmware File Selection in Flash Programmer Tool



Flash Programming Procedure

Set the size of the image to 0x0020000, as in Figure 9.

Star Flash Programmer	
Board <u>F</u> lash Setting <u>H</u> elp	
躍 ഈ 👁 è‱ 📉 ③ 🚳 🔮 🔺 🔺 💡	
Board File:	
C:\Texas Instruments-DLP\JTAGFlashProgrammer\BoardFile.brd	Browse
Flash ImageTo Write:	
C:\Texas Instruments-DLP\DLPR350PR0M-2.0.0\DLPR350PR0M_v2.0.0.bin	Browse
Flash Image To Read:	
	Browse
Start Address (HEX): 0x00000000 Size (HEX): 0x0020000	
100% Complete	
Ready	NUM

Figure 9. Firmware File Size Selection in Flash Programmer Tool



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Click the **Detect Chain** button in the upper left-hand corner of the tool. The **Detect Chain** button is indicated with a red box in Figure 10.

S JTAG Flash Programmer	
Board Flash Setting Help	
躍 📴 🐟 🗞 💘 🔜 😲 🍩 🛛 🏆 🛥 🛥 🛛 🎖	
Board File:	
C:\Users\a0225247\Desktop\JTAGFlashLoader\BoardFile.brd	Browse
Flash ImageT o Write:	
C:\Texas Instruments-DLP\DLPR350PR0M-2.0.0\DLPR350PR0M_v2.0.0.bin	Browse
Flash Image To Read:	
	Browse
Start Address (HEX): 0x00000000 Size (HEX): 0x0020000	
100% Complete	
DLPC350	
Ready	NUM //

Figure 10. JTAG Chain Detection in Flash Programmer Tool



Click the **Erase** button on the toolbar (see Figure 11).

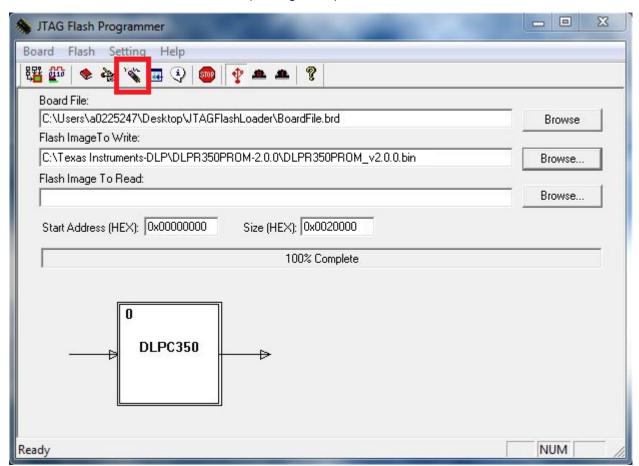


Figure 11. Erase Button in Flash Programmer Tool



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Select every block in the displayed list of memory locations, as shown in Figure 12. After all blocks are selected, click the **Erase** button. When the erase process is completed (indicated by the blue bar on the right) close the erase menu with the **Exit** button (see Figure 13).

