

# POWERhub DRIVER

R E A L L Y   S M A R T   P O W E R



## MODELS

PHD-16-ACDC – B - W – 6  
 PHD-16-ACDC – B - W – Z  
 PHD-16-ACDC – B - W – B  
 PHD-16-ACDC – B - W – NC  
 PHD-16-ACDC – B - ML – 6  
 PHD-16-ACDC – B - ML – Z  
 PHD-16-ACDC – B - ML – B  
 PHD-16-ACDC – B - ML – NC

PHD-16-ACDC – FF - W – 6  
 PHD-16-ACDC – FF - W – Z  
 PHD-16-ACDC – FF - W – B  
 PHD-16-ACDC – FF - W – NC  
 PHD-16-ACDC – FF - ML – 6  
 PHD-16-ACDC – FF - ML – Z  
 PHD-16-ACDC – FF - ML – B  
 PHD-16-ACDC – FF - ML – NC



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## ABOUT NEXTEK POWER SYSTEMS

Nextek Power Systems AC/DC integration technology represents a breakthrough in on-site electrical management, combining the availability of AC power with the quality and efficiency of a DC supply.

### NEXTEK PRODUCT BENEFITS

- Easy conversion of AC lighting fixtures to DC powered units.
- Easy conversion of AC grid power into DC power for commercial building applications.
- Highly efficient management of peak loads.
- Nextek Power Systems Direct Coupling® Technology directly connects clean power generated at buildings to their electronic loads inside. This connection cuts down on overall power consumption, boosts electricity generated and stored on-site, and delivers a robust, renewable energy ready network.

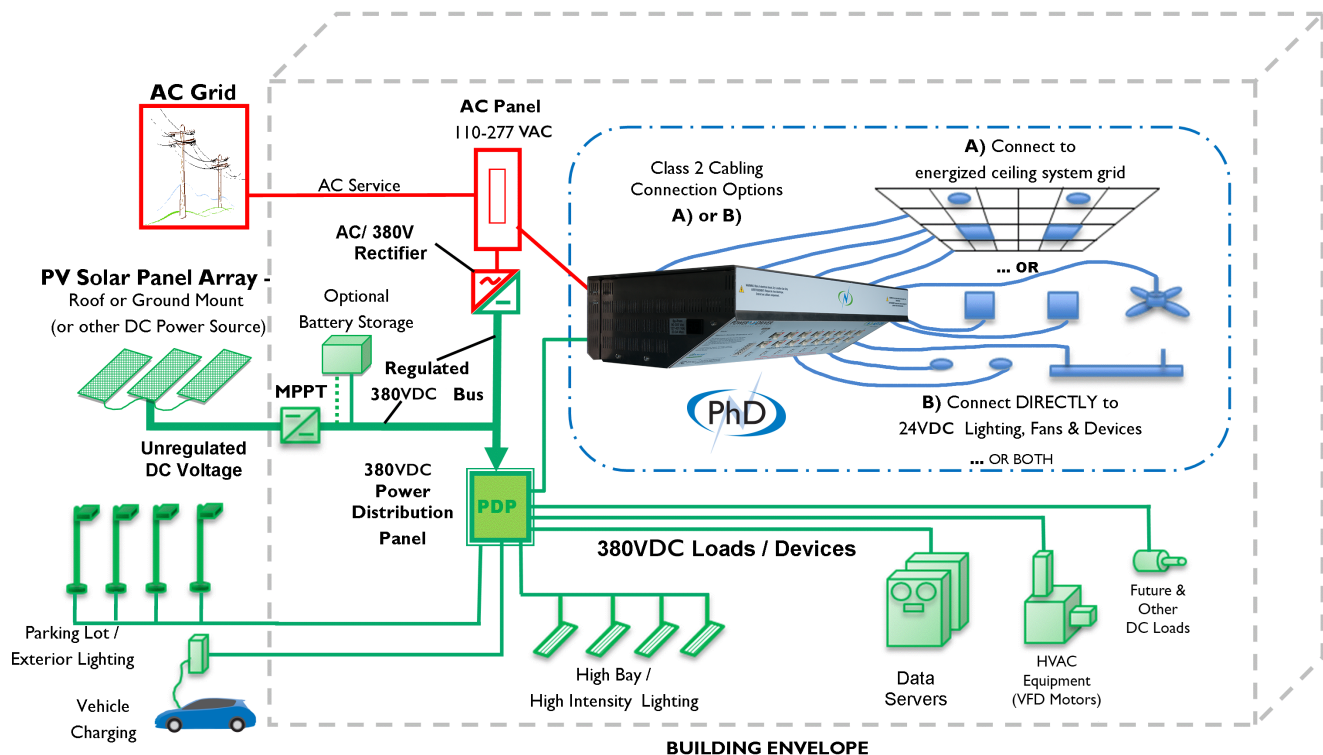
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## INTRODUCTION

Due to ever-changing building and energy codes, power and lighting systems are undergoing an industry-wide transformation. Components need to be interactive, responsive, efficient, reliable, and in one word: SMART! The Power hub Driver provides the ideal platform to support this evolution of smart power technology. The PhD offers fully integrated, multiple communication options and a significant array of built-in safety and performance features. The PhD supports a wide assortment of highly efficient DC powered fixtures and loads for buildings of today and tomorrow. The PhD offers you an unparalleled opportunity to provide your building with full integration using a variety of renewable power sources. In short, our PhD is 'Really Smart Power.'

- Nextek's Power Hub Driver converts 120, 208, 240, 277VAC, or 380VDC power to 24VDC through 16 individual Class 2 outputs. The Power Hub Driver has a wireless remote control and monitoring system.
- The system advantage of our Power Hub Driver is its safe, low-voltage DC distribution system, which supports quick "plug-and-play" with energy efficient and individually controllable Direct Current (DC) lighting and other loads.



