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Best Practices: Power Load

Your WattBox PDU (power distribution unit) is designed to handle a specific electrical load. So long as this level is not exceeded, your WattBox should provide flawless service.

You can prevent issues from arising by following these best practices.

Don't Use Daisy Chains

> **Warning:** Daisy chaining can overheat a multi-outlet power strip, which can lead to a fire.

Never plug a multi-outlet power strip or another PDU into an outlet of a WattBox PDU. If you do, power usage becomes much harder to track, and it's likely that the chained devices may draw more power than the PDU's rating. When this happens, the PDU flips to Overcurrent Protection Mode, shutting off to prevent permanent damage to itself and the devices it powers. See "Overcurrent Protection Mode" on page 9 for how to restore a unit from Overcurrent Protection Mode.

This sudden loss of power can also damage devices attached to the multi-outlet power strip. Most electrical devices are designed to operate only at optimal power input levels, and low power can permanently affect their performance.

Plan a Proper Power Load

Power load is the total amount of power that attached equipment draws from the WattBox PDU. If the load is higher than the PDU's rating, then the attached equipment cannot get enough power. This degrades performance and may damage the equipment.

You cannot calculate a power load using a device's average power consumption; certain devices draw more power at specific times. For example, when amplifiers start up, they can draw up to four times more power than normal. Security cameras draw more power at night when they activate their infrared emitters.

This means that a home system with sound and surveillance may run fine in the daytime, but if it's nighttime (cameras running infrared) and someone powers up the sound system (heavy amplifier draw), the extra power load can cause issues if you don't plan for it.

Avoid this by calculating the maximum potential power load for the devices on each WattBox PDU.

How to Determine the Potential Load for a WattBox PDU

Find the **maximum** power rating (in watts) for each device attached to the WattBox PDU.

Add the various power consumptions together to find the maximum potential load. This load must be lower than the power rating for the PDU you are using; this is 1440W for many WattBox PDUs. You can find this listed under "UL Power Rating" on the model's product page.

If the total load is greater than the PDU can handle, remove devices from the PDU until the maximum load is within parameters. This may require swapping devices between PDUs or purchasing additional PDUs to distribute the load.

If a Device Doesn't List a Maximum Power Rating (North America and other 120V systems)

If you can't find an official maximum power rating listed for your device, you can generate a good estimate with a quick calculation.

Find the fuse rating for your specific device on its product spec page. For an example, let's use the **[Episode® 70V IP-Enabled Amplifier](#)**. On the product page, it lists a fuse rating of **T 3.15A L 250V**. The part we are interested in is the 3.15A section of that fuse rating.

Take that 3.15 amps and multiply it by the standard North American power grid rating of 120 volts. 3.15A × 120V = 378W.

Is this accurate? In this case, we can cross-check that with the power consumption rating shown on the product page. We see that the amp is rated for 400W, so the 378W calculation is on point.

Note that this is peak power consumption, but with power conditioning and surge protection, this is the number we want to use. We don't care what the average consumption is.

How to Determine the Potential Load for a PDU (Europe and other 240V markets)

The procedure is the same as the above, substituting 240V for 120V in the formula.

Example Load Calculation

This example uses a six-outlet, 800-series WattBox. As you can see, the power consumption is well within parameters. A blank worksheet is provided at the end of this document for your convenience.

Outlet	Attached Device	Max Potential Load
1	Araknis 110 router	9
2	Araknis 210 switch	83
3	Araknis 510 AP	10
4	SunBrite Veranda	266
5	Episode EVO10 Sub	480
6	Episode 150W Amp	400
PDU Maximum Power Load: 1440W		1248W

WATT BOX

Test It Thoroughly

Test the system while you are still on site, including using any standby states, to ensure that a connected device (like an amplifier) doesn't trip overcurrent protection with a strong inrush while charging its capacitors.

> **Pro Tip:** Amplifiers rarely need to be restarted. If there is not a specific reason to connect an amp to an IP-enabled WattBox, consider plugging it in to a surge-only WattBox instead.