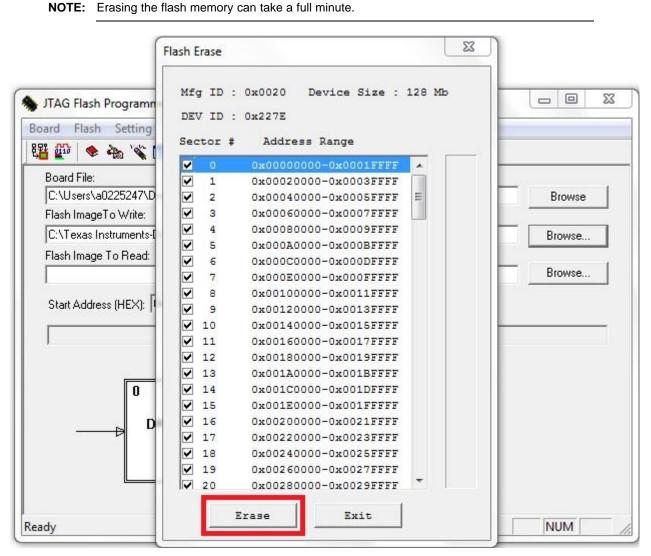


Figure 12. Flash Memory Block Selection and Erase Button

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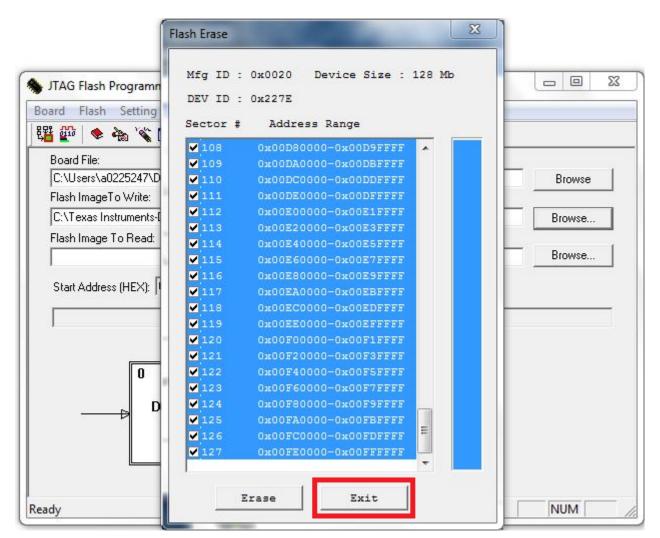


Figure 13. Flash Memory Block Erase Completed and Exit Button



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Click the **Program** button on the toolbar (see Figure 14).

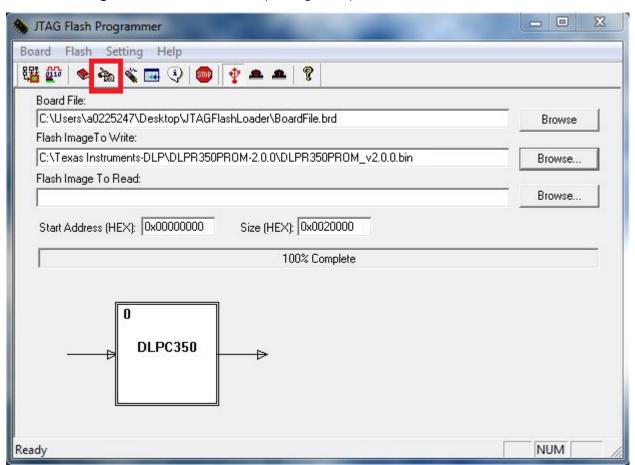


Figure 14. Program Button in Flash Programming Tool



After the flash programmer tool displays the operation is 100% complete, disconnect the JTAG cable, remove the jumper from J30, and disconnect the power supply from the DLP LightCrafter 4500, as shown in Figure 15.

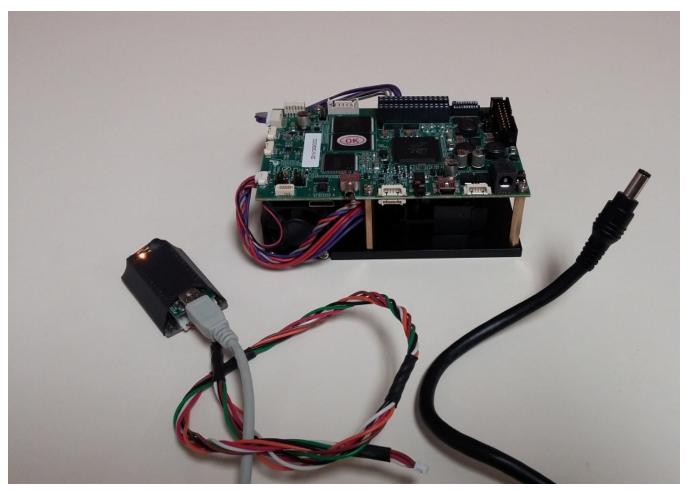


Figure 15. Power and JTAG Cable Removed from the DLP LightCrafter 4500

Connect the LightCrafter 4500 to a PC loaded with the LightCrafter 4500 GUI via USB. Reconnect the power cable to the LightCrafter 4500.



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Open the DLP LightCrafter 4500 GUI and wait for the device to connect. If the device does not connect restart at Section 4. After the device is connected click the **Image/Firmware** tab, then click the **Firmware Upload** tab. Click the **Browse** button. Figure 16 shows the firmware upload window and tabs.

	Green 135 Blue 130	LED Selection Automatic Manual Red Green
Connected System Reset Video Mode mware Version: 3.1.0 Power Standby mware Tag: DLPC350_v3dot1_REL Image Orientation init Done Seq. Running DRC Error	Green 135 Blue 130	Manual Red
mware Version: 3.1.0 mware Tag: DLPC350_v3dot1_REL mixt Done Seq. Running DRC Error Video Mode Power Standby Image Orientation Image Orientation North/South Flip E	Blue 130	Manual Red
mware Version: 3.1.0 Image Orientation Image Orientation Image Orientation Int Done Seq. Running DRC Error North/South Flip		
mware Tag: DLPC350_v3dot1_REL Image Orientation		Green
	ast/West Flip	Blue
Forced Swap Seq. Error DMD Parked		
Buffer Freeze Seq Abort 🗸 Auto Update Status	Set	Set
Apply Solution Save Solution	Apply	y Default Solution
to Mode Pattern Sequence Peripheral Control Image / Firmware Additional Resources		
reate Images Firmware Build Firmware Upload		
UPC350 firmware image contains two applications. Bootloader Application - Resides in first 128KB memory in the flash; this application checks for validity of Main Application and also allows p	programming the fash.	
 Main Application - Controler jumps to Main Application from Boot Loader on Valid image; this is main application responsible configuration and Note. 		
If by any reason the bootloader area is corrupted; system will not boot, in such case you are required to use JTAG tools DLPC350 JTAG tools		
	flash.	
Skip Bootloader Update - Checkbox option to skip erase and programming of fisrt 128KB of area where Bootloader Application reside in the f		
skep Bootboader Update - Checkbox option to skip erase and programming of tist 1,28KB of area where Bootboader Application reside in the t Fast Fash Update - Check box option enable faster programming of the fash, this option when selected, basically compare new Fimnware file trase and program the mismatch areas on the filesh. Mater updating the new Firmware file stored as cached file on the PC.	with the last programmed content which is maintained	as cached file on the PC; then selective

