

# Varium C1100 Compute Adaptor

## *Installation Guide*

UG1525 (v1.0) September 17, 2021



# Revision History

The following table shows the revision history for this document.

Section	Revision Summary
<b>09/17/2021 Version 1.0</b>	
Initial release.	N/A

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## Introduction

**Note:** Parts of this document contain information in languages other than English. This is required for regulatory compliance.

This document provides hardware and software installation procedures for the Varium™ C1100 compute adaptor using XRT 2020.2.1.

Different system configurations are available for running, developing, and debugging applications on your Varium C1100 compute adaptor:

- **Running Applications:** To configure a system to run accelerated applications, install a Varium C1100 compute adaptor into a system as described in [Chapter 3: Adaptor Installation Procedures](#) along with the required deployment software to support running applications.
- **Running, Developing, and Debugging Applications:** By installing the Varium C1100 compute adaptor with both the deployment and development software on a single machine, you can configure a system for developing and running compute applications. With the adaptor installed, developers can debug applications in both emulation modes and on the hardware.

## Adaptor Features

The full-height, half-length Varium C1100 compute adaptor is Gen3 x16 PCI Express® (PCIe) compliant. It features the Xilinx® UltraScale+™ architecture and targets compute applications. The Varium C1100 compute adaptor features are as follows.

*Table 1: Varium C1100 Compute Adaptor Features*

Adaptor Component	Varium C1100
<b>FPGA</b>	UltraScale+™ XCU55N FPGA
<b>HBM</b>	8 GB - two 4 gigabyte (GB) HBM memory stacks
<b>Network Interface</b>	2 x QSFP28 supporting 100 GbE, 40 GbE, or 4 x 10/25 GbE Status LEDs
<b>PCIe</b>	16-lane PCI Express PCIe integrated endpoint block connectivity Gen1, 2, or 3 up to x16, Gen4 x8 Dual Gen4 x8
<b>I2C Bus</b>	✓

Table 1: Varium C1100 Compute Adaptor Features (cont'd)

Adaptor Component	Varium C1100
<b>Power Management</b>	Power management with system management bus (SMBus) voltage, current, and temperature monitoring
<b>External Power Sources</b>	75W PCIe slot functional with PCIe slot power only. Provisioned with auxiliary power connector. However, the adaptor is thermally designed to support 150W.
<b>Configuration Options</b>	1 Gb Quad-SPI flash memory: UltraScale+ device configurable over USB/JTAG and Quad-SPI configuration flash memory
<b>UART</b>	UART access through the micro-USB connector

## Minimum System Requirements

The minimum system requirements for running the Varium C1100 compute adaptor are listed in the following table.

Table 2: Minimum System Requirements

Component	Requirement
Motherboard	PCI Express® 3.0-compliant with one full-height x16 slot.
System power supply	150W via PCI Express slot connection and 8-pin PCI Express auxiliary power.
Operating system <sup>1</sup>	Linux, 64-bit: <ul style="list-style-type: none"> <li>• <b>Ubuntu:</b> 16.04, 18.04, 20.04</li> <li>• <b>CentOS:</b> 7.6, 7.7, 7.8, 8.1, 8.2</li> <li>• <b>RHEL:</b> 7.6, 7.7, 7.8, 8.1, 8.2</li> </ul>
System memory	For deployment installations, a minimum of 16 GB plus application memory requirements is required. For development installations, a minimum of 64 GB of system memory is required, but 80 GB is recommended.
Internet connection	Required for downloading drivers and utilities.
Hard disk space	Satisfy the minimum system requirements for your operating system.
Licensing	None required for application deployment.

**Notes:**

1. For the latest OS support, see *XRT Release Notes* (UG1451).

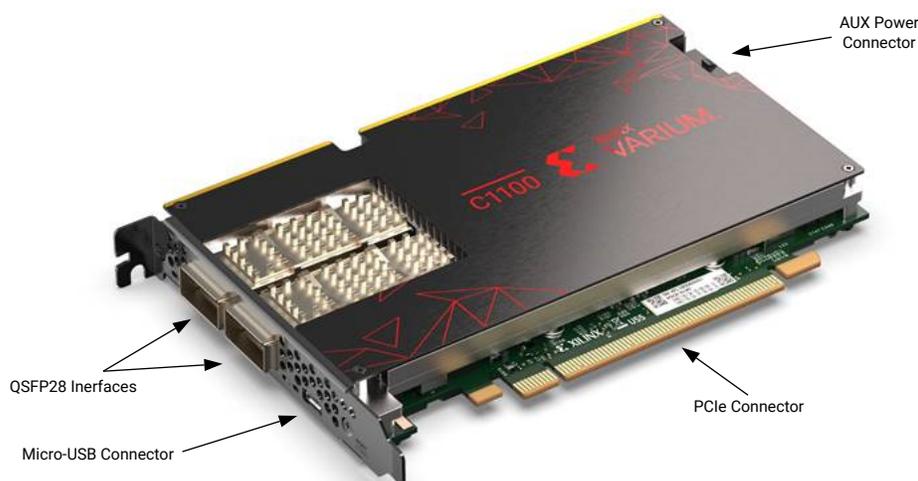
For details on the acceptable environmental conditions, see the *Varium C1100 Compute Adaptor Data Sheet* (DS1003).

# Adaptor Interfaces and Details

The Varium™ C1100 compute adaptor is available in a passive cooling configuration and is designed for installation into a data center server where controlled air flow provides direct cooling to the adaptor. The adaptor includes the following interfaces.