## 1.0 SAFETY / SÉCURITÉ

**1.1 IMPORTANT SAFETY INSTRUCTIONS – SAVE THESE INSTRUCTIONS** – This manual contains important safety and operating instructions for Nextek “Power Hub Driver” (PhD) models:

**CONSIGNES DE SÉCURITÉ IMPORTANTES – CONSERVEZ CES INSTRUCTIONS** - Ce manuel contient des consignes de sécurité et de fonctionnement importantes pour NEXTEK “Power Hub Driver” (PhD) Modèles:

PHD-16-ACDC – B - W – 6

PHD-16-ACDC – B - W – Z

PHD-16-ACDC – B - W – B

PHD-16-ACDC – B - W – NC

PHD-16-ACDC – B - ML – 6

PHD-16-ACDC – B - ML – Z

PHD-16-ACDC – B - ML – B

PHD-16-ACDC – B - ML – NC

PHD-16-ACDC – FF - W – 6

PHD-16-ACDC – FF - W – Z

PHD-16-ACDC – FF - W – B

PHD-16-ACDC – FF - W – NC

PHD-16-ACDC – FF - ML – 6

PHD-16-ACDC – FF - ML – Z

PHD-16-ACDC – FF - ML – B

PHD-16-ACDC – FF - ML – NC

The following symbols are used throughout this manual to indicate potentially dangerous conditions or mark important safety instructions:

Les symboles suivants sont utilisés dans ce manuel pour indiquer des conditions potentiellement dangereuses ou marquent des instructions de sécurité importantes:



### **DANGER / DANGER:**

Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

*Indique une situation extrêmement dangereuse qui, si elle n'est pas évitée, entraînera la mort ou des blessures graves.*



### **WARNING / MISE EN GARDE:**

Indicates a potentially dangerous condition. Use extreme caution when performing this task.

*Indique une situation potentiellement dangereuse. Soyez extrêmement prudent lorsque vous effectuez cette tâche.*



### **CAUTION / ATTENTION:**

Indicates a critical procedure for safe and proper operation of the controller.

*Signale une procédure essentielle pour le fonctionnement sûr et correct du régulateur.*



### **NOTE / REMARQUE:**

Indicates a procedure or function that is important for the safe and proper operation of the controller.

*Indique une procédure ou une fonction qui est importante pour le fonctionnement sûr et adéquat du régulateur.*



**DANGER – TO REDUCE THE RISK OF FIRE OR ELECTRIC SHOCK, CAREFULLY FOLLOW THESE INSTRUCTIONS.**

**DANGER - POUR RÉDUIRE LE RISQUE D'INCENDIE OU DE CHOC ÉLECTRIQUE, ATTENTIVEMENT SUIVRE CES INSTRUCTIONS.**

## **I.0 SAFETY / SÉCURITÉ**

- I.2 Before using the PhD, read all instructions and cautionary markings.

*Avant d'utiliser le PhD, lisez toutes les instructions et les avertissements.*

- I.3 Electrical hazards are probably the most common hazards throughout the industry. Virtually all workplaces have electrical installations and use electricity.

*Les risques électriques sont les dangers les plus communs dans l'industrie. Presque tous les lieux de travail disposent d'installations électriques et se servent d'électricité.*

- I.4 It is very important that the installer is familiar with electrical hazards and knows how to protect themselves when working on, near, or with electricity. In most cases, industry electrical and electronic equipment is designed for both maximum safety and efficiency. However, potentially hazardous conditions such as inadvertent contact with hazardous voltages may exist while performing servicing and maintenance, handling materials, or cleaning.

*Il est très important que tous les employés de l'industrie se familiarisent avec les risques électriques et savent comment se protéger lors de travailler sur, près de ou avec l'électricité. Dans la plupart des cas, l'équipement de l'industrie électrique et électronique est conçu à la fois pour un maximum de sécurité et d'efficacité. Cependant, les conditions potentiellement dangereuses telles que tout contact accidentel avec des tensions dangereuses peuvent exister lors de l'exécution, d'entretien et de service, la manutention des matériaux, ou le nettoyage.*

- I.5 The improper use of electrical extension cords and portable electrical equipment can result in hazardous exposure.

*L'utilisation incorrecte de rallonges électriques et des appareils électriques portatifs peuvent entraîner une exposition dangereuse.*

- I.6 Install the power unit in a place that will likely not come into contact with people.

*Installez l'unité de puissance dans un endroit qui ne sera probablement pas entrer en contact avec des personnes.*



- I.7 WARNING – RISK OF ELECTRICAL SHOCK**

An environment relatively free of conductive contaminants, such as carbon dust and the like, is provided with protection against humidity and the formation of condensation.

**MISE EN GARDE – RISQUE DE CHOC ÉLECTRIQUE**

*Un environnement relativement exempt de contaminants conducteurs, tels que la poussière de carbone et analogue, est pourvu d'une protection contre l'humidité et la formation de condensation.*

- I.8 DANGER – TO REDUCE THE RISK OF FIRE OR ELECTRIC SHOCK, CAREFULLY FOLLOW THESE INSTRUCTIONS**



**DANGER – POUR RÉDUIRE LE RISQUE D'INCENDIE OU CHOC ÉLECTRIQUE, SUIVEZ ATTENTIVEMENT CES CONSIGNES**

- I.9 WARNING – HOT SURFACE – DO NOT TOUCH**



**MISE EN GARDE – SURFACE CHAUDE – NE TOUCHE PAS**

- I.10 WARNING – BRANCH CIRCUIT PROTECTION REQUIRED**

**MISE EN GARDE – BRANCH CIRCUIT DE PROTECTION REQUIS**

## I.0 SAFETY / SÉCURITÉ

- I.11.1 Ensure power cable is unplugged from PhD before installing or removing the unit.

*Veiller à ce que le câble d'alimentation est non- branché de la PhD avant d'installer ou de retirer l'unité.*



Plugged



Unplugged

### I.12 INSTALLATION SAFETY PRECAUTIONS

#### CONSIGNES DE SECURITÉ D'INSTALLATION

- I.12.1 Mount PhD indoors. Prevent exposure to the elements and do not allow water to enter the unit.

*Montez le PhD à l'intérieur seulement. Évitez l'exposition aux éléments.*

- I.12.2 Power connections must remain tight to avoid excessive heating from a loose connection. Assure that power cable is locked to PhD power receptacle before powering up unit.

*Les connexions d'alimentation doivent rester étanches pour éviter un échauffement excessif à partir d'une connexion lâche. Assurez-vous que le câble d'alimentation est verrouillé PhD prise de courant avant de l'unité la mise sous tension.*

- I.12.3 Use properly sized conductors and circuit interrupters.