Best Practices: Installation

You want your equipment protected; we want your equipment protected. To that end, here are some best practices that can help.

This guide is neither comprehensive nor exhaustive, and it's certainly not a replacement for using (or becoming) a certified and licensed electrician. Electricity is a complex topic, but just using these simple tips will make your installs better.

There Are Limits

Like the brakes on your car, surge protection wears out.

PDUs are rated for how much surge they can withstand. This amount is rated in joules. Typically, PDUs divert their excess energy to metal oxide varistors (MOVs), which get degraded as they dissipate this energy. Thus, if you have a MOV rated to 1000 joules, it can withstand one 1000-joule hit, ten 100-joule hits, or 1000 tiny 1-joule hits.

Replace your PDUs periodically, because even small surges eventually grind down your protection. If you're in a location that has frequent thunderstorms, replace your PDUs every 4–5 years. In locations with no thunderstorms and a stable power supply, you might be able to stretch this to 6–8 years.

How to Tell if your MOVs Are Dead

If you have a surge and the AC power cuts out to all devices on a specific PDU, that shows that the PDU just shut down power transmission to save the gear. It must be replaced, even if the unit can be restarted (this happens in rare cases).

Also, most WattBox PDUs (300s, 700s, 800s) have an LED light called "Protected." When this LED is green, that indicates that the MOVs are still operational. When this LED is off, that indicates that the MOVs have been used up; replace the PDU.

Physical Installation

All WattBox devices must be installed indoors.

Plug the PDU directly into a grounded outlet. Do not use extension cords, non-grounded two-prong adapters, or other gear between the PDU and the outlet. Having a ground is required for the surge protection to work.

Always confirm that the Ground LED (available on most models) is green; this indicates that the device is properly grounded.

Do not use external ground wires or ground connections other than those installed by an electrician.

Electricity will get into your circuit any way it can. To be safe, all metal wires (including, e.g., power cords, Ethernet cables, coaxial cable, etc.) leading into the protected equipment must first pass through a PDU. **For example, if a coaxial cable runs from the cable box to the rack without passing through surge protection, then your system is vulnerable.**

In cases where a single protector cannot completely protect a complex installation, employ a systemic approach that uses multiple protectors.

You have a WattBox here

Place another WattBox here
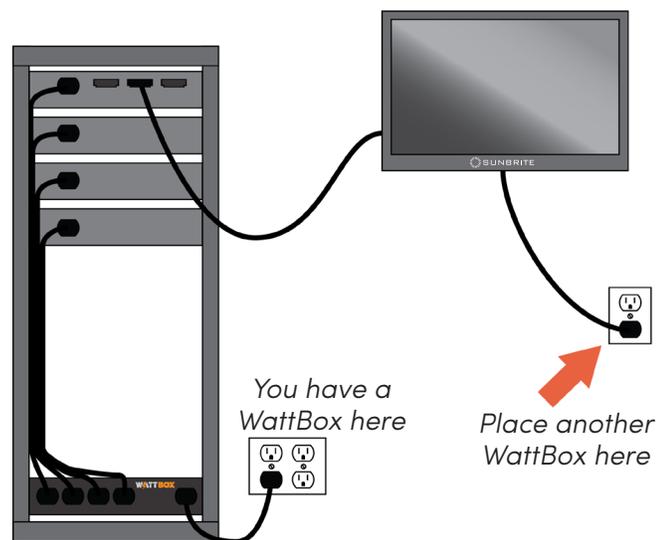
> **Caution:** WattBox does not currently (pun intended) provide protection for 1Gb Ethernet cabling. If you plug a 1Gb cable into a WattBox, it automaticaly downgrades to 100Mbps.

> **Pro Tip:** Fiberoptic cables do not conduct electricity and do not need to be surge protected.