- A PCI Express® card connector
- A PCI Express® auxiliary power connector
- The production qualified (PQ) adaptor and engineering sample (ES) adaptor both have two QSFP28 interfaces
- A micro-USB connector for JTAG programming

*Figure 1: Varium C1100 Compute Adaptor with Full-Height Bracket*



**Note:** Varium C1100 compute adaptor is designed to be installed into a data center server, where controlled air flow provides direct cooling. If the cooling enclosure is removed from the adaptor and the adaptor is powered-up, external fan cooling airflow **MUST** be applied to prevent over-temperature shut-down and possible damage to the adaptor electronics. Removing the cooling enclosure voids the board warranty.

For adaptor specifications, dimensions, list of adaptor features, and block diagram, see the *Varium C1100 Compute Adaptor Data Sheet (DS1003)*.

# Adaptor Installation Procedures

To reduce the risk of fire, electric shock, or injury, always follow basic safety precautions.



**CAUTION!** You must always use an ESD strap or other antistatic device when handling hardware.



**ATTENTION!** Il est fortement recommandé d'utiliser un bracelet ESD ou autres dispositifs antistatiques.



**VORSICHT!** Beim Umgang mit Hardware müssen sie immer ein Erdungs Armband oder ein anderes antistatisches Gerät verwenden.

---

## Safety Instructions

### Safety Information

To ensure your personal safety and the safety of your equipment:

- Keep your work area and the computer/server clean and clear of debris.
- Before opening the computer/system cover, unplug the power cord.

### Dispositif de Sécurité

Pour assurer votre sécurité personnelle et la sécurité de votre équipement:

- Maintenez votre zone de travail et l'ordinateur/serveur propre et dégagé de débris.
- Avant d'ouvrir le capot de l'ordinateur/système, débranchez le cordon d'alimentation.

### Sicherheitsinformation

Um ihre persönliche Sicherheit und die Sicherheit ihrer Ausrüstung zu gewährleisten:

- Halten sie ihren Arbeitsbereich und den Computer / Server sauber und frei von Ablagerungen.
- Ziehen sie vor dem Öffnen der Computer / Systemabdeckung das Netzkabel ab.

## Electrostatic Discharge Caution

Electrostatic discharge (ESD) can damage electronic components when they are improperly handled, and can result in total or intermittent failures. Always follow ESD-prevention procedures when removing and replacing components.

To prevent ESD damage:

- Use an ESD wrist or ankle strap and ensure that it makes skin contact. Connect the equipment end of the strap to an unpainted metal surface on the chassis.
- Avoid touching the adaptor against your clothing. The wrist strap protects components from ESD on the body only.
- Handle the adaptor by its bracket or edges only. Avoid touching the printed circuit board or the connectors.
- Put the adaptor down only on an antistatic surface such as the bag supplied in your kit.
- If you are returning the adaptor to Xilinx Product Support, place it back in its antistatic bag immediately.

## Attention aux Décharge Électrostatique (ESD)

L'ESD peut endommager les composants électroniques lorsqu'ils sont mal manipulés, et peut entraîner des défaillances totales ou intermittentes. Suivez toujours les procédures de prévention contre les ESD lors du retrait et remplacement des composants.

Pour prévenir les dommages dus aux ESD:

- Utilisez une sangle de poignet ou de cheville anti-ESD et assurez-vous qu'elle est en contact avec la peau. Branchez l'extrémité du câble de la sangle à une surface métallique non peinte du châssis et à la masse.
- Évitez de mettre en contact le adapateurs de circuit imprimé ou les connecteurs avec vos vêtements. La sangle de poignet protège la carte ou connecteurs contre les ESD du corps seulement.
- Manipulez le adapateurs uniquement par son support ou par ses bords. Évitez de toucher la carte de circuit imprimé ou les connecteurs.
- Ne posez le adapateurs de circuit imprimé ou les connecteurs que sur une surface antistatique telle que le sac anti-statique fourni avec la carte.
- Si vous retournez le adapateurs à Xilinx, remettez-la dans son sac antistatique immédiatement.

## Vorsicht Elektrostatische Entladung

Elektrostatische Entladung (ESD) kann elektronische Bauteile beschädigen, wenn sie unsachgemäß behandelt werden, und es kann zu totalen oder zeitweiligen Ausfällen kommen. Befolgen sie beim Entfernen und Austauschen von Komponenten stets die ESD-Schutzmaßnahmen.

So verhindern sie ESD-Schäden:

- Verwenden sie einen ESD-Handgelenk-oder Knöchelriemen und stellen sie sicher, dass er Hautkontakt hat. Verbinden sie das Ende des Riemens mit einer unlackierten Metalloberfläche am Gehäuse.
- Berühren sie der adapter nicht mit ihrer Kleidung. Der Riemen schützt Komponenten nur vor ESD am Körper.
- Fassen sie der adapter nur an der Halterung oder an den Kanten an. Berühren sie nicht die Leiterplatte oder die Anschlüsse.
- Legen sie der adapter nur auf einer antistatischen Oberfläche ab, z.B. dem antistatischen Beutel der mit dem Kit mitgeliefert wurde.
- Wenn sie der adapter an den Xilinx Product Support zurücksenden, legen Sie sie bitte sofort wieder in den antistatischen Beutel.

---

## Before You Begin

 **IMPORTANT!** *Varium C1100 adaptors are delicate and sensitive electronic devices; equipment is to be installed by a qualified technician only. This equipment is intended for installation in a restricted access location.*

 **IMPORTANT!** *Les adaptateurs Varium sont des appareils électronique sensibles et fragiles; l'équipement doit être installé par un technicien certifié seulement. Cet équipement est destiné à être installé dans un lieu d'accès restreint.*

 **WICHTIG!** *Die adaptoren Varium sind sensible und empfindliche elektronische Geräte. Das Gerät darf nur von einem qualifizierten Techniker installiert werden. Dieses Gerät ist für die Installation an einem Ort mit begrenztem Zugang vorgesehen.*

- Verify that the minimum space is available to install your adaptor. Adaptor specifications and dimensions are listed in the *Varium C1100 Compute Adaptor Data Sheet (DS1003)*.
- Check for adaptor compatibility with the system. Also check for proper system requirements such as power, bus type, and physical dimensions to support the adaptor.