*Utilisez des conducteurs et interrupteurs de circuit de taille appropriée.*

- I.12.4 The PhD output is to be connected to DC circuits only.

*La puissance de sortie du PhD doit être raccordée uniquement à des circuits à courant continu.*

- I.12.5 Use only Anderson Power Saf-D-Grid® 12AWG Power Cords to connect AC or DC power to PhD.

*Utilisez uniquement Anderson Power Saf-D-Grid® 12AWG Cordons pour connecter AC ou DC au doctorat.*

- I.12.6 Not suitable for battery charging.

*Ne convient pas pour la recharge de la batterie.*



## 2.0 STANDARDS AND REQUIREMENTS

- 2.1 Shut off all AC breakers before installing any unit into the field.
- 2.2 Use only Anderson Power Saf-D-Grid® 12AWG Power Cords to connect AC or DC power to PhD.

Note 2m (6ft) Anderson Power Saf-D-Grid® single-end cable (ST Type) is included with each PhD.

[http://www.andersonpower.com/\\_global-assets/downloads/pdf/ds-sdg.pdf](http://www.andersonpower.com/_global-assets/downloads/pdf/ds-sdg.pdf)

- 2.2.1 See table below for matching building wire colors to Saf-D-Grid® cable supplied with PhD.

		Saf-D-Grid® CABLE - WIRE COLOR (NON IEC)		
		Black	White	Green
CIRCUIT CONFIGURATION	VOLTAGE TO PhD	BUILDING WIRE COLOR		
Single Phase 100 (Japan)	100VAC	Black (Line)	White (Neutral)	Green (Ground)
Single Phase 120	120VAC	Black (Line)	White (Neutral)	Green (Ground)
Single Phase 120/240	240VAC	Black (Phase A)	Red (Phase B)	Green (Ground)*
3 Phase 208Y/120	208VAC	Black (Line)	Red (Alt Line)	Green (Ground)
3 Phase 480Y/277	277VAC	Black (Line)	White (Neutral)	Green (Ground)

		Saf-D-Grid CABLE TYPE HO5VVF - WIRE COLOR		
		Brown (Line)	Blue (Neutral)	Grn/Yel (Ground)
CIRCUIT CONFIGURATION	VOLTAGE TO PhD	BUILDING WIRE COLOR		
Single Phase 230VAC	230VAC	Brown (Line)	Blue (Neutral)	Grn/Yel (Ground)

- 2.2.2 The table below shows recommended number of PhD units per 20A circuit breakers (Type B and Type C).

CIRCUIT VOLTAGE	Number of PhD units per 20A Circuit	Maximum Current (A)
100VAC	1	16
120VAC	1	13.3
208VAC	2	15.4
230VAC	2	13.9
240VAC	2	13.3
277VAC	3	17.3
380VDC	4	16.8

### 2.3 AC wiring to Power Hub Driver

- 2.3.1 Use only Anderson Power Saf-D-Grid 12AWG 600V 90C Power Cords to connect AC or DC power to PhD.
- 2.3.1.1 The “ST,” “SOOW,” and “HVCT” cable types are acceptable.
- 2.3.1.2 The “Wide ‘T’ Latch,” “Small Latch,” and “Right Angle” plug styles are acceptable.

Reference: [www.andersonpower.com/\\_global-assets/downloads/pdf/ds-sdg.pdf](http://www.andersonpower.com/_global-assets/downloads/pdf/ds-sdg.pdf)

- 2.3.2 The Power Server Module must be protected by a 20A circuit breaker.

### 2.4 Connect to a branch circuit with 20A circuit protection.



## 3.0 REGULATORY INFORMATION

**NOTE:** This section contains important information for safety and regulatory requirements.

3.1 The PhD should be installed by a qualified technician according to the prevailing electrical code where the product is installed.

### 3.2 FCC Requirements:

This device complies with Part 15 of the FCC rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference that may cause undesired operation.

Changes or modifications not expressly approved by Nextek Power Systems, Inc. for compliance could void the user's authority to operate the equipment.

Note: This equipment has been tested and found to comply with the limits for a Class A or Class B digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communication. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment on and off, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Find an outlet with a different circuit to connect the equipment (do not use the outlet where the receiver is connected).
- Consult the dealer or an experienced radio/TV technician for help.

## 4.0 INSTALLATION QUALIFICATIONS

- 4.1 The PhD unit is a portable unit and therefore not permanently connected. Power cable whip installation work must be performed by a qualified electrician according to the prevailing electrical code.
- 4.1.1 The Anderson Power Saf-D-Grid® plug and receptacle provide for the direct connection of DC electronic devices to a DC micro-grid powered by renewable energy, high efficiency DC sources, or the AC grid. The system meets international safety requirements for hazardous, low voltage applications including UL950 and IEC60950. The Saf-D-Grid® is size compatible with the IEC320 C13 and C14AC connection system.
- 4.1.2 The Anderson Power Saf-D-Grid® system has the following safety features:
- First Mate, Last Break Ground Contact - Provides the safety of an earthing path before engagement of the power contacts.
  - Integral Latch - Connectors cannot be accidentally unmated, preventing unwanted power loss to critical equipment.
  - Hot Plug Rated - The connectors are rated for current interruption for both electronic (capacitive) and electrical (resistive) loads.
  - Touch Safe and Shock Protection - Minimizes the risk of personal contact with a hazardous voltage. Passes UL & IEC finger probe (plug & receptacle) and 3mm probe tests (receptacle).
  - Arcing Protection – Plug and receptacle contain the arc in case the connectors are mated or unmatched while under load, minimizing risk to personnel.

