



Power Guidelines for Workstation Products

Application Note

Document History

DA-07261-001_v11

Version	Date	Authors	Description of Change
01	June 6, 2014	VL, SM	Initial Release
02	June 2, 2015	JK, SM	<ul style="list-style-type: none"> Updated to include Quadro M6000, Quadro K5200, Quadro K4200, Quadro K2200, Quadro K1200, Quadro K620, and Quadro K420 Updated with Quadro M6000 power guidelines Updated PCIe connectors figure (Figure 2) Added a power requirements for 250 W cards (single 8-pin connector) section Added a dual 6-pin to 8-pin adapter cable section
03	July 8, 2015	JK, SM	Updated error Table 1
04	May 5, 2017	JK, SM	Updated to include Quadro GP100, Quadro P6000, Quadro P5000, Quadro P4000, Quadro P2000, Quadro P1000, Quadro P600, and Quadro P400
05	March 21, 2018	PV, SM	<ul style="list-style-type: none"> Updated Figure 1 Updated Table 1
06	December 12, 2018	JK, SM	Updated to include Quadro RTX 4000, Quadro RTX 5000, Quadro RTX 6000, and Quadro RTX 8000
07	January 25, 2019	HG, SM	Updated pin numbers in Figure 2
08	October 22, 2020	AS, SM	<ul style="list-style-type: none"> Added NVIDIA RTX A6000 information to Table 1 Updated “Power Connectors” section and Figure 2 to reflect CPU 8-Pin connection option Updated “Power Adapters” section with CPU 8-Pin standard cable information
09	July 29, 2021	AS, SM	Added NVIDIA RTX A5000, A4000, and A2000 information to Table 1
10	February 1, 2022	AS, SM	<ul style="list-style-type: none"> Added NVIDIA RTX A5500, RTX A4500 and RTX A2000-12GB information to Table 1 Updated application meet to current NVIDIA standards
11	April 15, 2022	AS, SM	Updated power connector diagram in Figure 2

Table of Contents

- Overview1
- Power Requirements2
- Power Connectors.....4
- Power Requirements for 250 W Cards with a Single PCIe 8-Pin Connector.....5
- Power Adapters.....6
 - PCIe 6-Pin Y-Splitter Cable 6
 - PCIe 8-Pin to 6-Pin Adapter Cable..... 7
 - PCIe Dual 6-Pin to 8-Pin Adapter Cable 7
 - CPU 8-Pin Standard Power Adapter Cable 8

List of Figures

Figure 1. NVIDIA Workstation Graphics Cards 1

Figure 2. Power Connectors 4

Figure 3. 6-Pin Y-Splitter Cable 6

Figure 4. 8-Pin to 6-Pin Adapter Cable 7

Figure 5. Dual 6-Pin to 8-Pin Adapter Cable 7

Figure 6. CPU 8-Pin Standard Adapter Cable 8

List of Tables

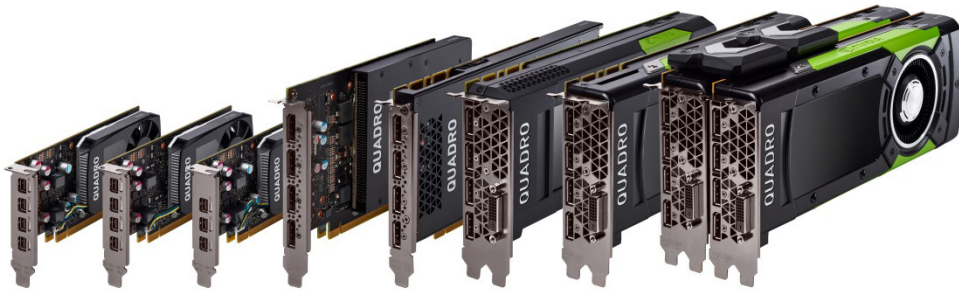
Table 1. Workstation GPU Power Specifications 2

Table 2. Power Connectors Pin Description 4

Overview

This application note discusses the power requirements of the NVIDIA® workstation products based on NVIDIA RTX™, and Quadro RTX™ line of graphics cards. A suitable power supply is necessary to maintain system integrity under computational load.

Figure 1. NVIDIA Workstation Graphics Cards



Power Requirements

The workstation desktop graphics cards may require auxiliary power within the host chassis. Ensure that your system can deliver the necessary wattage and auxiliary power connectors for all cards in the system. If the supplied power is not adequate, the cards will not function properly. Table 1 specifies the power requirements and power connectors for the various workstation desktop graphics cards.