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## Installing the Adaptor

The following procedure is a guide for the Varium™ C1100 compute adaptor installation. Consult your computer documentation for additional information.

**Note:** For use with UL listed servers or ITE.

If you encounter any issues during installation, see [Chapter 6: Troubleshooting](#).

1. Shut down the host computer and unplug the power cord.
2. Open your computer by removing the casing.
3. If necessary, remove the adjacent PCIe® slot cover corresponding to the PCIe slot in which you are installing the Varium C1100 compute adaptor.
4. Plug the Varium C1100 compute adaptor into the PCIe x16 slot on the motherboard.
5. Connect the AUX power connector to the Varium C1100 compute adaptor, ensure the plug is mechanically fixed (with the click).

---

 **IMPORTANT!** *Operation of the Varium C1100 compute adaptor only with AUX power connector is not allowed.*

---

 **IMPORTANT!** *Le fonctionnement des adaptateurs Varium uniquement avec le connecteur auxiliaire n'est pas autorisé.*

---

 **WICHTIG!** *Der Betrieb von Varium-Adaptoren mit dem Hilfsstecker ist nicht zulässig.*

---

To provide additional power, the Varium C1100 compute adaptor has an 8-pin female PCIe AUX power connector which can accept an 8-pin or 6-pin AUX power cable. For applications requiring optimum card performance, the PCIe AUX power needs to be connected to increase the power supplied to the card from 75W from the PCIe to 150W. Consult your computer documentation for additional information.

6. Re-install the computer casing.
7. Connect the power cord and turn on the computer.

**Note:** Do not power-on a passively cooled adaptor without adequate forced airflow across the adaptor with proper air flow direction, otherwise the adaptor can be damaged. This adaptor can heat up after use in the server. Use caution when handling. For more information, see the *Varium C1100 Compute Adaptor Data Sheet (DS1003)*.

8. To verify that the device has been installed correctly, enter the following Linux command in the terminal:

```
$ sudo lspci -vd 10ee:
```

If the adaptor is successfully installed and found by the operating system, a message similar to the one below will be displayed.

This is a sample output for an installed Varium C1100 compute adaptor:

```
af:00.0 Processing accelerators: Xilinx Corporation Device 5058
Subsystem: Xilinx Corporation Device 000e
Flags: bus master, fast devsel, latency 0, NUMA node 1
Memory at 386ff2000000 (64-bit, prefetchable) [size=32M]
Memory at 386ff4040000 (64-bit, prefetchable) [size=256K]
Capabilities: [40] Power Management version 3
Capabilities: [60] MSI-X: Enable+ Count=32 Masked-
Capabilities: [70] Express Endpoint, MSI 00
Capabilities: [100] Advanced Error Reporting
Capabilities: [1c0] #19
```

```
Capabilities: [e00] Access Control Services
Capabilities: [e10] #15
Capabilities: [e80] Vendor Specific Information: ID=0020 Rev=0 Len=010
Kernel driver in use: xclmgmt
Kernel modules: xclmgmt
```

If you do not see a message similar to the previous one, see [Chapter 6: Troubleshooting](#).

# Installing the Deployment Software

This chapter details the procedures for installing deployment software on RedHat/CentOS and Ubuntu operating systems. All software installations use standard Linux RPM and Linux DEB packages and require root access.

The deployment software consists of the following software packages:

- **Xilinx<sup>®</sup> runtime (XRT):** XRT provides the libraries and drivers for an application to run on Varium<sup>™</sup> C1100 compute adaptor.
- **Deployment platform:** The deployment platform provides the base firmware needed to run pre-compiled applications. It cannot be used to compile or create new applications.

Both the Xilinx runtime (XRT) and deployment platform installation packages can be downloaded from the Varium C1100 compute adaptor product page.

If you encounter any issues during installation, see [Chapter 6: Troubleshooting](#).

---

 **IMPORTANT!** *Root access is required for all software and firmware installations.*

---

 **IMPORTANT!** *L'accès Root est requis pour toutes les installations logicielles et firmware.*

---

 **WICHTIG!** *Root-Zugriff ist für alle Software- und Firmware-Installationen erforderlich.*

---

---

## XRT and Deployment Platform Installation Procedures on RedHat and CentOS

Use the following steps to download and install the XRT and deployment platforms using `.rpm` installation package.

For details on upgrading or downgrading the XRT and deployment platform, see [Appendix A: Changing XRT and Target Platform Versions](#).

1. XRT installation requires Extra Packages for Enterprise Linux (EPEL) and a related repository. If not already installed, install EPEL on your system by following the steps provided on the [XRT Installation](#) page.
2. Run the following two commands to install kernel headers and kernel development packages. Ensure that `uname` is surrounded by backticks (```) and not single quotes (`'`):

```
$ sudo yum install kernel-headers-`uname -r`
$ sudo yum install kernel-devel-`uname -r`
```

**Note:** If these `yum` commands fail because they cannot find packages matching your kernel version, set up a Vault repository. For more information, see [Appendix B: Creating a Vault Repository for CentOS](#).