## 5.0 WARNINGS AND CAUTIONS / MISE EN GARDE ET ATTENTION



**WARNING – THESE SERVICING INSTRUCTIONS ARE FOR USE BY QUALIFIED PERSONNEL ONLY. TO REDUCE THE RISK OF ELECTRIC SHOCK, DO NOT PERFORM ANY SERVICING OTHER THAN THAT SPECIFIED IN THE OPERATING INSTRUCTIONS UNLESS YOU ARE QUALIFIED TO DO SO.**

**MISE EN GARDE - CES INSTRUCTIONS D'ENTRETIEN NE DOIVENT ÊTRE UTILISÉES QUE PAR LE PERSONNEL QUALIFIÉ. POUR RÉDUIRE LE RISQUE DE CHOC ÉLECTRIQUE, NE FAITES TOUTE INTERVENTION QUE CELLES INDIQUÉES DANS LES INSTRUCTIONS DE FONCTIONNEMENT À MOINS QUE VOUS ÊTES QUALIFIÉ.**

**WARNING – Shock Hazard**

**MISE EN GARDE – Risque de choc**

**WARNING – Hot Surfaces – Risk of burns, Do not touch.**

**MISE EN GARDE – Surfaces chaudes – Risque de brûlures, ne touchez pas.**

- 5.1 The Nextek Power Hub Driver electrical connection should only be performed by trained service personnel.

*Le Nextek PhD raccordement électrique ne doit être effectué par du personnel qualifié.*

- 5.2 The PhD is designed to keep its external surface temperature from rising more than 30°C above the ambient temperature. However, the surface of PhD may burn under some conditions.

*Le PhD est conçu pour maintenir la température de la surface externe de plus de 30°C au-dessus de la température ambiante. Cependant, la surface de PhD peut brûler dans certaines conditions.*

- 5.3 Treat any non-locked out conductor as dangerous.

*Traiter tout conducteur non - verrouillé comme dangereux.*

**LOCKOUT / TAGOUT MUST ALWAYS BE USED.**

**VERROUILLAGE / ÉTIQUETAGE DOIT TOUJOURS ÊTRE UTILISÉ.**

- 5.4 Alternating Current or Direct Current input power may be connected to PhD using an Anderson Power Saf-D-Grid® Power Cord.

*Courant alternatif ou direct la puissance d'entrée actuelle peut être connecté à l'aide d'un PhD Cord Anderson Power Saf-D-Grid® Power.*

- 5.5 The PhD comes with a 2m Anderson Power Saf-D-Grid® single-ended Power Cord. Only plug power into one input power receptacle. Second power receptacle is for passing power to the other PhD on the same circuit via an Anderson Power Saf-D-Grid® double-ended Power Cord. See Section 9.7 for detailed instruction.

*Le doctorat est livré avec un 2m Anderson Power Saf-D-Grid® simple cordon d'alimentation limitée. Ne branchez le pouvoir en une seule prise de courant d'entrée. Deuxième prise de courant est pour passer le pouvoir à un autre doctorat sur le même circuit via un Anderson Power Saf-D-Grid® Puissance double extrémité du cordon. Voir la section 9.7 pour des instructions détaillées.*

- 5.6 Unit must be installed on branch circuit with 20A circuit protection.

*L'appareil doit être installé sur le circuit de branche avec 20A protection de circuit.*

- 5.7 For Armstrong DC FlexZone™ installation, install support legs on grid before attaching to PhD. See detailed instructions shipped separately with optional CL or SL legs.

*Pour l'installation Armstrong DC FlexZone™, installez les pattes de support sur la grille avant de vous attacher à PhD. Voir les instructions détaillées livrées séparément avec des pieds CL ou SL en option.*

## 6.0 INSTALLATION PROCEDURE

### 6.1 Structural Suspension

6.1.1 The preferred mounting method is to suspend PhD from the building structure using 1/4-20 threaded rod through each of the four (4) mounting holes. The suspended PhD must be in position so that:

- Unit is hung level with the outputs facing downward.
- Threaded rod is properly anchored to building structure.

### 6.2 Cable Suspension

6.2.1 If local building codes permit, PhD may be suspended by “High-Bay Loop and Paddle” cables. Alternative cable or chain suspension methods can be used if the following criteria are met:

- Cables or chains are secured to the building structure.
- Cables or chains are rated to support at least 55lbs (25kg).





### 6.3 Mounting to concrete deck

PhD may be mounted directly to concrete deck if the following conditions are met:

- Four (4) 1/4" concrete anchors are used. Each fastener should be able to hold 25kg (55 lbs).
- PhD is hung level with the outputs facing downwards.
- There is at least 6" of unobstructed air flow around each side of PhD.



### 6.4 Mounting directly to suspended ceiling

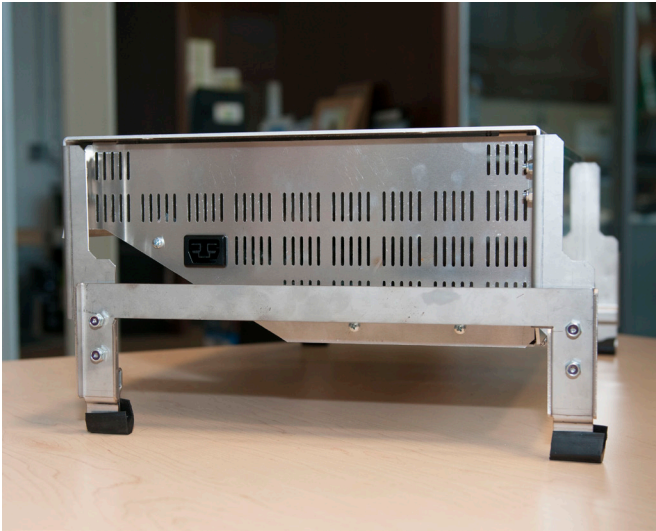
Refer to installation instruction for optional mounting leg kit (CL).