Table 1. Workstation GPU Power Specifications

Model	TGP	Required Auxiliar Power Connectors
NVIDIA RTX A6000	300 W	CPU 8-pin (EPS-12V)
NVIDIA RTX A5500	230 W	
NVIDIA RTX A5000	230 W	
NVIDIA RTX A4500	200 W	
NVIDIA RTX A4000	140 W	
NVIDIA RTX A2000 12GB	70 W	
NVIDIA RTX A2000	70 W	
Quadro RTX 8000	260 W	PCIe 8-pin + PCIe 6-pin
Quadro RTX 6000	260 W	
Quadro RTX 5000	230 W	
Quadro RTX 4000	125 W	
Quadro GV100	250 W	PCIe 8-pin
Quadro GP100	235 W	
Quadro P6000	250 W	
Quadro M6000 24GB	250 W	
Quadro M6000	250 W	
Quadro K6000	225 W	PCIe 6-pin + PCIe 6-pin
Quadro P5000	180 W	
Quadro M5000	150 W	PCIe 6-pin
Quadro K5200	150 W	
Quadro K5000	122 W	

Model	TGP	Required Auxiliar Power Connectors
Quadro P4000	105 W	PCIe 6-pin
Quadro M4000	120 W	
Quadro K4200	108 W	
Quadro K4000	80 W	
Quadro P2000	75 W	Not applicable
Quadro M2000	75 W	
Quadro K2200	60 W	
Quadro K2000	51 W	
Quadro K2000D	51 W	
Quadro P1000	47 W	Not applicable
Quadro K1200	45 W	
Quadro P620	40 W	Not applicable
Quadro P600	40 W	
Quadro K620	41 W	
Quadro P400	30 W	Not applicable
Quadro K420	41 W	

The total graphics power (TGP) represents the maximum amount of graphics board power that the system power supply should be able to provide to the graphics card.

Power Connectors

Depending on the workstation graphics card the end customer is utilizing, external power connectors may be required to fully power up the graphics card. The supported power connectors on workstation graphics card are CPU 8-pin, PCIe 8-pin and PCIe 6-pin.

Figure 2. Power Connectors

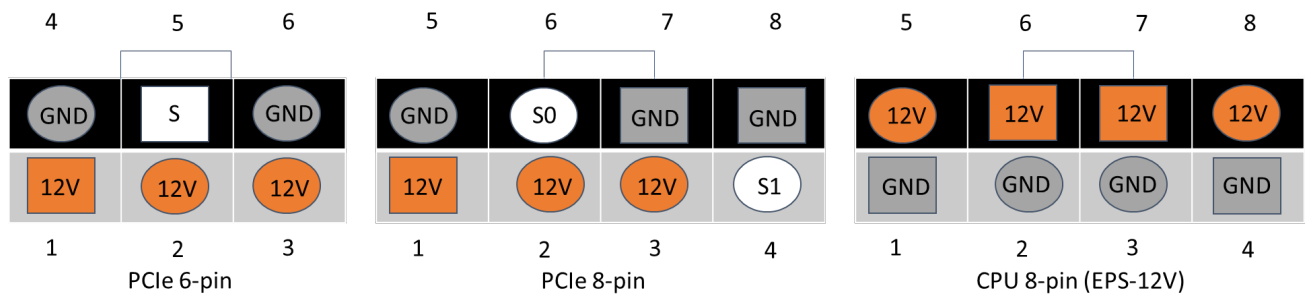


Table 2. Power Connectors Pin Description

Pin	CPU 8-Pin	PCIe 8-Pin	PCIe 6-Pin
1	GND	12V	12V
2	GND	12V	12V
3	GND	12V	12V
4	GND	SENSE1	GND
5	12V	GND	SENSE
6	12V	SENSE0	GND
7	12V	GND	Not applicable
8	12V	GND	Not applicable

Power Requirements for 250 W Cards with a Single PCIe 8-Pin Connector

Typically, the PCIe slot is rated for 75 W and the 8-pin PCIe connector is rated for 150 W. However, based on our testing and surveying the current ecosystem, it was found that the 8-pin PCIe connector can drive up to 175 W. Along with the PCIe slot, it can support a graphics card consuming up to 250 W.

However, due to the increased power delivery on the 8-pin PCIe connector, PSU with a 12V rail capable of driving at least 18A needs to be dedicated for the 8-pin PCIe connector.

Power Adapters

It is extremely important to understand the board power requirements when selecting power supplies. It is recommended to use a power supply that has all the required connectors. However, if the required connector is not available on a given power supply, it is possible to use adapters to convert existing connectors to PCIe or CPU auxiliary connectors.

When using power adapters, it is important to evaluate the rated amperage on the 12V rail that is being used to source the adapter cable. The information is available in the power supply's user manual, or it is printed on the power supply casing.

