

## NetShelter SX Cable Management Guidelines

By Scott Neal

### Abstract

Cable management is an ever increasing concern at the equipment and enclosure level in the data center. The move to higher density servers and switch applications has increased the cable quantity for both data and power. In addition, higher speed data cables are becoming larger in diameter. These factors are pushing the usable space within the enclosure to the limits. Poor cable management causes congestion and restricts airflow. Proper cable management eliminates congestion and allows air to flow unobstructed through the equipment.

## Introduction

APC offers various cable management products to facilitate cable management in the front and rear of the enclosures. These products are designed for a variety of applications. This guide will focus on some common applications, and should be used as a general guideline for planning your installation. The APC Product Development Team realizes the importance of cable management and is working everyday to offer new and creative products to help with the customer's installation.

Cable management is a very general term and can cover many different applications. This guide will focus on cable management products for use within the enclosure for vertical and horizontal routing. In addition, recommendations for cable entry and exit will also be discussed.

## Planning

Selection of cable management starts by identifying the quantity of cables expected to be in the enclosure. This is basically the count of the number of data ports and power outlets on the particular pieces of equipment being installed. The next step is to determine where the cable will be routed either within the enclosure or to the exit points of the enclosure. Space for cable routing is the one of the largest problems customers encounter when installing their equipment. For this reason, the size of the enclosure in which the cable management will be used is another key factor for planning a clean and efficient operating space for the equipment.

## 1U and 2U Server Applications

An enclosure filled with 1U and / or 2U servers will commonly have a mix of data cables and power cables. At maximum capacity this could be up to 120 data cables and as many as 80 power cords. This arrangement typically consists of multiple rack Power Distribution Units (PDUs) in tandem or opposite of data cable managers.

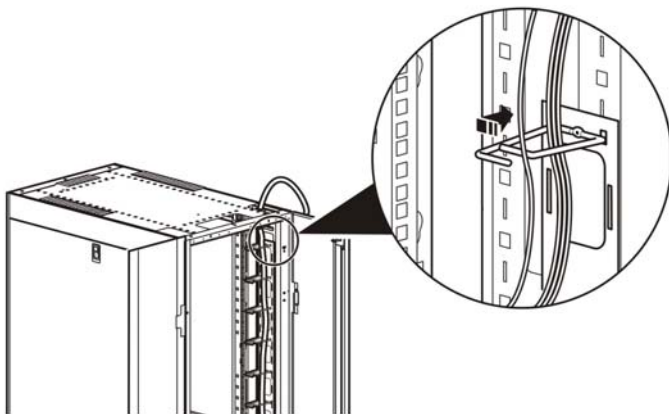
**Challenge:** Manage up to 120 data cables in combination with PDUs in the rear of the enclosure. Deeper servers often crowd cable space in the rear of the enclosure.

**Solution:** Manage cables by utilizing the 2 rear cable channels in the rear of the SX enclosure. Use one channel for data cable management and the other for power distribution.

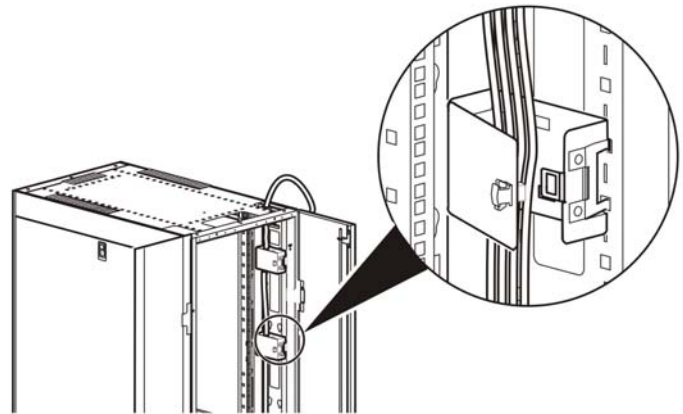
Up to 90 data cables: Four AR7702 cable containment brackets can be mounted on the rear cable channel to provide a low profile manager for vertical runs.

Up to 120 data cables: Two AR8442 vertical cable organizers can be mounted in tandem on the rear cable channel for vertical cable runs.