3. After the previous command completes, reboot your machine.
4. From the Getting Started tab of the Varium C1100 compute adaptor product page, download the XRT installation package file by selecting your OS and version, then select the displayed XRT file name.
5. Install the XRT installation package by running the following command from within the directory where the XRT installation packages reside. `<version>` is the latter part of the installation package file name.

```
$ sudo yum install ./xrt-<version>.rpm
```

This will install the XRT and its necessary dependencies. Follow the instructions when prompted throughout the installation.

6. From the Varium C1100 compute adaptor product page, download and unpack the deployment installation `tar.gz` file. Download the `tar.gz` file by first selecting your OS and version, then clicking on the displayed file name. Unpack the `tar.gz` file into a single directory. The location of the directory is not important, however the directory should not contain any other files.
7. Install the deployment packages. From within the directory where the installation packages were unpacked, run the following command. This will install all deployment packages.

```
$ sudo yum install ./xilinx*.rpm
```

The installation of the deployment partition and firmware are located in the `/opt/xilinx/firmware` directory and contains the named partition and firmware sub-directories. After installing the deployment packages you will see the following message.

```
Partition package installed successfully.
Please flash card manually by running below command:
```

```
$ sudo /opt/xilinx/xrt/bin/xbmgmt flash --update --shell <base_name> --
card <card_bdf>
```

8. Flash the base firmware to the Varium C1100 compute adaptor using the command displayed in the output of the previous step. It has the following format.

```
$ sudo /opt/xilinx/xrt/bin/xbmgmt flash --update --shell <base_name> --
card <card_bdf>
```

If the card has been upgraded, you will see a message similar to the following and no additional installation steps are necessary.

```
Status: shell is up-to-date Card(s) up-to-date and do not need to be
flashed.
```

- You will be asked to confirm the update, as follows. Type **y** and press the **Enter** key.

```
Status: shell needs updating
Current shell: <current_base_partition_name>
Shell to be flashed: <base_partition_to_be_flashed>
Are you sure you wish to proceed? [y/n]:
```

Flashing can take several minutes.

---

 **IMPORTANT!** Do not enter **Ctrl + c** in the terminal while the firmware is flashing as this can cause the card to become inoperable.

---

 **IMPORTANT!** N'entrez pas **Ctrl + c** dans le terminal lorsque le micrologiciel clignote, car cela pourrait rendre la carte inutilisable.

---

 **WICHTIG!** Geben Sie im Terminal nicht **Strg + c** ein, während die Firmware blinkt, da dies dazu führen kann, dass die Karte nicht mehr funktioniert.

---

Successfully flashing a new card results in a message similar to the following. If the command returns **Card Not Found**, perform a cold reboot, and retry. Otherwise, see [Chapter 6: Troubleshooting](#).

```
Updating shell on card[0000:d8:00.0]
Bitstream guard installed on flash @0x1002000
Persisted 545084 bytes of meta data to flash 0 @0x7f7ae98
Extracting bitstream from MCS data:
.....
Extracted 32306392 bytes from bitstream @0x1002000
Writing bitstream to flash 0:
.....
Bitstream guard removed from flash
Successfully flashed Card[0000:d8:00.0]

1 Card(s) flashed successfully.
Cold reboot machine to load the new image on card(s).
```

- Cold boot your machine to load the new base firmware image on the FPGA.

**Note:** Be sure to fully power OFF the machine and then power it ON again. The image will not boot from flash if the machine is only rebooted.

- Update the SC firmware by re-running the update command in the previous step.

```
$ sudo /opt/xilinx/xrt/bin/xbmgmt flash --update --shell <base_name> --
card <card_bdf>
```

If the SC is up to date, you will see the following message and no additional upgrade steps are necessary.

```
Status: shell is up-to-date
Card(s) up-to-date and do not need to be flashed
```

If you have multiple cards installed or need to regenerate the command, follow the steps given in [Appendix D: Obtaining xbmgmt Command Options](#).

If the SC needs updating it will report the following message.

```
Status: SC needs updating
Current SC: <current_sc_version>
SC to be flashed: <sc_version_to_be_flashed>
Are you sure you wish to proceed? [y/n]: y
```

Updating the SC firmware can take several minutes. Successfully flashing the SC results in a message similar to the following. No reboot is necessary.

```
Updating SC firmware on card[0000:d8:00.0]
Stopping user function...
.....
Successfully flashed Card[0000:d8:00.0]
1 Card(s) flashed successfully.
```

The installation for deployment is now complete. You can go directly to [Chapter 5: Card Bring-Up and Validation](#).

## XRT and Deployment Package Installation Procedures on Ubuntu

Use the following steps to download and install the XRT and deployment platform using a *.deb* installation package.

For details on upgrading or downgrading the XRT and deployment platform, see [Appendix A: Changing XRT and Target Platform Versions](#).

**Note:** The installation packages referenced here are updated regularly and the file names frequently change. If you copy and paste any commands from this user guide, be sure to update the placeholders in those commands to match the downloaded packages.

1. From the Varium C1100 compute adaptor product page, download the XRT installation package by first selecting your OS and version, then select the displayed XRT file name
2. Install the XRT installation package by running the following command from within the directory where the XRT installation packages reside. `<version>` is the latter part of the installation package file name.

```
$ sudo apt install ./xrt*.deb
```

This will install the XRT along with any necessary dependencies. Follow the instructions when prompted throughout the installation.