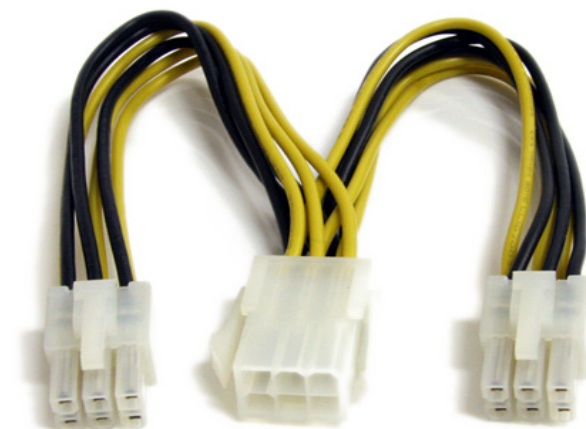


CAUTION: System builders should review the power specifications and guidelines outlined on their system power supply to ensure that the connector limits are not exceeded when using adapters.

PCIe 6-Pin Y-Splitter Cable

It is possible to split a single 6-pin auxiliary PCIe connector into two 6-pin auxiliary PCIe connectors. While NVIDIA does not recommend using the Y-splitter with the Quadro cards, it is extremely important to ensure that the 12V rail on the power supply driving this can handle the additional connector if one must use the splitters.

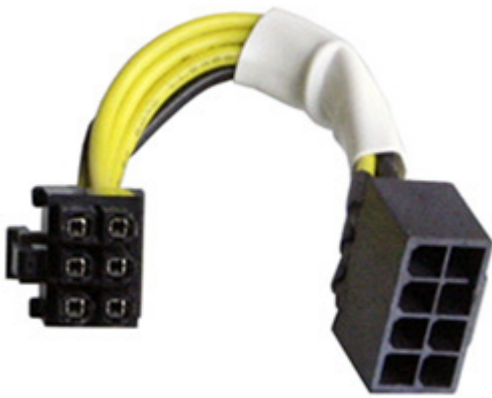
Figure 3. 6-Pin Y-Splitter Cable



PCIe 8-Pin to 6-Pin Adapter Cable

It is possible to split a single 8-pin auxiliary PCIe connector into a single or two 6-pin auxiliary PCIe connectors. If you are using such a splitter, it is important to ensure that the 12V rail on the power supply driving this can handle the additional connector. Refer to the rated amperage on the 12V rail sourcing the splitter to ensure that the connector limits are not exceeded.

Figure 4. 8-Pin to 6-Pin Adapter Cable



PCIe Dual 6-Pin to 8-Pin Adapter Cable

It is possible to combine two 6-pin auxiliary PCIe connectors into a single 8-pin auxiliary PCIe connector. If you are using such an adapter, it is important to ensure that the 12V rail on the power supply driving this adapter is rated for at least 18A.

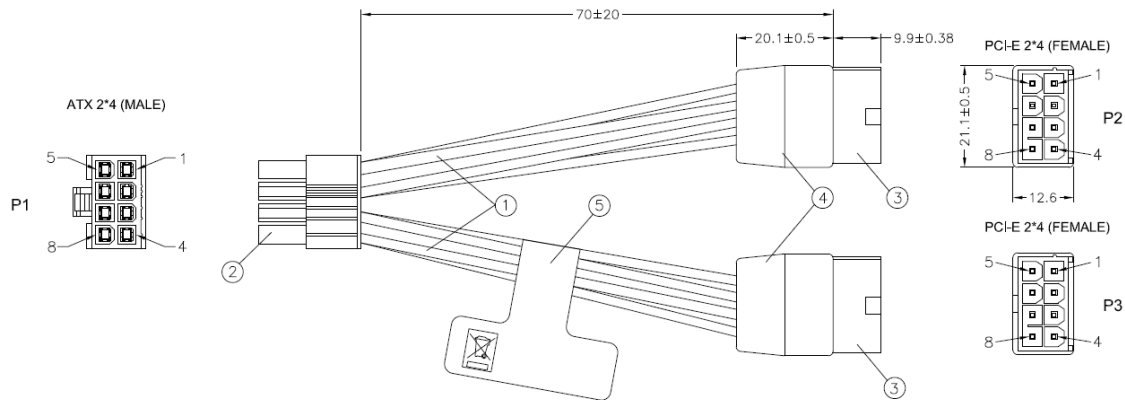
Figure 5. Dual 6-Pin to 8-Pin Adapter Cable



CPU 8-Pin Standard Power Adapter Cable

For NVIDIA products with a CPU 8-pin connector, a power adapter to convert two PCIe 8-pin connectors to a single CPU 8-pin may be used.