Which Device(s) to Use

- If the job requires multiple amplifiers, consider dedicated electrical outlets for the equipment. Check that the circuit that powers the equipment can support the total potential load. When in doubt, consult an electrician.
- If a device needs to be remotely restarted or put on a schedule, use an 800-series, IP-controllable WattBox PDU.
- If the device has high peak-power requirements, consider a 200-series WattBox PDU with a dedicated outlet for proper surge protection.
- If a device has an inrush current that is high enough to trip a WB-800, but also needs to be power cycled or controlled via schedule, a WB-250 or WB-300 provides surge protection and individual outlet control without overcurrent protection.
- If the device doesn't need to be on a controlled outlet, use a surge-only PDU.

Take Full Advantage of OvrC

OvrC ("oversee") is a **free** remote management platform that lets you manage and monitor each of your clients from the comfort of your office and with the convenience of your cell phone. With OvrC, your WattBox can:

- Automatically restart devices when they become unresponsive
- Restart your router when the internet goes down
- Schedule off times for specific equipment
- Configure power-on delays so multi-device systems come online smoothly
- Allow the homeowner to power cycle select equipment safely, without calling you or going behind the rack

You can explore OvrC's complete capabilities at **OvrC.com**.

Configuring Backup Power

When the power goes out, emergency power can be supplied by a battery backup, called a UPS (uninterruptible power supply).

What a UPS Does

The UPS provides battery power for a short time to ensure that equipment can be powered down in a proper manner. This helps eliminate equipment damage, loss of computer files, etc.

Like PDUs, each UPS has a maximum power output that it can support. You can find this on the product spec sheets under Power Rating. A UPS is designed to supply power to a PDU to support the PDU's equipment. Depending on your gear, this maximum UPS power may be below the level that a PDU can support.

Since the UPS is responsible for powering all gear attached to the PDU, once you attach it to your PDU, the UPS becomes the ruling device for power throughput to that PDU. As such, **total power throughput of the PDU is limited to the capacity of the UPS even if AC power is present**. Example: If your 1440W PDU is plugged into the wall, it can pass 1440W of power. If it is plugged into a UPS (that is in turn plugged into the wall) with a maximum power rating of 1000W, then your 1440W PDU can only pass 1000W of power, as set by the UPS, even though AC power is available.

Load Shedding

Battery backup is not intended to provide full power for a long time. Typically, a UPS providing power to a full load only lasts for a few minutes. However, if the UPS is only powering, say, a network modem, router and switch, it might be able to provide power for hours.

When your PDU has a linked UPS, you can extend the time that battery backup can power mission-critical components by configuring the PDU for load shedding. This extends the duration of battery backup by disconnecting non-critical components.

When switching to battery backup, the PDU powers off equipment in an order that you specify, doing so in a predictable manner to provide maximum safety for both gear and data.

To customize your load shedding schedule, log in to OvrC, click on the PDU, and navigate to the Configure tab. Under the General Setting group, click on UPS Settings.

The UPS has four stages at which it can shut off equipment. These stages are based on remaining battery life. While every install is different, best practices generally adhere to the following schedule:

- **Immediate:** If you switch off the toggle to the left of the outlet, the UPS will not support that outlet with battery power, and the UPS priority reads "Disabled". The attached equipment shuts off as soon as power goes out. Best practice is to immediately drop power to all of your nonessential and high-draw equipment that does not require an orderly shutdown. This includes audio gear, televisions, and minor items like lights and fans.
- **75%:** Shortly after power goes out, shut off nonessential gear that requires a safe shutdown. This gives the client time to shut down the device manually, or provides the device with extra time to complete a task in progress. One such example is a recording device; you want to be able to shut it down nicely so that you don't risk the integrity of the recorded data file.
- **50%:** All comfort and convenience gear should shut down at this time, leaving as much power as possible for essentials.
- **25%:** This is the UPS's last gasp. Only the most essential gear should still receive power. This may be surveillance gear, computers, and/or the network.

Calculating Battery Life

Calculating how long your UPS will last is not precise, because the amount of power each device uses is not a fixed, reliable amount. In addition, battery duration is not strictly arithmetic based on power consumption. That is, if you use a battery at 1/10 of its capacity, it will last over twenty times as long as a battery that runs at full capacity. However, it is possible to estimate the duration based on loads.