Figure 16. LightCrafter 4500 GUI Firmware Upload Window



When the firmware image is displayed in the **Firmware File** text box, click the **Upload** button, both of which are highlighted in Figure 17.

Connected			Operating Mode		LED Driver Control	
Connected	System R	eset	Pattern Sequence Pattern Sequence [Variable E Video Mode Power Standby	(posure]	LED Current (0-255) Red 104 Green 135 Blue 130	LED Selection Automatic Manual Red
rmware Version: 3.1.0			Image Orientation		blue 150	
rmware Tag: DLPC350_v3dot1_REL			Indge offentation			Green
Init Done Seq. Running	I DRC E	Fror	North/South Flip	East/West Flip		Blue
Forced Swap Seq. Error		Parked	Get	Set		
Buffer Freeze Seq Abort	🗹 Auto U	pdate Status			Get	Set
Apply Solution			Save Solution		Apply Defa	ault Solution
deo Mode Pattern Sequence Peripheral Cont	rol Image / Firmware	Additional Resources				
DLPC350 firmware image contains two application 1. Bootloader Application - Resides in first 128 2. Main Application - Controler jumps to Main A	KB memory in the flash; thi				erating modes.	
Note	; system will not boot, in su	ich case you are required	d to use JTAG tools <u>DLPC350 JTAG</u>	ools		
Note If by any reason the bootloader area is corrupted						
Note If by any reason the bootloader area is corrupted Skip Bootloader Update - Checkbox option to	skip erase and programmir	g of fisrt 128KB of area	where Bootloader Application resid	e in the flash.		

Figure 17. Starting The LightCrafter 4500 Firmware File Upload Process

The GUI will upload the entire firmware image to the LightCrafter 4500 through the USB port. When the process is completed, the LightCrafter will automatically be reset.

The DLP LightCrafter 4500 now contains the DLPR350 firmware distribution. Verify proper operation of the projector with the GUI. If the device does not boot up properly, restart at Section 4 and continue, making sure to erase every block of the flash memory.



5 Troubleshooting

• **Problem:** The JTAG flash programmer tool displays the error message: There are no FTDI devices installed.

Solution: Check that the JTAG cable is connected to the PC with a USB cable and the proper driver in Section 2.3 is installed.

• **Problem:** The JTAG flash programmer tool displays the error message: No Device found. Please check the board power, USB/LPT port and JTAG connections.

Solution: Ensure that the target board is receiving power by observing fan operation. Verify that the JTAG cable is connected to the JTAG boundary scan port J25 on the underside of the target board.

• **Problem:** The DLP LightCrafter 4500 does not display the splash screen after the flash is complete.

Solution: Ensure the 2-mm jumper has been removed from J30. Cycle board power and verify fan operation. If the splash screen still does not display, return to and continue with the procedure, making sure to erase every block of the flash memory.

• **Problem:** The DLP LightCrafter 4500 displays a distorted image after the flash is complete. **Solution:** Restart the procedure at Section 4 and continue, making sure to erase every block of the flash memory.



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Revision History

CI	Changes from A Revision (September 2014) to B Revision		
•	Added information about what to do if the device does not connect to the GUI	16	
•	Updated GUI screenshot of the firmware upload window	16	
•	Updated GUI screenshot of the firmware upload process	17	
•	Added missing link to the Flash Programming Procedure	17	
•	Added missing link to the Flash Programming Procedure	18	

Changes from Original (March 2014) to A Revision

•	Included installation of LightCrafter 4500 GUI to procedure	2
•	Added steps regarding flash programming procedure	4
• (Changed procedure to flash only first 128 kB of firmware through JTAG	. 9
•	Added step to connect LightCrafter 4500 to PC	15
• ,	Added step to upload entire DLPR350 PROM through LightCrafter 4500 GUI	16

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