Figure 6. CPU 8-Pin Standard Adapter Cable



Notice

This document is provided for information purposes only and shall not be regarded as a warranty of a certain functionality, condition, or quality of a product. NVIDIA Corporation ("NVIDIA") makes no representations or warranties, expressed or implied, as to the accuracy or completeness of the information contained in this document and assumes no responsibility for any errors contained herein. NVIDIA shall have no liability for the consequences or use of such information or for any infringement of patents or other rights of third parties that may result from its use. This document is not a commitment to develop, release, or deliver any Material (defined below), code, or functionality.

NVIDIA reserves the right to make corrections, modifications, enhancements, improvements, and any other changes to this document, at any time without notice.

Customer should obtain the latest relevant information before placing orders and should verify that such information is current and complete.

NVIDIA products are sold subject to the NVIDIA standard terms and conditions of sale supplied at the time of order acknowledgement, unless otherwise agreed in an individual sales agreement signed by authorized representatives of NVIDIA and customer ("Terms of Sale"). NVIDIA hereby expressly objects to applying any customer general terms and conditions with regards to the purchase of the NVIDIA product referenced in this document. No contractual obligations are formed either directly or indirectly by this document.

NVIDIA products are not designed, authorized, or warranted to be suitable for use in medical, military, aircraft, space, or life support equipment, nor in applications where failure or malfunction of the NVIDIA product can reasonably be expected to result in personal injury, death, or property or environmental damage. NVIDIA accepts no liability for inclusion and/or use of NVIDIA products in such equipment or applications and therefore such inclusion and/or use is at customer's own risk.

NVIDIA makes no representation or warranty that products based on this document will be suitable for any specified use. Testing of all parameters of each product is not necessarily performed by NVIDIA. It is customer's sole responsibility to evaluate and determine the applicability of any information contained in this document, ensure the product is suitable and fit for the application planned by customer, and perform the necessary testing for the application in order to avoid a default of the application or the product. Weaknesses in customer's product designs may affect the quality and reliability of the NVIDIA product and may result in additional or different conditions and/or requirements beyond those contained in this document. NVIDIA accepts no liability related to any default, damage, costs, or problem which may be based on or attributable to: (i) the use of the NVIDIA product in any manner that is contrary to this document or (ii) customer product designs.

No license, either expressed or implied, is granted under any NVIDIA patent right, copyright, or other NVIDIA intellectual property right under this document. Information published by NVIDIA regarding third-party products or services does not constitute a license from NVIDIA to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property rights of the third party, or a license from NVIDIA under the patents or other intellectual property rights of NVIDIA.

Reproduction of information in this document is permissible only if approved in advance by NVIDIA in writing, reproduced without alteration and in full compliance with all applicable export laws and regulations, and accompanied by all associated conditions, limitations, and notices.

THIS DOCUMENT AND ALL NVIDIA DESIGN SPECIFICATIONS, REFERENCE BOARDS, FILES, DRAWINGS, DIAGNOSTICS, LISTS, AND OTHER DOCUMENTS (TOGETHER AND SEPARATELY, "MATERIALS") ARE BEING PROVIDED "AS IS." NVIDIA MAKES NO WARRANTIES, EXPRESSED, IMPLIED, STATUTORY, OR OTHERWISE WITH RESPECT TO THE MATERIALS, AND EXPRESSLY DISCLAIMS ALL IMPLIED WARRANTIES OF NONINFRINGEMENT, MERCHANTABILITY, AND FITNESS FOR A PARTICULAR PURPOSE. TO THE EXTENT NOT PROHIBITED BY LAW, IN NO EVENT WILL NVIDIA BE LIABLE FOR ANY DAMAGES, INCLUDING WITHOUT LIMITATION ANY DIRECT, INDIRECT, SPECIAL, INCIDENTAL, PUNITIVE, OR CONSEQUENTIAL DAMAGES, HOWEVER CAUSED AND REGARDLESS OF THE THEORY OF LIABILITY, ARISING OUT OF ANY USE OF THIS DOCUMENT, EVEN IF NVIDIA HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES. Notwithstanding any damages that customer might incur for any reason whatsoever, NVIDIA's aggregate and cumulative liability towards customer for the products described herein shall be limited in accordance with the Terms of Sale for the product.

Trademarks

NVIDIA, the NVIDIA logo, NVIDIA RTX, Quadro, and Quadro RTX are trademarks and/or registered trademarks of NVIDIA Corporation in the U.S. and other countries. Other company and product names may be trademarks of the respective companies with which they are associated.

Copyright

© 2014 - 2022 NVIDIA Corporation. All rights reserved.