*Figure 1 – AR8442 mounting in rear of enclosure*



*Figure 2 – AR7702 mounting in rear of enclosure*



### Notes:

- See table 1-1 for cable capacity of AR8442 and AR7702.
- The power cord slack is often bundled with Velcro style cable ties or plastic cable ties to manage the cords leading to the PDUs.
- Additional PDU or AR8442 mounting can be achieved by adding the AR7505 cable tree. The cable tree mounts in the center, rear of the enclosure.

## Blade Servers

Blade servers provide varying degrees of cable density depending on the blade architecture. Data cable densities can range from 40 cables to 120 cables. One of the main differences from traditional servers is that the blade chassis require accessibility from the front and the rear. This requires additional space in the rear of the enclosure for removal of power and fan modules. The need for accessibility puts more emphasis on organization, and keeping data and power cables to the sides of the enclosure. Blades typically require larger power inputs which results in larger power distribution units. The increase in power needs together with medium cable densities requires significantly more space in the rear of the enclosure.

**Challenge:** Maintain accessibility to the rear of blade chassis while supporting large power distribution units and 40 to 120 data cables.

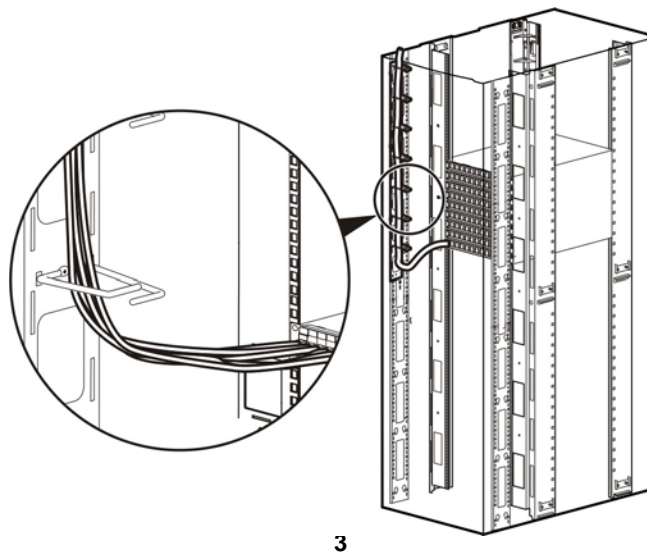
**Solution:** Use a 750mm wide enclosure. A wider enclosure will provide additional space on sides of the enclosure for cable management and PDU placement to maintain accessibility to the back of the blade chassis. A 1200mm deep x 600mm wide enclosure is also an option for blade applications. This provides additional depth where wider enclosures are not an option.

Up to 90 data cables: Four AR7702 cable containment brackets can be mounted on the rear cable channel to provide a low profile manager for vertical runs.

Up to 120 data cables: Two AR8442 vertical cable organizers can be mounted in tandem on the rear cable channel for vertical cable runs.

See **Table 1** for cable capacity of AR8442 and AR7702.

*Figure 3 – AR8442 in blade server application*



3

## Networking Applications

An enclosure supporting large switches and patch panels typically have a very high cable density. When patch panels are used, a combination of horizontal and vertical cable management will be necessary. The cables in networking applications are commonly routed in the front of the enclosure although some users may find it beneficial to use the front and rear of the enclosure. Networking equipment such as switches and patch panels are often less deep as compared to servers, so the extra space can be utilized for cable management.