Example Duration Calculation

This example uses a 12-outlet, 800-series WattBox attached to a 2000VA UPS.

Here is the runtime in minutes for the UPS, based on load (this data is available on the website; note that these are decimal minutes, not minutes and seconds):

Load	100%	90%	80%	70%	60%	50%	40%	30%	20%	10%
Time	3.42	4.37	5.44	6.88	8.85	11.63	15.76	22.59	36.69	73.82

This particular client wants no interruption to his outdoor media when power goes out. This way he can shut down his audio nicely, then finish viewing whatever scene is happening on TV before he shuts that down (maybe not the best of priorities, we know). After that, he wants to maintain his surveillance until the total power gets down to 25%.

- For each shedding column, enter the device's load in watts for active outlets, or leave it blank if that outlet is disabled at that level.
- For power rating, enter the UPS's power rating. You can find this on the product's web page.
- For capacity, divide the load by the power rating to determine how taxing the active equipment is. Since this is all based on averages, the actual duration can vary greatly.
- Finally, for runtime, look at the runtime for that approximate load, and divide by four. This tells you how many minutes that the UPS can provide energy for that quartile of power consumption.

Outlet	Device	100%	75%	50%	25%
1	Araknis 110 router	9	9	9	9
2	Araknis 210 switch	83	83	83	83
3	Araknis 510 AP	10	10	10	10
4	Luma NVR	180	180	180	
5	Front Dome Camera	8	8	8	
6	Back PTZ Camera	23	23	23	
7	SunBrite Veranda	266	266		
8	Episode EVO10 Sub	480			
9	Episode 150W Amp	400			
10–12	Empty				
Total Load	*Add rows 1–12*	1459	579	313	102
Power Rating	*of your UPS*	1710W	1710W	1710W	1710W
Capacity	*Load / UPS Rating*	85%	34%	18%	6%
Time	*Load time / 4*	1.25	4.8	9.2	18.4

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- Looking at the loads, in the 100% column, we are running an 85% load. That's halfway between 80% (5.44 minutes) and 90% (4.37 minutes), so we'll split that time and call it 4.9 minutes. Divide that by 4 (for operating from 100% down to 75%), and we get a final runtime of 1.25 minutes for that section.
- For the next column, 34% splits the difference between 30% and 40%. Those durations average out to 19.2 minutes. One fourth of that means that devices in this section run for roughly 4.8 minutes.
- The 18% we'll just round up to 20%. Taking the 36.69 minute runtime and dividing by four, we get 9.2 minutes for the battery to drain from 50% capacity down to 25%.
- Finally, the 6% we'll just call 10%, with a final calculated runtime of 18.4 minutes.

This means that, if everything is running at full power consumption at the moment the power goes out, the UPS will provide power for roughly 33 minutes, 30 seconds. Of course, if the TV and outdoor audio are already off, and the system only has to run the surveillance and network, the battery will last a whole lot longer.

Installing a UPS in a Rack

UPSs are very heavy pieces of equipment. As such, install them as low in the rack as you can, to avoid the rack tipping when the rack is bumped or being moved.

Best practice is that 70% of the gear weight in a rack should be in the lowest 30% of the rack height to ensure stability.

WattBox Troubleshooting

If a client is having problems, follow these basic troubleshooting steps. Each step is described in detail below. Note that each of these steps is made easier and faster if you are using OvrC.

- Update the firmware
- Ensure there are no daisy chains
- Check that there are no new devices
- Check the outlet mode
- Check the schedule
- Check the power load

Update the Firmware

Always keep your firmware up to date. Firmware updates fix known security and performance issues.

Firmware updates are most easily checked and applied through OvrC. Find out more about OvrC at **ovrc.com** or on Tech Community at **tech.control4.com**. Otherwise, follow the update instructions on your PDU's manual.

> **Caution:** When updating to firmware version 2.1.2.0, you must either (a) power cycle the entire WattBox with its power button, or (b) or use the "Reset All" command in OvrC. Before doing this ensure that each of the PDU's outlets are Enabled. If any outlets are Disabled, the firmware update will not take effect.