- From the Varium C1100 compute adaptor product page, download and extract the deployment installation `tar.gz` file by first selecting your OS and version, then clicking on the displayed file name. Extract the `tar.gz` file into a single directory. The location of the directory is not important, however the directory should not contain any other files.
- Install the deployment packages. From within the directory where the installation packages were unpacked, run the following command. This will install all deployment packages.

```
$ sudo apt install ./xilinx*.deb
```

The installation of the deployment partition and firmware are located in the `/opt/xilinx/firmware` directory and contain the named partition and firmware sub-directories. After installing the deployment packages you will see the following message.

```
Partition package installed successfully.
Please flash card manually by running below command:
```

```
$ sudo /opt/xilinx/xrt/bin/xbmgmt flash --update --shell <base_name> --
card <card_bdf>
```

- Flash the base firmware to the Varium C1100 compute adaptor using the command displayed in the output of the previous step. It has the following format.

```
$ sudo /opt/xilinx/xrt/bin/xbmgmt flash --update --shell <base_name> --
card <card_bdf>
```

If the card has been upgraded, you will see a message similar to the following and no additional installation steps are necessary.

```
Status: shell is up-to-date Card(s) up-to-date and do not need to be
flashed.
```

The following command can be used for obtaining the `base_name` and `card_bdf` command options.

```
$ sudo /opt/xilinx/xrt/bin/xbmgmt flash --scan
```

If you have multiple cards installed or need to regenerate the command, follow the steps given in [Appendix D: Obtaining xbmgmt Command Options](#).

- You will be asked to confirm the update, as follows. Type **y** and press the **Enter** key.

```
Status: shell needs updating
Current shell: <current_base_partition_name>
Shell to be flashed: <base_partition_to_be_flashed>
Are you sure you wish to proceed? [y/n]:
```

Flashing can take several minutes.



**IMPORTANT!** Do not enter **Ctrl + c** in the terminal while the firmware is flashing as this can cause the card to become inoperable.

---

 **IMPORTANT!** *N'entrez pas **Ctrl + c** dans le terminal lorsque le micrologiciel clignote, car cela pourrait rendre la carte inutilisable.*

---

 **WICHTIG!** *Geben Sie im Terminal nicht **Strg + c** ein, während die Firmware blinkt, da dies dazu führen kann, dass die Karte nicht mehr funktioniert.*

---

Successfully flashing a new card results in a message similar to the one shown below. If the command returns `Card Not Found`, perform a cold reboot, and retry. Otherwise, see [Chapter 6: Troubleshooting](#).

```
Updating shell on card[0000:86:00.0]
Bitstream guard installed on flash @0x1002000
Persisted 547368 bytes of meta data to flash 0 @0x7f7a5ac
Extracting bitstream from MCS data:
.....
Extracted 44476060 bytes from bitstream @0x1002000
Writing bitstream to flash 0:
.....
Bitstream guard removed from flash
Successfully flashed Card[0000:86:00.0]
1 Card(s) flashed successfully.
Cold reboot machine to load the new image on card(s)
```

7. Cold boot your machine to load the new base firmware image on the FPGA.

**Note:** Be sure to perform a cold boot to fully power OFF the machine and then power it ON again. The image will not boot from flash if the machine is only rebooted.

8. Update the SC firmware by re-running the update command in the previous update step.

```
$ sudo /opt/xilinx/xrt/bin/xbmgmt flash --update --shell <base_name> --
card <card_bdf>
```

If the SC is up to date, you will see the following message and no additional upgrade steps are necessary.

```
Status: shell is up-to-date
Card(s) up-to-date and do not need to be flashed.
```

9. If the SC needs updating it will report the following message.

```
Status: SC needs updating
Current SC: <current_sc_version>
SC to be flashed: <sc_version_to_be_flashed>
Are you sure you wish to proceed? [y/n]: y
```

Updating the SC firmware can take several minutes. A successful SC firmware update will result in a message similar to the following. The SC firmware will be updated and no cold boot is required.

```
Updating SC firmware on card[0000:d8:00.0]
Stopping user function...
.....
Successfully flashed Card[0000:d8:00.0]

1 Card(s) flashed successfully.
```

The installation for deployment is now complete. You can go directly to [Chapter 5: Card Bring-Up and Validation](#).

# Card Bring-Up and Validation

After installing the XRT and deployment platform, the card installation can be verified using the following commands which are described in subsequent sections.

- `lspci`
- `xbmgmt flash --scan`
- `xbutil validate`

The `lspci` Linux command is used to confirm the card, is seen by the OS, as was done when installing the card.

The additional commands use the `xbmgmt` and `xbutil` utilities included during the XRT package installation. These utilities include multiple commands to validate and identify the installed card(s) and report additional card details including memory, PCIe®, platform name, and system information. See *Vitis Unified Software Platform Documentation: Application Acceleration Development (UG1393)* for a detailed list of commands.

Set the environment to use the utilities by running the following command. Note that the command is dependent on the command shell you are using.

Use the following command in `csh` shell:

```
$ source /opt/xilinx/xrt/setup.csh
```

Use the following command in `bash` shell:

```
$ source /opt/xilinx/xrt/setup.sh
```

---

## Running `lspci`

Perform the following to run `lspci`:

1. Enter the following command.

```
$ sudo lspci -vd 10ee:
```

2. If the card is successfully installed and found by the operating system, you will see a message similar to the following. Note that for each card, there will be two physical functions found: one for management and one for user. See <https://xilinx.github.io/XRT/master/html/platforms.html> for additional details.

```
d8:00.0 Processing accelerators: Xilinx Corporation Device 5058
Subsystem: Xilinx Corporation Device 000e
Flags: bus master, fast devsel, latency 0, NUMA node 1
Memory at 387ff2000000 (64-bit, prefetchable) [size=32M]
Memory at 387ff4040000 (64-bit, prefetchable) [size=256K]
Capabilities: [40] Power Management version 3
Capabilities: [60] MSI-X: Enable+ Count=32 Masked-
Capabilities: [70] Express Endpoint, MSI 00
Capabilities: [100] Advanced Error Reporting
Capabilities: [1c0] #19
Capabilities: [e00] Access Control Services
Capabilities: [e10] #15
Capabilities: [e80] Vendor Specific Information: ID=0020 Rev=0 Len=010
Kernel driver in use: xclmgmt
Kernel modules: xclmgmt
```

```
d8:00.1 Processing accelerators: Xilinx Corporation Device 5059
Subsystem: Xilinx Corporation Device 000e
Flags: bus master, fast devsel, latency 0, IRQ 326, NUMA node 1
Memory at 387ff0000000 (64-bit, prefetchable) [size=32M]
Memory at 387ff4000000 (64-bit, prefetchable) [size=256K]
Memory at 387fe0000000 (64-bit, prefetchable) [size=256M]
Capabilities: [40] Power Management version 3
Capabilities: [60] MSI-X: Enable+ Count=32 Masked-
Capabilities: [70] Express Endpoint, MSI 00
Capabilities: [100] Advanced Error Reporting
Capabilities: [e00] Access Control Services
Capabilities: [e10] #15
Capabilities: [e80] Vendor Specific Information: ID=0020 Rev=0 Len=010
Kernel driver in use: xocl
Kernel modules: xocl
```

## Running `xbmgmt flash --scan`

Use the `xbmgmt flash --scan` command to display and confirm the card's flashed base firmware version and additional card details, including the card Bus:Device:Function (BDF).

1. Enter the following command.

```
$ sudo /opt/xilinx/xrt/bin/xbmgmt flash --scan
```

For each card in the server, you will see an output similar to the following example.

```
Card [0000:d8:00.0]
Card type: u55n
Flash type: SPI
Flashable partition running on FPGA:
xilinx_u55n_gen3x16_xdma_base_2,[ID=0x8df674eb3b13f7a5],[SC=7.1.9]
Flashable partitions installed in system:
xilinx_u55n_gen3x16_xdma_base_2,[ID=0x8df674eb3b13f7a5],[SC=7.1.9]
```

The name of the partition and SC firmware version running on the FPGA are found under `Flashable partition running on FPGA` while the ones installed in the system are found under `Flashable partitions installed in system`.

See [xbmgmt Utility](#) in the Application Acceleration Development flow of the *Vitis Unified Software Platform Documentation* (UG1416) for details about BDF, partitions, ID, and SC.

2. Verify that the deployment platform version installed on the FPGA is identical to that installed on the system. You can do this by making sure the lines under `Flashable partition running on FPGA` and `Flashable partitions installed in system` are identical.

If these versions do not match, perform a cold reboot, and retry. See [Chapter 6: Troubleshooting](#).

## xbutil validate

The `xbutil validate` command validates the correct installation by performing the following set of tests:

1. Validates the device found.
2. Checks PCIe link status.
3. Runs a verify kernel on the card.
4. Performs the following data transfer tests:
  - a. DMA test - Data transfer between host and card memory through PCIe.
  - b. Memory test - Data transfer between kernels and card memory.

With the shell programmed, run the `validate` command as follows:

The `validate` command has the following format.

```
$ xbutil validate -d <card_bdf>
```

Where, `-d` is optional and `card_bdf` is the BDF of the card to be validated. If `-d` is not specified, the command will validate all cards in the system. See [xbmgmt Utility](#) in the Application Acceleration Development flow of the *Vitis Unified Software Platform Documentation (UG1416)* for additional information.

Run the following validate command.

```
$ /opt/xilinx/xrt/bin/xbutil validate -d <card_bdf>
```

If the card was installed correctly, you will see a high-level summary of the tests performed similar to the following output. If the output is not similar, see [Chapter 6: Troubleshooting](#).

```
INFO: Found 1 cards

INFO: Validating card[0]: xilinx_u55n_gen3x16_xdma_base_2
INFO: == Starting Kernel version check:
INFO: == Kernel version check PASSED
INFO: == Starting AUX power connector check:
AUX power connector not available. Skipping validation
INFO: == AUX power connector check SKIPPED
INFO: == Starting Power warning check:
INFO: == Power warning check PASSED
INFO: == Starting PCIE link check:
INFO: == PCIE link check PASSED
INFO: == Starting SC firmware version check:
INFO: == SC firmware version check PASSED
INFO: == Starting verify kernel test:
INFO: == verify kernel test PASSED
INFO: == Starting DMA test:
Host -> PCIe -> FPGA write bandwidth = 11613.137362 MB/s
Host <- PCIe <- FPGA read bandwidth = 11247.308993 MB/s
INFO: == DMA test PASSED
INFO: == Starting device memory bandwidth test:
.....
Maximum throughput: 42842 MB/s
INFO: == device memory bandwidth test PASSED
INFO: == Starting PCIE peer-to-peer test:
P2P BAR is not enabled. Skipping validation
INFO: == PCIE peer-to-peer test SKIPPED
INFO: == Starting memory-to-memory DMA test:
M2M is not available. Skipping validation
INFO: == memory-to-memory DMA test SKIPPED
INFO: == Starting host memory bandwidth test:
Host_mem is not available. Skipping validation
INFO: == host memory bandwidth test SKIPPED
INFO: Card[0] validated successfully.

INFO: All cards validated successfully.
```

**Note:** The DMA bandwidth can vary depending upon NUMA/CPU affinity.

## Troubleshooting

For debug issues see the *Alveo Card Debug Guide* ([XD027](#)).