**NOTE – The power unit is intended to be correctly orientated in a vertical or floor mount position.**

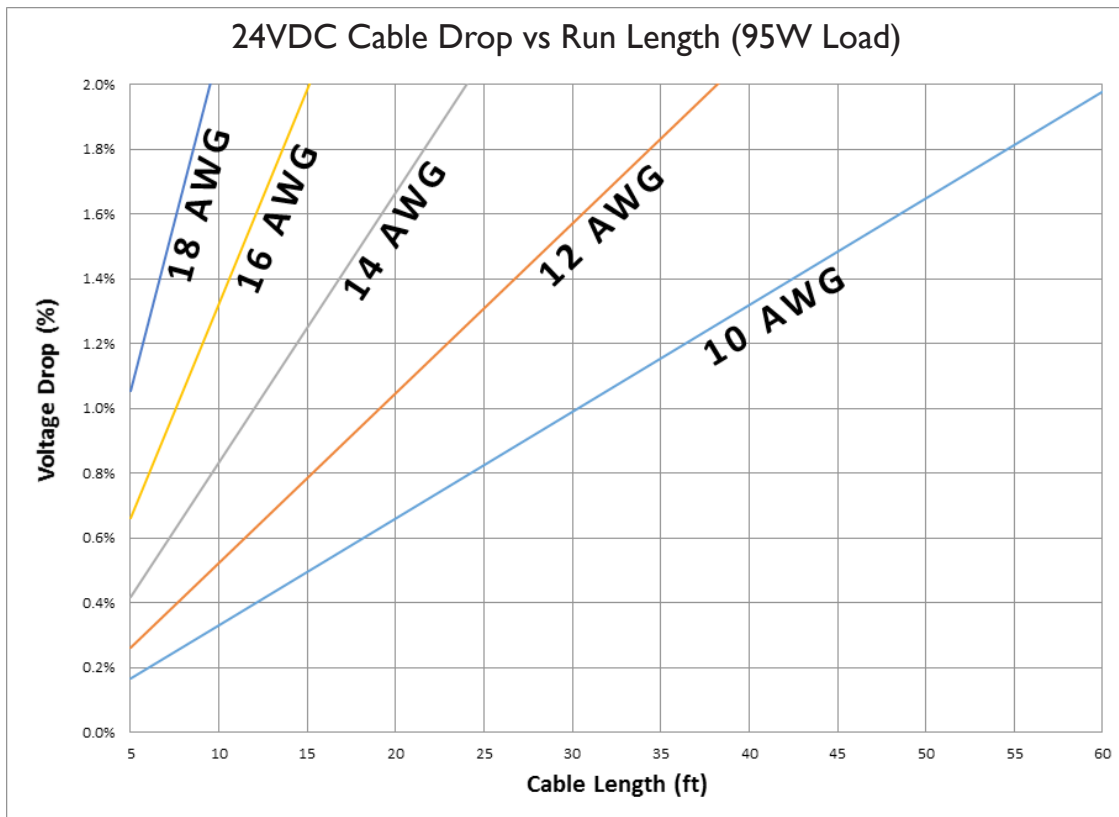
## 6.5 Mounting to shelf

Refer to installation instruction for optional mounting leg kit (SL).



## 6.6 Connecting output loads

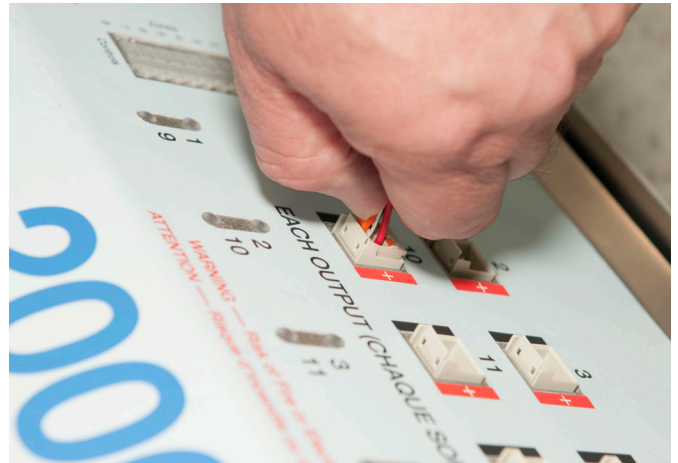
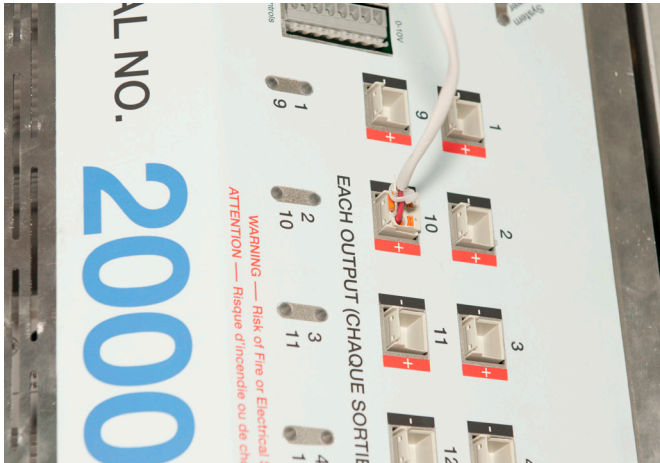
Connect up to 95W of loads to each channel (single output) of PhD. We recommend using Nextek Power System supplied 2-conductor cables. Emerge Alliance standard specifies a maximum of 2% voltage drop at end of cable. See graph below on cable voltage drop (%) vs cable length (ft).





### 6.6.1 Wago PicoMAX® Connectors (-W)

Standard output connector system for PhD is 2-position Wago PicoMAX 7.5. Nextek Power System cables are supplied with mating female connector (Wago MPN 2092-3102/002-000).



### 6.6.2 TE Mate-N-Lok® Connectors (-ML)

Optional output connector system for PhD is 2-conductor Mate-N-LOK®. Nextek Power System cables are supplied with mating female connector.





## 6.7 Connecting By-Pass Power Cables

- 6.7.1 The PhDs can be connected in series using Anderson Power Saf-D-Grid® double-ended cables. Nextek Power System can supply cable in lengths of 2, 3, or 6m and wire gages of 12 or 14 AWG.



- 6.7.2 Before connecting by-pass cable, ensure PhD is disconnected from building power. Plug one end of cable into “By-Pass” receptacle on PhD supplying power and other end of cable into “Power-In” receptacle on PhD receiving power.

Anderson Saf-D-Grid® cables are rated for connecting and disconnecting with building circuits live. However, Nextek Power Systems recommends turning off the respective building circuit during installation. Ensure a certified electrician has connected and supplied cable to junction box.