Ensure There Are No Daisy Chains

Double-check to ensure that no one has plugged a multi-outlet power strip into the PDU.

Check That There Are No New Devices

If someone plugs a new device into your WattBox, that's a power draw that you haven't accounted for, and it might cause problems.

With 800-series PDUs, if you have labeled your outlets in OvrC, you can check power consumption with the metering data to see if it has changed (or if an "empty" outlet is mysteriously drawing power).

You can also use OvrC to scan the network to see if there are any devices that you haven't accounted for. Some of these might just be the neighbor kid's cellphone that's using the client's Wi-Fi, but others might be that new sound system the client forgot to tell you about.

Check the Outlet Mode

Using OvrC, an outlet can be turned off or set to Disabled. To check the outlet mode, log in to OvrC, navigate to the location, and click the PDU.

Outlets that are off provide no power. In the Details tab, check that the outlet's slider is to the right and colored blue. If the slider is to the left and gray, the outlet has been turned off and transmits no power. Click the slider to turn the outlet back on.

Outlets that are set to Disabled are no longer affected by OvrC commands, OvrC Connect commands, or the PDU's power button. They cannot be adjusted from their current state. To fix this, go to the Configure tab, click Outlet Options, and choose either the Enabled or Network Device (Reset Only) mode.

Check the Schedule

OvrC can set your WattBox PDU to shut off or reboot selected outlets at specified times. A forgotten scheduled event looks just like a major failure.

To check the schedule, log in to OvrC and navigate to your WattBox PDU.

Click the PDU. In the Schedule tab, check that there are no unwanted events in the calendar. If there are, edit or delete them.

Also check that the proper Time Zone is set.

Check the Power Load

If an outlet with a high-inrush device (such as an amplifier) shuts off as the amplifier powers up, it may be an overcurrent issue. Verify that the WattBox firmware is up to date. If the problem persists, move the device to a different outlet. If the issue follows the device, there is most likely an overcurrent issue with that device.

If all else fails, calculate the total power load as described under ""How to Determine the Potential Load for a WattBox PDU" on page 2.

Once any power issues have been cleared, if any outlets remain unresponsive, it's possible that overcurrent protection has been tripped; reset the outlet as described under Update the Firmware on the previous page.

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Overcurrent Protection Mode

Overcurrent Protection (OCP) is a feature of the WattBox 800 series that protects each outlet (and therefore the equipment connected to that outlet) from excessive current.

Identifying Overcurrent Issues

OCP turns off an individual outlet in order to protect itself, appearing unresponsive. You know that OCP is tripping if:

- The total possible load of all devices connected to the WattBox exceeds the UL rating of 12A @ 120V, 1440 Watts ("constant OCP").
- An outlet with a high-inrush device such as an amplifier shuts off as the device powers up ("instantaneous OCP").