### Known Issues

- **xbutil validate output shows AUX power connector not available even when connected:**

When you run `xbutil validate` command, the output shows an error message saying *AUX power connector not available. Skipping validation.* To verify the AUX power connection, review the electrical values by running the following command:

```
/opt/xilinx/xrt/bin/xbutil query | grep Electrical -A 20
```

In the resulting output, if the AUX voltage and current are not close to zero, it means that the AUX power connector is connected.

```
Electrical(mV|mA)
12V PEX          12V AUX          12V PEX Current  12V AUX Current
12200           12216            1304              1312
3V3 PEX         3V3 AUX          DDR VPP BOTTOM   DDR VPP TOP
3280            N/A              N/A              N/A
SYS 5V5        1V2 TOP          1V8 TOP          0V85
5015            N/A              1815             N/A
MGT 0V9        12V SW           MGT VTT          1V2 BTM
909             N/A              1203             N/A
VCCINT VOL     VCCINT CURR      VCCINT IO VOL    VCC3V3 VOL
854             23500            853               3341
3V3 PEX CURR   VCCINT IO CURR   HBM1V2 VOL       VPP2V5 VOL
1440            800              1204              2489
VCC1V2 CURR    V12 I CURR       V12 AUX0 CURR    V12 AUX1 CURR
N/A             N/A              N/A               N/A
12V AUX1 VOL   VCCAUX VOL       VCCAUX PMC VOL   VCCRAM VOL
N/A            N/A              N/A               N/A
3V3 AUX CURR   POWER WARN
N/A            N/A
```

~~~~~  
~~~~~

# Changing XRT and Target Platform Versions

The Varium™ C1100 compute adaptor target platform and XRT revisions can change significantly between releases. To ensure a successful upgrade (or downgrade) of the Varium C1100 compute adaptor XRT and platform, carefully follow the instructions for your specific release pairing. Failure to adhere to these procedures can result in an unstable installation or other issues. See [Modifying XRT or Platform](#) for installation support.

**Note:** For links to the available platform and XRT revisions, see [Chapter 4: Installing the Deployment Software](#).

---

 **IMPORTANT!** Do not enter **Ctrl + c** in the terminal while the firmware is flashing as this can cause the card to become inoperable.

---

 **IMPORTANT!** N'entrez pas **Ctrl + c** dans le terminal lorsque le micrologiciel clignote, car cela pourrait rendre la carte inutilisable.

---

 **WICHTIG!** Geben Sie im Terminal nicht **Strg + c** ein, während die Firmware blinkt, da dies dazu führen kann, dass die Karte nicht mehr funktioniert.

---

---

## RedHat and CentOS

During upgrading, downgrading, or uninstalling, it can be useful to list the currently installed Varium C1100 compute adaptor packages. To list all currently installed platform packages, run the following command in a Linux terminal:

```
$ yum list installed | grep xilinx
```

To list the currently installed XRT package, run the following command:

```
$ yum list installed | grep xrt
```

## Upgrade

The following steps require XRT 2019.2 or later to be installed.

1. Restore the card to the original manufacturing state by following the instructions in [Appendix C: Reverting the Card to Factory Image](#).
2. Remove the current XRT and installed platform(s).

```
$ sudo yum remove xrt
```

3. Follow the installation procedures outlined in [Chapter 4: Installing the Deployment Software](#).

## Downgrade

The following steps require XRT 2019.2 or later to be installed.

To downgrade perform the following steps.

1. Restore the card to the original manufacturing state by following the instructions in [Appendix C: Reverting the Card to Factory Image](#).
2. Remove the current XRT and installed platform(s).

```
$ sudo yum remove xrt
```

3. Follow the installation procedures outlined in the chapter [Chapter 4: Installing the Deployment Software](#).

## Uninstalling Packages in RedHat and CentOS

To completely uninstall the XRT and installed deployment platform packages, run the following command in a Linux terminal. Uninstalling XRT also uninstalls the deployment platform.

```
$ sudo apt remove xrt
```

## Ubuntu

During upgrading, downgrading, or uninstalling, it can be useful to list the currently installed Varium C1100 compute adaptor packages. To list all currently platform packages, run the following command in a Linux terminal:

```
$ apt list --installed | grep xilinx
```

To list the currently installed XRT package, run the following command:

```
$ apt list --installed | grep xrt
```

## Upgrade

The following steps require XRT 2019.2 or later to be installed.

1. Restore the card to the original manufacturing state by following the instructions in [Appendix C: Reverting the Card to Factory Image](#).
2. Remove the current XRT and installed platform(s).

```
$ sudo apt remove xrt
```

3. Follow the installation procedures outlined in [Chapter 4: Installing the Deployment Software](#).

## Downgrade

The following steps require XRT 2019.2 or later to be installed.

To downgrade perform the following steps.

1. Restore the card to the original manufacturing state by following the instructions in [Appendix C: Reverting the Card to Factory Image](#).
2. Remove the current XRT and installed platform(s).

```
$ sudo apt remove xrt
```

3. Follow the installation procedures outlined in the chapter [Chapter 4: Installing the Deployment Software](#).

## Uninstalling Packages in Ubuntu

To completely uninstall the XRT and installed deployment platform packages, run the following command in a Linux terminal. Uninstalling XRT also uninstalls the deployment platform.

```
$ sudo apt remove xrt
```

# Creating a Vault Repository for CentOS

On CentOS, `yum install kernel-headers` always installs the latest version of the headers, but might not match your kernel version. This causes the installation of XRT to skip compilation of the driver modules and will silently fail. To correctly install XRT, you must create a vault repository file that points to versions matching the kernel.