**WARNING — NEVER CONNECT POWER TO BOTH “BY-PASS” AND “POWER-IN” RECEPTACLES.**

**AVERTISSEMENT — NE CONNECTEZ JAMAIS LA PUISSANCE AUX RÉCIPIENTS “BY-PASS” ET “POWER-IN”.**

**WARNING — NEVER CONNECT MORE PhD UNITS IN SERIES THAN CIRCUIT BREAKER’S RATING. See section 2.2.2.**

**AVERTISSEMENT — NE CONNECTEZ JAMAIS PLUS D’UNITÉS DE DOCUMENTS EN SÉRIE QUE LA COTE DE DISJONCTEUR. Voir section 2.2.2.**

**WARNING — NEVER CONNECT MORE PhD UNITS IN SERIES THAN CABLE CURRENT RATING. See section 2.2.2.**



**AVERTISSEMENT — NE CONNECTEZ JAMAIS PLUS D'UNITÉS DE DOCUMENTS EN SÉRIE QUE LA COTE COURANTE DES CÂBLES. Voir section 2.2.2.**

## 6.8 Connecting Building Power

Anderson Saf-D-Grid® cables are rated for connecting and disconnecting with building circuits live. However, Nextek Power Systems recommends turning off the respective building circuit during



Plugged



Unplugged

installation. Ensure a certified electrician has connected and supplied cable to junction box.



### 6.8.1 Hardwired to Junction Box

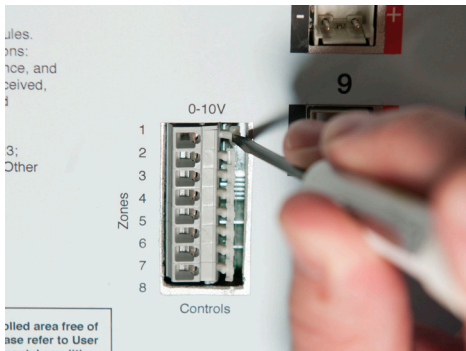
### 6.8.2 Optional Nextek Safe-D-Grid® Junction Box



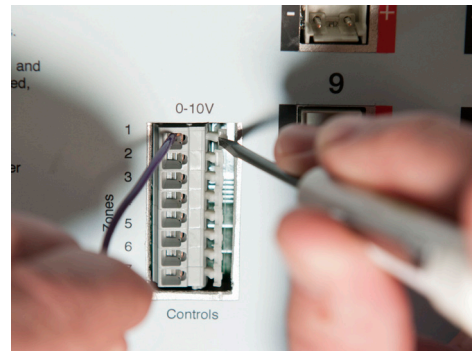
## 6.9 Commissioning

### 6.9.1 Wired – 0-10V Source

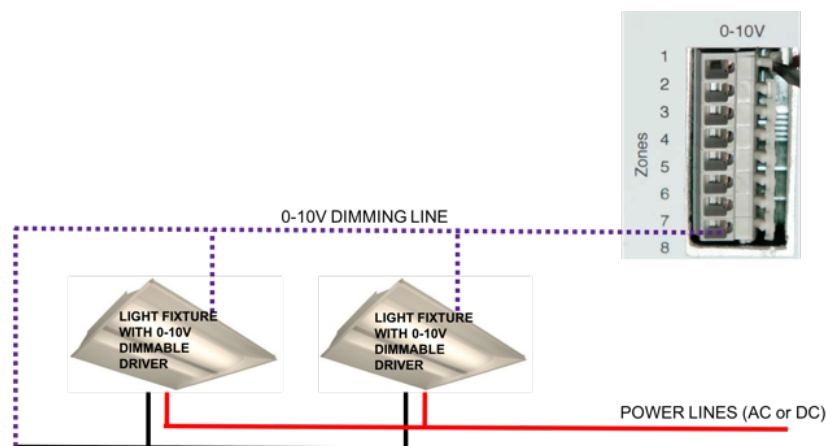
- The full featured PhD (-FF) allows users to install up to eight (8) zones for controlling devices with a 0-10V analog source. A typical device is a LED light fixture with a 0-10V dimming driver. Do not connect sensors or switches to the 0-10V network. This should be connected directly to the control system.
- PhD 0-10V wire must eventually be connected to the ground.  
Note: PhD 0-10V compatible with AC and DC powered LED 0-10V LED drivers.
- To install purple 0-10V signal wire, refer to the images below.
- Up to 20AWG solid or stranded wire can be used.
- Stranded wire can be directly inserted into connector.
- For stranded wire, use small flat head screw to depress lever and open up terminal block. Depress lever to release wire.
- Strip wire to 3/8"
- Output is 0-120mA



Lever depressed - ready for wire insert



Lever depressed - ready for wire release



### 6.9.2 Wireless

- The PhD (-6) unit connects to Nextek's "Sky Control" 6LoWPAN network, which supports wireless switches, sensors, and load controls. Consult Nextek's Sky controls website and user guide for compatible products and full instructions.  
<http://www.nextekpower.com/sky-controls>
- The PhD (-Z) unit connects to a ZigBee network, which supports wireless switches, sensors, and load controls. Consult ZigBee Alliance website for compatible products.  
<http://www.zigbee.org/zigbee-products-2/>

### 6.9.3 Wired – BACnet

- The PhD (-B) unit connects to a BACnet/IP network via an Ethernet CAT5 or better cable. Consult Nextek's BACnet user guide for full instructions.



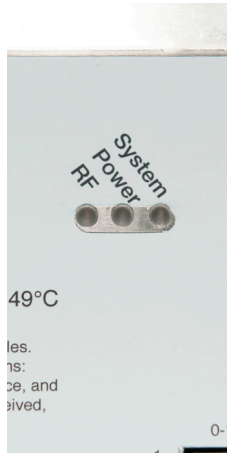
**NOTE – The wiring methods used shall be in accordance with the National Electric Code and the Canadian Electrical Code, Part I**



## 7.0 TROUBLESHOOTING

### 7.1 Power Hub Driver Status Indicator

The PhD has the ability to communicate its status through its control system, LED lights, and a chime. There are three (3) system related LED lights, RF, Power System, and (16) channel LED lights.



#### 7.1.1 RF Status Light

- Yellow LED On – PhD has a control system ready. Not applicable to communication option (-NC)
- Yellow LED Blinking – Control system is communicating. Not applicable to communication option (-NC)

#### 7.1.2 System Status Light

- Green LED On – No error codes. System fully operational.
- Red LED On – System fault. Recycle power or consult the control system you are communicating with.

#### 7.1.3 Power Status Light

- Green LED On – Power ready to be delivered to 24VDC output channel.
- LED Off – No power can be delivered to 24VDC output channel.