When operating with the latest firmware, the WattBox provides a warning banner in OvrC that notifies you that an OCP event has occurred.
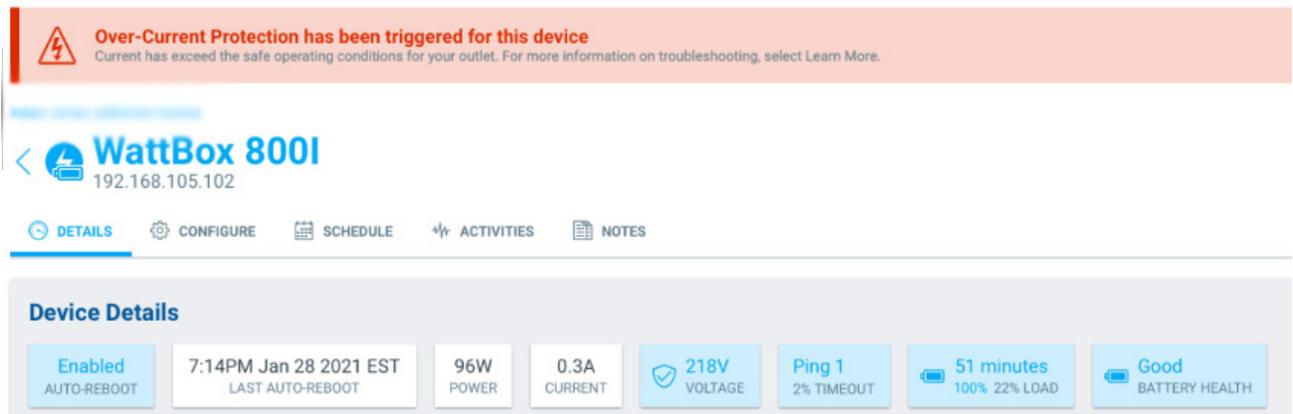
There is also a new "Learn More" link that explains OCP and ways to troubleshoot.
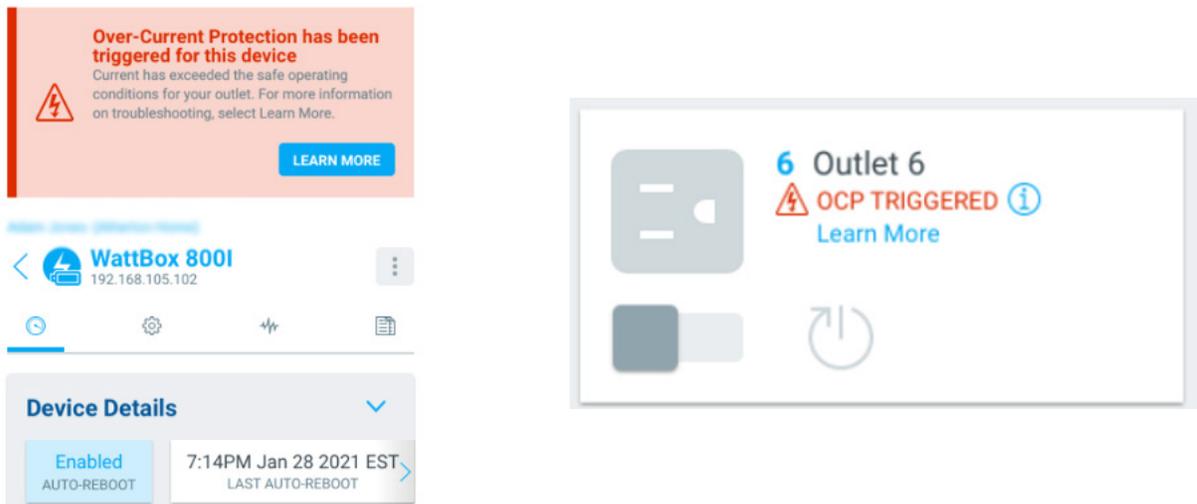
WattBox/OvrC Install Checklist

Technician: ....

Client: ....

Date: ....

OvrC Basics

- ☐ Customer added
  - ○ Site named clearly and precisely
  - ○ Site street address added
  - ○ Site street address verified
  - ○ ISP added
  - ○ Time zone specified
  - ○ Contact phone added
  - ○ Contact email added
- ☐ Claim the Araknis/Pakedge router or OvrC Pro Hub first
  - ○ Ensure it has claimed all other devices on the network
  - ○ Manually add devices if necessary

For Each Device

- ☐ Name each device clearly
- ☐ IP Settings > Address Assignment set to DHCP
  - ○ DHCP reservation at the router for primary devices
- ☐ Time Zone and Daylight Saving set
- ☐ Firmware updated

Site Settings

- ☐ Set network scan frequency
- ☐ Set Internet speed test frequency to 24 hours
- ☐ Enable basic security settings
  - ○ Set content filtering to client specifications

Wi-Fi Management

Wi-Fi management allows you to set up several access points simultaneously. It is beyond the scope of this document. **Click here for a guide to Wi-Fi Management**.

For details on best-practice access point settings, see the **Network Install Checklist on Tech Community**.