Use the following example repository as a guide to create your own repository. It is an example repository for CentOS 7.4 created in the following file:

```
/etc/yum.repos.d/centos74.repo
```

```
# CentOS-Base-7.4.repo
#
# This repo is locked to 7.4.1708 version
#
# C7.4.1708
[C7.4.1708-base]
name=CentOS-7.4.1708 - Base
baseurl=http://vault.centos.org/7.4.1708/os/$basearch/
gpgcheck=1
gpgkey=file:///etc/pki/rpm-gpg/RPM-GPG-KEY-CentOS-7
enabled=1
[C7.4.1708-updates]
name=CentOS-7.4.1708 - Updates
baseurl=http://vault.centos.org/7.4.1708/updates/$basearch/
gpgcheck=1
gpgkey=file:///etc/pki/rpm-gpg/RPM-GPG-KEY-CentOS-7
enabled=1
[C7.4.1708-extras]
name=CentOS-7.4.1708 - Extras
baseurl=http://vault.centos.org/7.4.1708/extras/$basearch/
gpgcheck=1
gpgkey=file:///etc/pki/rpm-gpg/RPM-GPG-KEY-CentOS-7
enabled=1
[C7.4.1708-centosplus]
name=CentOS-7.4.1708 - CentOSPlus
baseurl=http://vault.centos.org/7.4.1708/centosplus/$basearch/
gpgcheck=1
gpgkey=file:///etc/pki/rpm-gpg/RPM-GPG-KEY-CentOS-7
enabled=1
[C7.4.1708-fasttrack]
name=CentOS-7.4.1708 - CentOSPlus
baseurl=http://vault.centos.org/7.4.1708/fasttrack/$basearch/
gpgcheck=1
gpgkey=file:///etc/pki/rpm-gpg/RPM-GPG-KEY-CentOS-7
enabled=1
```

**Note:** For CentOS 7.5, create the repo file `/etc/yum.repos.d/centos75.repo` and add the previously listed content, replacing "7.4.1708" with "7.5.1804". Similarly, for CentOS 7.6, create the repo file `/etc/yum.repos.d/centos76.repo` and add the previously listed content, replacing "7.4.1708" with "7.6.1810".

# Reverting the Card to Factory Image

The Varium™ C1100 compute adaptor can be reverted to the factory image, also known as golden. This requires that XRT release 2019.2 or later is installed on the same system as the Varium C1100 compute adaptor. For more information, see [AR71757](#).

# Obtaining xbmgmt Command Options

Xilinx® Board Management (`xbmgmt`) utility is a standalone command line tool that is included with the XRT installation package. This utility is used for card installation and administration, and requires `sudo` privileges when running it and supports tasks include flashing the card firmware, and scanning the current device and system configuration. Complete command documentation can be found under [xbmgmt Utility](#) in the Application Acceleration Development flow of the *Vitis Unified Software Platform Documentation (UG1416)*.

This section describes how to obtain the `xbmgmt` command options necessary for flashing the base partition.

The following command is used to flash the base partition.

```
$ sudo /opt/xilinx/xrt/bin/xbmgmt flash --update --shell <base_name> --card <card_bdf>
```

Command options, descriptions, and commands to display the options are provided in the following table.

**Table 3: Command Options and Descriptions**

Option	Description	Command
<code>card_bdf</code>	Card Bus Device Function (BDF) for the card in the following format: [Bus : Device : Function]	<code>xbmgmt flash --scan</code> or <code>xbmgmt partition --scan</code>
<code>base_name</code>	Base partition firmware name	<code>xbmgmt flash --scan</code>

Use the following command to list the available base partition.

```
$ sudo /opt/xilinx/xrt/bin/xbmgmt flash --scan
```

An example output of this command is given below with available base partitions displayed under the `Flashable` partitions installed in system. Only one base partition is shown `xilinx_u55n_gen3x16_xdma_base_2`.

```
Card [0000:d8:00.0]
Card type: u55n
Flash type: SPI
Flashable partition running on FPGA:
xilinx_u55n_gen3x16_xdma_base_2, [ID=0x8df674eb3b13f7a5], [SC=7.1.9]
Flashable partitions installed in system:
xilinx_u55n_gen3x16_xdma_base_2, [ID=0x8df674eb3b13f7a5], [SC=7.1.9]
```

The `card_bdf` is displayed on the first output line for either command in these examples is `0000:d8:00.0`.

Using the command options from the previous example, the command for flashing the base is as follows,

```
$ sudo /opt/xilinx/xrt/bin/xbmgmt flash --update --shell
xilinx_u55n_gen3x16_xdma_base_2 --card 0000:d8:00.0
```

# Additional Resources and Legal Notices

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## Xilinx Resources

For support resources such as Answers, Documentation, Downloads, and Forums, see [Xilinx Support](#).

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## Documentation Navigator and Design Hubs

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- From the Vivado<sup>®</sup> IDE, select **Help** → **Documentation and Tutorials**.
- On Windows, select **Start** → **All Programs** → **Xilinx Design Tools** → **DocNav**.
- At the Linux command prompt, enter `docnav`.

Xilinx Design Hubs provide links to documentation organized by design tasks and other topics, which you can use to learn key concepts and address frequently asked questions. To access the Design Hubs:

- In DocNav, click the **Design Hubs View** tab.
- On the Xilinx website, see the [Design Hubs](#) page.

**Note:** For more information on DocNav, see the [Documentation Navigator](#) page on the Xilinx website.

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## References

These documents provide supplemental material useful with this guide:

1. *Variium C1100 Compute Adaptor Data Sheet (DS1003)*.
2. *Vitis Unified Software Platform Documentation: Application Acceleration Development (UG1393)*.
3. *Vitis Unified Software Platform Documentation (UG1416)*.
4. *Vitis Unified Software Platform Documentation: Embedded Software Development (UG1400)*.
5. *Vitis Application Acceleration Development Flow Tutorials (GitHub)*.
6. *XRT Release Notes (UG1451)*.
7. *Alveo Card Debug Guide (XD027)*.

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