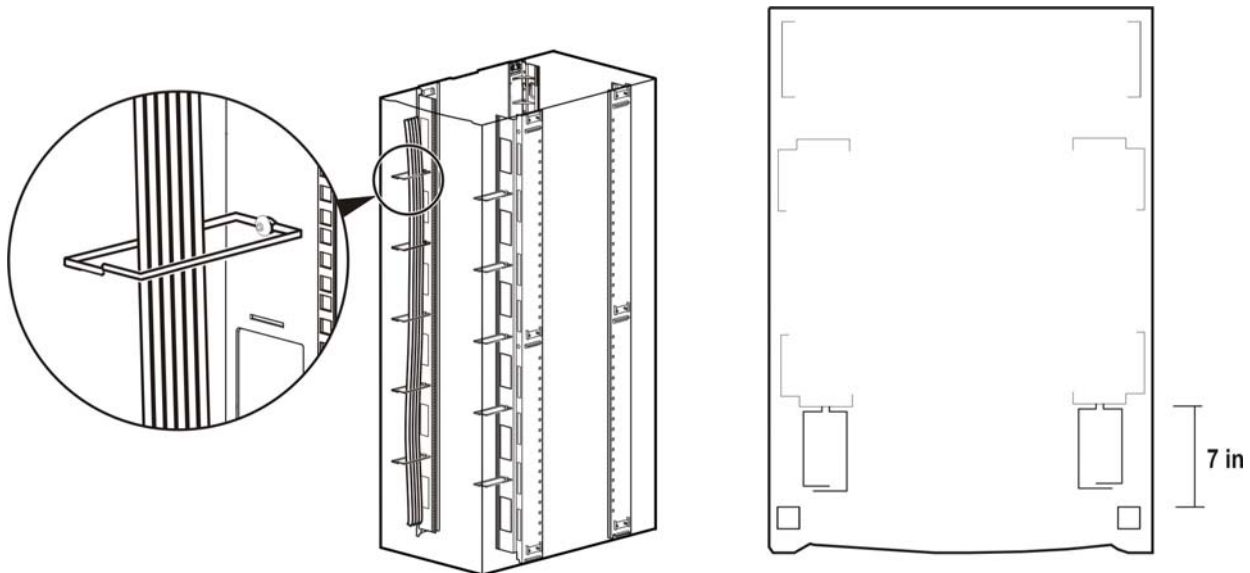
**Challenge:** High density networking applications could require cable management from 300 up to 600 data cables.

### Solution 1:

Up to 400 data cables

- Use 750 mm (30 in) wide enclosures AR3150, AR3157. The wider enclosure will provide more cabling space
- Move the front equipment mounting rails back 7 in (180 mm).
- Mount AR7707 large cable rings to the mounting holes on the rails.
- Mount power distribution in back of enclosure on rear cable channels
- To exit the cables out of the top of the enclosure, remove the roof and add an AR7209 roof bridge for maximum cable access. See 'Cable Entry and Exit' section for additional details

*Figure 4 – AR7707 large cable rings in wide enclosure*



## Networking Applications (cont.)

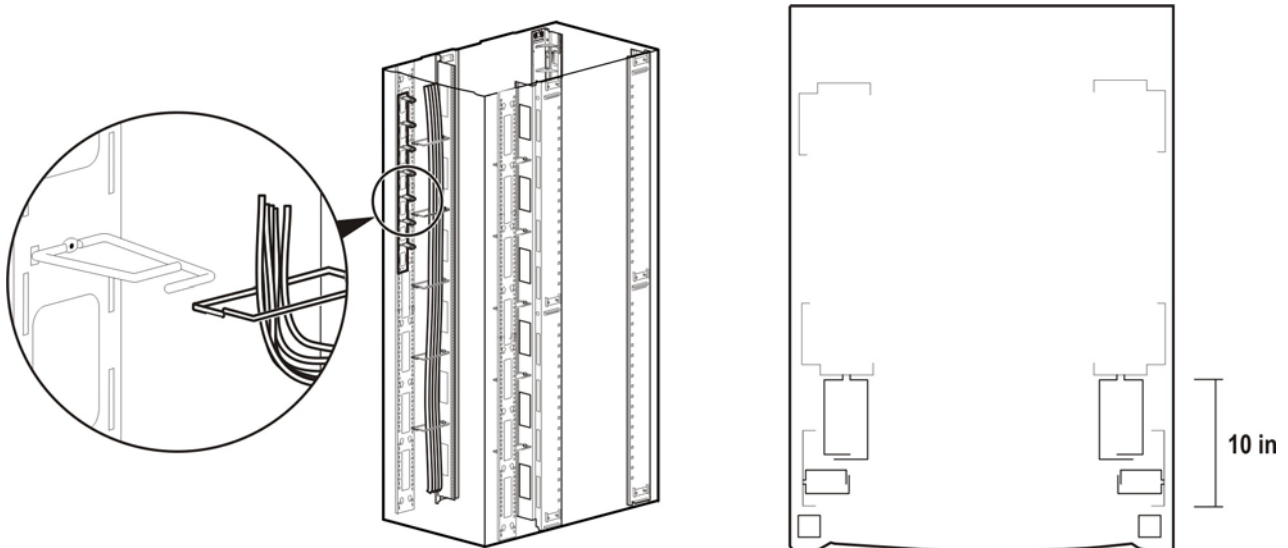
### Solution 2:

Up to 600 data cables

- Use 750 mm (30 in) wide enclosures AR3150, AR3157. The wider enclosure will provide more cabling space
- Move the front equipment mounting rails back 10 in (250 mm).
- Mount AR7707 large cable rings to the mounting holes on the rails.
- Mount AR7502 cable channel in front of the front mounting rails with 2 AR8442 vertical cable organizers. This will provide additional cable space over the AR7707 cable rings.
- To exit the cables out of the top of the enclosure, remove the roof and add an AR209 roof bridge for maximum cable access. See 'Cable Entry and Exit' section for additional details

For the above solutions 1U or 2U horizontal cable managers are typically mounted in between patch panels for routing cable to the corners of the enclosure. See the horizontal cable management section for addition details

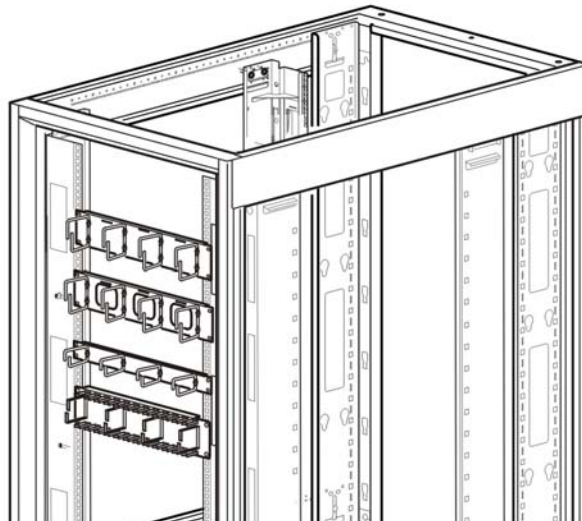
*Figure 5 – AR7707 large cable rings with AR8442 mounted in front of a wide enclosure*



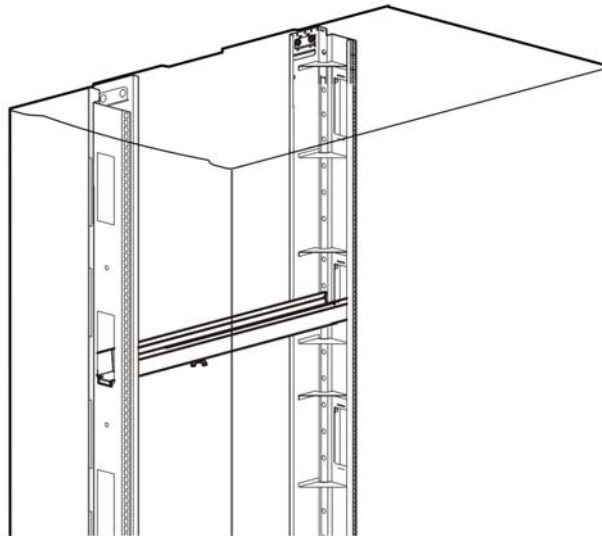
## Horizontal Cable Management

Horizontal cable managers are typically used to organize and route cables horizontally to the sides of the enclosure where they can be transitioned vertically to exit the top or bottom of the enclosure. They are typically mounted in the U spaces between equipment such as switches, routers and patch panels. Standard horizontal cable managers are available in 1U and 2U sizes. Additional managers exist to route cables from front to back within the enclosure. The following illustrations provide additional details.

*Figure 6 – Horizontal cable management accessories*



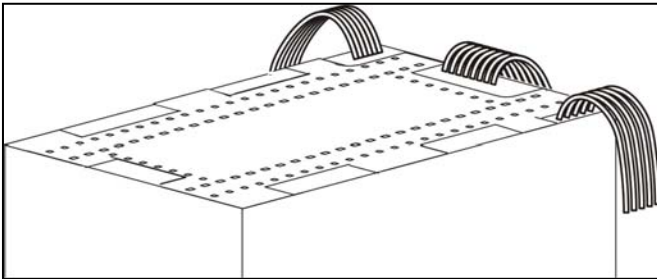
*Figure 7 – Cable trough*



## Cable Entry and Exit

Cables entering or exiting an enclosure are typically routed through the top via cable ladders or troughs, or through the bottom via a raised floor. To manage the cables overhead, the SX roof provides many cable management options. Cable troughs and partitions are available that mount without tools on the SX roof to support power and data cables in a rack line-up. The overhead troughs and partitions are used to support cables from rack to rack or from an existing main run.