#### 7.1.4 Channel LED Lights

Upon power up, PhD runs through a series of checks. Once PhD successfully completes its start-up sequence, Channel LEDs can be green, orange, or red. A channel set to OFF by control will not turn green during its turn.

- Green – Channel enabled and functioning properly.
- Red – Channel is disabled due to a detached short on the channel. Once the short is cleared, the channel should return to green.
- Orange – Channel is disabled due to a fault, consecutive short circuit, overcurrent, etc. This fault will require a controls method to clear or a power cycle once the fault is clear.

## 7.0 TROUBLESHOOTING

Problem: PhD is not delivering power to ALL outputs (channel)		
Symptom	Possible Cause	Possible Solution
System LED is unlit.	PhD is not connected to power source.	<ul style="list-style-type: none"> <li>Check that PhD is plugged into power source (refer to section 9.8).</li> <li>Connect Saf-D-Grid® cable to PhD.</li> </ul>
	Voltage of PhD's power source is too low.	<ul style="list-style-type: none"> <li>Verify the power source's voltage is &gt; 90VAC or 127VDC.</li> <li>Correct as necessary.</li> </ul>
	Voltage of PhD's power source is too high.	<ul style="list-style-type: none"> <li>Verify power source's voltage &lt; 305VAC or 431VDC.</li> <li>Correct as necessary.</li> </ul>
	Circuit breaker tripped / Short circuit or ground-fault in power wiring.	<ul style="list-style-type: none"> <li>Inspect wiring and junction boxes between circuit breaker and PhD.</li> <li>Repair or replace any defects.</li> <li>Reset circuit breaker.</li> </ul>
	Open circuit in power wiring.	<ul style="list-style-type: none"> <li>Inspect wiring and junction boxes between circuit breaker and PhD.</li> <li>Repair or replace any defects.</li> </ul>
	Power is connected to input and by-pass plug receptacles.	<ul style="list-style-type: none"> <li>Check that PhD is correctly plugged into power source.</li> <li>Refer to section 9.8.</li> </ul>
System LED - RED.	Internal temperature of PhD is too high.	<ul style="list-style-type: none"> <li>Check that PhD has a minimum of 6 inch clearance around its sides.</li> <li>Ensure that ventilation slots are not blocked or clogged.</li> <li>Refer to section 9.</li> </ul>
	Internal bus voltage of PhD is too high.	<ul style="list-style-type: none"> <li>Cycle power to PhD (Wait 60 seconds after turn off).</li> <li>1. Switch circuit breaker off-on.</li> <li>2. Un-plug and plug power cable.</li> <li>If unsuccessful clearing fault, contact Nextek Power Systems.</li> </ul>
	Internal bus voltage of PhD is too low.	
	Micro-controller's memory is corrupted.	

## Problem: PhD is not delivering power to SOME outputs (channel)

Symptom	Possible Cause	Possible Solution
LED on non-functional channels is "RED".	Non-recoverable fault from either in-rush, short circuit, or excess load.	<ul style="list-style-type: none"> <li>• Unplug 24VDC output cable and wait 1 minute.</li> <li>• Check for short in output wiring and connected load.</li> <li>• Repair or replace any defects.</li> <li>• Verify that load does not exceed 95VA (e.g. 3.95A) @ 24VDC.</li> <li>• Verify that load does not draw more than 4.1A.</li> <li>• Cycle power to PhD (Wait 60 seconds after turn off).</li> <li>1. Switch circuit breaker off-on.</li> <li>2. Un-plug and plug power cable.</li> <li>• If unsuccessful at clearing fault, contact Nextek Power Systems.</li> </ul>
	Channel disabled due to in-rush, short circuit, or excess load.	<ul style="list-style-type: none"> <li>• Check for short in output wiring and connected load</li> <li>• Repair or replace any defects</li> <li>• Verify that load does not exceed 95VA (e.g. 3.95A) @ 24VDC.</li> <li>• Verify that load does not draw more than 6A.</li> <li>• Wait 5 minutes for fault to clear.</li> </ul>
	Channel disabled by transient induced by electromagnetic noise.	<ul style="list-style-type: none"> <li>• Wait 5 minutes for fault to clear.</li> </ul>



## 8.0 MODEL DESCRIPTIONS AND FEATURES

PHD-I6-ACDC – B - W – 6  
 PHD-I6-ACDC – B - W – Z  
 PHD-I6-ACDC – B - W – B  
 PHD-I6-ACDC – B - W – NC  
 PHD-I6-ACDC – B - ML – 6  
 PHD-I6-ACDC – B - ML – Z  
 PHD-I6-ACDC – B - ML – B  
 PHD-I6-ACDC – B - ML – NC  
 PHD-I6-ACDC – FF - W – 6  
 PHD-I6-ACDC – FF - W – Z  
 PHD-I6-ACDC – FF - W – B  
 PHD-I6-ACDC – FF - W – NC



PHD-I6-ACDC – FF - ML – 6  
 PHD-I6-ACDC – FF - ML – Z  
 PHD-I6-ACDC – FF - ML – B  
 PHD-I6-ACDC – FF - ML – NC

*For an explanation of the PSM nomenclature, please see page 12.*

## FEATURES

- Converts Class IAC (90-305VAC) or DC (127-431VDC) power to 16 individual Class 2 outputs to reduce installation costs
- Modulates Class 2 output power to dim LED lighting to eliminate LED drivers in light fixtures (not all models)
- Integrated eight zone 0-10V dimming system to eliminate additional 0-10V dimming system (not all models)
- Integrated wired or wireless communication to simplify commissioning of control systems
- Fanless, passive cooling for quiet, long-lasting operation
- Anderson Power Saf-D-Grid® Class I plug-in power cables can be safely connected and disconnected under power
- State-of-the-Art Class 2 connector system for robust, adjustable, cost-effective installation
- Each Class 2 output (aka Channel) has short circuit and over-power shutdown to protect low voltage installers
- PhD is easy to service and can be repaired directly at installed location
- Compatible with Nextek custom cable to have turn-key solution delivered to site
- Compatible with Emerge Alliance® LED light fixtures to ensure trouble-free installation
- Compatible with “High Resistance Mid-Point” grounding systems to achieve safest Class I DC systems
- Optional mounting brackets for installing unit on Armstrong DC FlexZone® modular ceiling system
- Optional color choices to complement building aesthetic

