



# 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"> <li>• Updated to include Quadro M6000, Quadro K5200, Quadro K4200, Quadro K2200, Quadro K1200, Quadro K620, and Quadro K420</li> <li>• Updated with Quadro M6000 power guidelines</li> <li>• Updated PCIe connectors figure (Figure 2)</li> <li>• Added a power requirements for 250 W cards (single 8-pin connector) section</li> <li>• Added a dual 6-pin to 8-pin adapter cable section</li> </ul> |
| 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"> <li>• Updated Figure 1</li> <li>• Updated Table 1</li> </ul>  |
| 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"> <li>• Added NVIDIA RTX A6000 information to Table 1</li> <li>• Updated “Power Connectors” section and Figure 2 to reflect CPU 8-Pin connection option</li> <li>• Updated “Power Adapters” section with CPU 8-Pin standard cable information</li> </ul>  |
| 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"> <li>• Added NVIDIA RTX A5500, RTX A4500 and RTX A2000-12GB information to Table 1</li> <li>• Updated application meet to current NVIDIA standards</li> </ul>  |
| 11      | April 15, 2022    | AS, SM  | Updated power connector diagram in Figure 2  |

# Table of Contents

- Overview ..... 1
- Power Requirements ..... 2
- 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 |

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# 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 | PCIe 8-pin                         |
| NVIDIA RTX A5000      | 230 W | PCIe 8-pin                         |
| NVIDIA RTX A4500      | 200 W | PCIe 8-pin                         |
| NVIDIA RTX A4000      | 140 W | PCIe 6-pin                         |
| NVIDIA RTX A2000 12GB | 70 W  | Not applicable                     |
| NVIDIA RTX A2000      | 70 W  | Not applicable                     |
| Quadro RTX 8000       | 260 W | PCIe 8-pin + PCIe 6-pin            |
| Quadro RTX 6000       | 260 W | PCIe 8-pin + PCIe 6-pin            |
| Quadro RTX 5000       | 230 W | PCIe 8-pin + PCIe 6-pin            |
| Quadro RTX 4000       | 125 W | PCIe 8-pin                         |
| 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 | PCIe 8-pin                         |
| Quadro M5000          | 150 W | PCIe 6-pin                         |
| Quadro K5200          | 150 W | PCIe 6-pin                         |
| Quadro K5000          | 122 W | PCIe 6-pin                         |

| 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

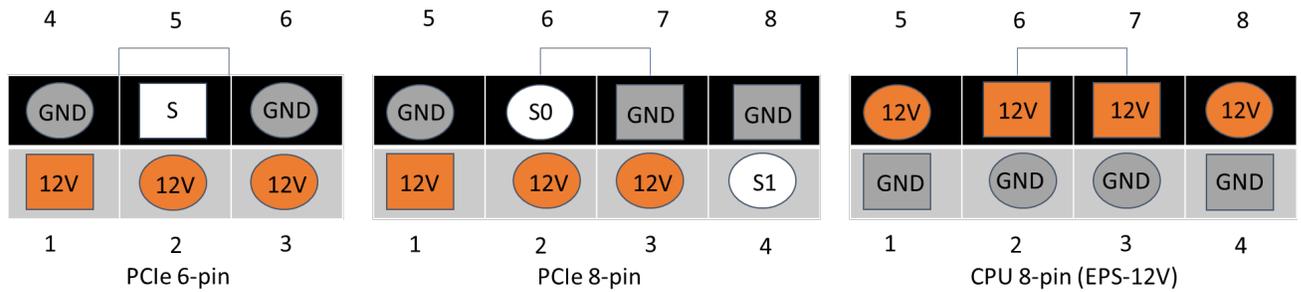


Table 2. Power Connectors Pin Description

| 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 |

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# 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.

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# 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.

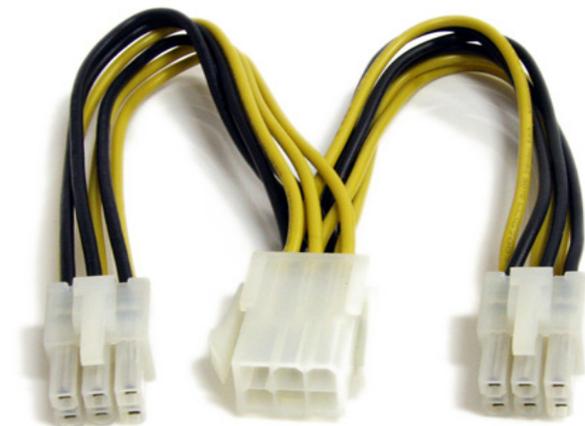


**CAUTION:** System builders should review the power specifications and guidelines outlined on their system power supply to ensure that the connector limits are not exceeded when using adapters.

## 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.

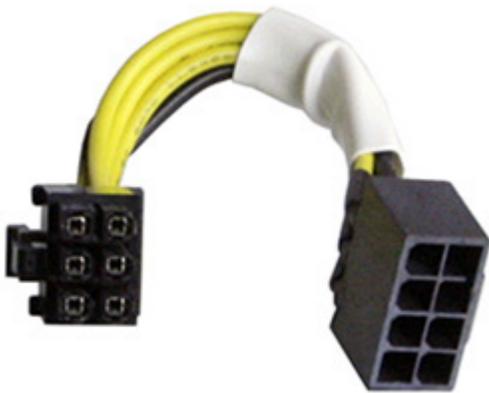
Figure 3. 6-Pin Y-Splitter Cable



## 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.

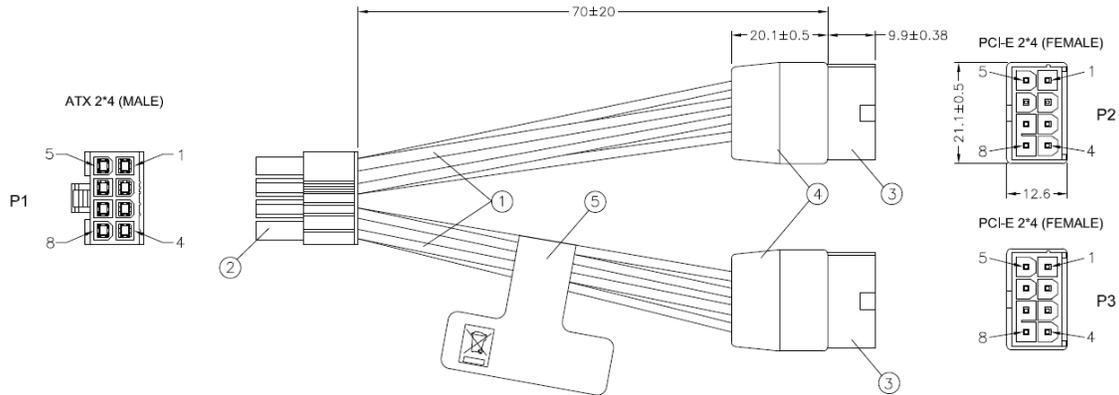
Figure 5. Dual 6-Pin to 8-Pin Adapter Cable



# 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



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