*Figure 9 – Cable access slots*

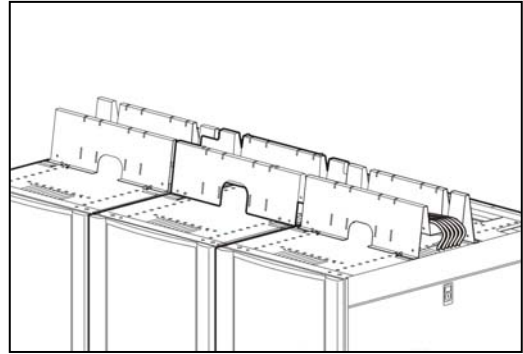


8 cable access slots are located on the roof for unlimited cable entry for overhead cabling (3 on each side and 1 each in front and back). The roof was designed for easy installation or removal by the use of simple hand operated spring pins. The cable slots are located on the outside edges so that removal of the roof does not interfere with the existing cable runs.

If desired, the roof can be completely removed for unlimited cable access. As a replacement option to the standard roof, the AR7209 roof bridge is a simple two-piece bracket that spans the roof allowing for an open roof top while still providing mounting surfaces for the cable troughs.

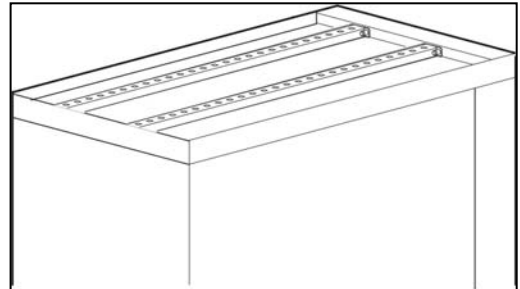
The bottom of the SX enclosure is completely open to provide unlimited cable access via a raised floor.

*Figure 8 – Overhead cable troughs*



The troughs are also designed to connect without tools to end of 12" cable ladders for easy connect to a main cable run. See the APC Application Note #133, cable trough application note for additional information about the APC trough system.

*Figure 10 – Roof bridge*



## Cable Management Sizing Table

*Table 1 – Cable management sizing*

		Cable Type	Fiber	CAT 5				CAT6a
		Cable Diameter (in)	0.12	0.21	0.23	0.25	0.28	0.3
		Cable Diameter (mm)	3.0	5.3	5.8	6.4	7.1	7.6
Vertical Cable Managers	Cable Space Dim. (mm)	Usable Cross-sec (mm) at 70% fill	Cable Quantity					
AR8442	38 x 64	1702	233	76	64	54	43	37
AR7702	38 x 108	2873	394	129	107	91	72	63
AR7707	57 x 187	7461	102 3	334	278	236	188	164
Horizontal Cable Managers								
AR8428	70 x 64	3136	430	140	117	99	79	69
AR8425A	38 x 64	1702	233	76	64	54	43	37
AR8426A	70 x 64	3136	430	140	117	99	79	69
AR8427A	38 x 64	1702	233	76	64	54	43	37

## Conclusions

Cable management within an enclosure is usually dependant upon the available space. Planning ahead to ensure the necessary space is available before deployment is half the battle in the selection of cable management accessories. As server and networking densities continue to increase, the quantity of data cables and power cables continue to increase and ultimately push the current cable management space to the limits. This growing trend will continue to make cable management and organization an important issue for IT managers.

### About the Author:

**Scott Neal** is the Product Line Manager for Racks and Enclosures at American Power Conversion. Previously, Scott fulfilled multiple roles in the support of enclosures for the electrical, mechanical, and telecommunications industries. During his 11 year career Scott also spent over 2 years in Shanghai, China developing international sourcing operations for the division. Now at APC Scott is responsible for product management and product development of racks and enclosures as well as rack accessories. Scott received his Bachelor's degree in Mechanical Engineering from Purdue University of Lafayette, Indiana in 1995.