## COMMUNICATION OPTIONS

- 6LoWPAN/IPV6 protocol to integrate with Nextek SKY wireless controls (Default)
- ZigBee 3 protocol to implement multi-vendor wireless solutions (Option)
- BacNet/IP to integrate with wired Building Management Systems (Option)

## 9.0 TECHNICAL SPECIFICATIONS

### SPECIFICATIONS

- Dimensions (WXHxD): 23.5 X 5.8 X 13.6in (597 X 147 X 345mm)
- Weight: 32lbs (20kg)
- Mounting Options: Hard mount to concrete ceiling, bracket mount to suspended ceiling, threaded rod, wire rope hanging systems
- Input Voltage Range: 90-305VAC or 127-431VDC
- Power Factor Correction: >0.98 @ 115VAC, >0.93 @ 277VAC

### COMPLIANCE / FILE NO.

- UL 1012
- UL 1310
- UL 8750 (CSA C22.2#250.13)
- UL 2043 (ULC/ORD C2043)
- UL 2577
- EmergeAlliance®
- RoHS compliant

### PhD ORDERING OPTIONS

	INPUT		MODEL		OUTPUT CONNECTIONS		COMMUNICATION
PhD 16 16 Channels	ACDC Dual Rated Input 90VAC-305VAC 127VDC-430VDC	—	<div style="border: 1px solid black; width: 40px; height: 20px; margin: 0 auto;"></div> <b>B (default)</b> (Base Model - Limited Control / Non Plenum Rated)  <b>FF</b> (Full Featured - Each power channel with PWM output + 8 independent wired 0-10 signal outputs + Plenum Rated)	—	<div style="border: 1px solid black; width: 40px; height: 20px; margin: 0 auto;"></div> <b>W (default)</b> (Wago PicoMAX® Connectors)  <b>ML (TE MATE-N-LOK®)</b> Connectors	—	<div style="border: 1px solid black; width: 40px; height: 20px; margin: 0 auto;"></div> <b>6 (default)</b> (6LowPAN® Wireless Radio) <b>Z (ZigBee® Wireless Radio)</b> <b>B (Wired BACnet/IP®)</b> <b>NC (No Communication)</b>

### COLOR OPTIONS

- N** - Natural Aluminum (Standard)
- BLK** - Black
- TAN** - Putty/ Tan
- CC** - Custom color

### MOUNTING OPTIONS

- CL** - Leg kit to attach PhD to ceiling grid
- SL** - Leg kit to attach PhD to a shelf

### POWER INPUT CABLE OPTIONS

(One SE is included with each PhD unit)

- SE** - Male Molded End at PhD end with open conductor pig tail at other end - 2 meters long
- DE2** - Male Molded Ends at each cable end - 2 meters long
- DE3** - Male Molded Ends at each cable end - 3 meters long
- DE6** - Male Molded Ends at each cable end - 6 meters long
- JBR** - Junction Box Receptacle with a panel mount Female receptacle 4x4

### CLASS 2 POWER OUTPUT CABLE OPTIONS

(All cables available in lengths from 10ft to 60ft in 10ft increments - Specify length as needed)

- DCON-ML** (Mate-N-LOK connector on PhD end with open conductor pig tail at opposite end)
- DCON-W** (Wago connector on PhD end with open conductor pig tail at opposite end)
- DCFZ-ML** (Mate-N-LOK connector on PhD end with DC Flexzone connector at opposite end)
- DCFZ-W** (Wago connector on PhD end with DC Flexzone connector at opposite end)

## 10.0 ADDENDUM: APPROVED UL 2577 POWERED GRID

10.1 The following Powered Ceiling Grid is currently available to use with all PhD models:

### 10.1.1 Armstrong®:

#### DC FLEXZONE™ - SUPRAFINE® T-BAR

Model DC750106: 72" x 9/16" x 1 11/16"

Model DC750108: 96" x 9/16" x 1 11/16"

Model DC750110: 120" x 9/16" x 1 11/16"

Model DC750112: 144" x 9/16" x 1 11/16"

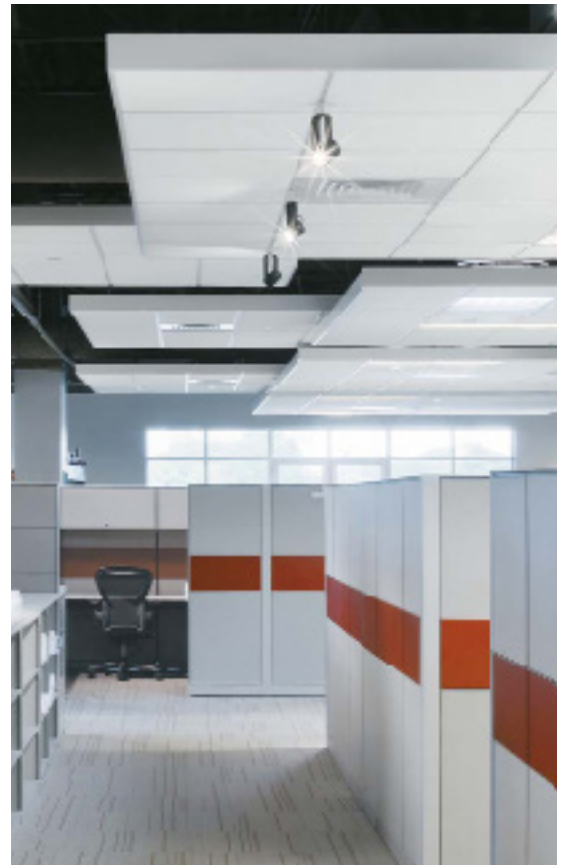
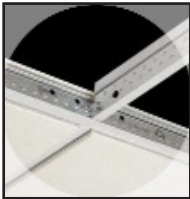
#### DC FLEXZONE™ - SILHOUETTE® 1/4" REVEAL

Model DC760106: 72" x 9/16" x 1 11/16"

Model DC760108: 96" x 9/16" x 1 11/16"

Model DC760110: 120" x 9/16" x 1 11/16"

Model DC760112: 144" x 9/16" x 1 11/16"



DC Flexzone™ application with inset of system construction. Images courtesy of Armstrong®. <http://www.armstrong.com>