WattBox PDU Name

- ☐ Device clearly named
- ☐ Location and other details recorded under Notes
- ☐ Firmware updated
  - ○ After installing the update, set all outlets to Enabled and reboot the PDU

Self-Healing Auto Reboot: Internet

- ☐ Auto-reboot enabled
- ☐ At least three hosts entered
  - ○ Each named for the site (not "ping 1" or the like)
  - ○ URLs start with www. (or similar)
  - ○ Each host's ping has been tested
- ☐ Reboot when
  - ○ All relevant hosts selected
  - ○ All/any relevant host times out
- ☐ Reboot network gear
  - ○ Boot delays set
  - ○ Adequate delays to finish booting before the next device starts
  - ○ Devices boot from the outside in (first modem, then router, then core switch, then other switches)
- ☐ Time-out settings completed

Self-Healing Auto Reboot: Temperamental Devices

Connected devices can become unresponsive, due either to an internal connectivity issue or by losing connection to their data source. Setting up auto-reboot can help keep the system working while you investigate a permanent solution.

- ☐ Auto-reboot enabled
- ☐ Finicky device added
  - ○ Clearly named
  - ○ IP address of finicky device added
  - ○ Ping has been tested
- ☐ Reboot when the device times out
- ☐ Reboot all associated devices
  - ○ Boot delays set to finish booting before the next starts
  - ○ Devices boot from the master to the subordinates
- ☐ Time-out settings completed

Outlet Options

- ☐ Each outlet named for the device it powers
  - ○ Unused outlets labeled "Empty"
- ☐ Network outlets set to Network Device (Reset Only)
- ☐ Mission-critical outlets set to Network Device (Reset Only)
- ☐ Other outlets set to Enabled

Other General Settings

- ☐ Time Zone and Daylight Saving set
- ☐ IP Settings > Address Assignment set to DHCP
  - ○ DHCP address reservation made at the router
- ☐ All wall wart power supplies secured with hook and loop
- ☐ Power cords labeled with the name of the attached device

Wireless Outlets

To set up OvrC control for wireless outlets, **see this Smart Skill**.

UPS

- ☐ Location and specs recorded under the Notes section of the PDU that it powers
- ☐ PDU power cord plugged into UPS

OvrC-Enabled UPS

- ☐ UPS connected to IP PDU's UPS port
- ☐ Load shedding programmed
  - ○ Load shedding schedule recorded in PDU Notes tab

OvrC Connect

- ☐ Commands enabled for OvrC Connect
- ☐ Each command properly set up
  - ○ Command has a clear, non-technical name
  - ○ Command has an appropriate icon
  - ○ Command location set (if client has multiple sites)
  - ○ Stop command option set appropriately
  - ○ Delays set between command steps
  - ○ Command disabled until all steps finish processing
- ☐ Users added
  - ○ Each user has an individual account
  - ○ Customer taught to use commands
  - ○ Customer taught to use Contact Us feature

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UPS Battery Duration Worksheet

For each shedding column, enter the device's peak load for active outlets, or 0 if that outlet is disabled at that level.

For power rating, enter the UPS's power rating. You can find this (and the data below) on the product's web page.

For capacity, divide the load by the power rating to determine how taxing the active equipment is. Since this is all based on averages, the actual duration can very greatly.

Finally, for runtime, look at the runtime for that approximate load, and divide by four. This will tell you how many minutes that the UPS can provide energy for that quartile of power use.

Outlet	Device	100%	75%	50%	25%
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
Total Load	*Add rows 1–18*				
Power Rating	*of your UPS*				
Capacity	*Load / UPS Rating*				
Time	*Load time / 4*				

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Load Calculation Worksheet

Outlet	Attached Device	Max Potential Load
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		
17		
18		
PDU/UPS Max Load:		

Technical Support

For chat and telephone, visit https://tech.control4.com/s/contactsupport • Email: TechSupport@SnapOne.com

Visit tech.control4.com/technician for discussions, instructional videos, news, and more.

Warranty and Legal Notices

Find details of the product's Limited Warranty and other resources such as regulatory notices and patent and safety information, at **snapone.com/legal** or request a paper copy from Customer Service at 866.424.4489.

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