Technical Specification for Advanced Power Strips

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Preface

Advanced power strips (APSs) are similar to conventional power strips that are often used for plugging multiple electronic devices into a wall outlet; however, APSs have built-in technology to reduce plug and process load (PPL) runtimes and save energy when the devices are not in use.

Commercial PPLs account for nearly 225 trillion British thermal units (Btu) of primary energy use per year, totaling approximately $2.2 billion annually [1][1]. Office equipment alone consumes approximately 7% of all commercial electric energy [2]. Inefficient equipment—such as older office equipment and computers—can draw excessive power and emit heat that can contribute to higher cooling bills. Therefore, reducing the amount of electricity consumed by PPLs has important economic and environmental benefits. According to the U.S. Department of Energy's Building Technologies Office Prioritization Tool, controllable power outlets could save as much as 830 TBtu of primary energy by 2030 [3].

This specification provides detailed selection criteria for five major APSs, and sets standards for modeling APSs. It is intended to help those who procure APSs select the most effective models for their commercial buildings. It also aims to encourage building owners and operators to promote the use of the specification within their organizations and information technology procurement officers. Elements of the specification that are labeled as "*optional*" in italics are encouraged because they may yield additional energy savings or achieve a higher level of user acceptance. If all building owners adopted this APS specification, U.S. commercial building energy consumption could be reduced by 1% (equivalent to $606 million or 63 trillion Btu annually, based on 28% savings demonstrated in the study in citation [4]).

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[1] The energy savings potential of APSs is higher if other equipment such as mini-refrigerators and vending machines are included in the totals.

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Nomenclature and Acronyms

ACEEE	American Council for an Energy-Efficient Economy
APS	advanced power strip
BTU	British thermal unit
NEEP	Northeast Energy Efficiency Partnerships
NREL	National Renewable Energy Laboratory
PPL	plug and process load
Btu	British thermal units

Definitions

Activity Monitor Power Strip – A power strip that detects activity in a room (via infrared or by other means) and turns off outlets if no activity is detected.

Advanced Power Strip – A block of electrical sockets, used for plugging multiple electronic devices into a wall outlet, that has built-in technology to reduce PPL runtimes and save energy when the devices are not in use.

Always On Outlets - Outlets that are always energized and are not controlled by the built-in functionality of the APS.

Controlled Outlets - Outlets that are energized and de-energized according to the APS's built-in control functionality.

De-energize - A process by which an electrical device is disconnected from an electricity source ("turned off").

Energize - A process by which an electrical device is connected to an electricity source ("turned on").

Master-Controlled Power Strip – An APS that automatically turns off (de-energizes) controlled outlets, where peripheral devices (such as a task light or printer) are plugged in, when a user turns off a primary device (such as a computer or television).

Masterless Power Strip – A power strip that completely turns off power to controlled outlets, including parasitic loads, when all the controlled electrical devices are turned off.

Parasitic Load - Power draw of an electrical device in its "off" state, also referred to as vampire or ghost loads. [5]

Power Strip - A block of electrical sockets, used for plugging multiple electronic devices into a wall outlet.

Power Switching Threshold –

▶ **Fixed Power Switching Threshold –** The level at which a master-controlled or master less power strip de-energizes and energizes controlled outlets. The power level threshold is set by the manufacturer or manually set by the user. The APS does not set the power level automatically.

▶ **Dynamic Power Switching Threshold –** The power level threshold is determined automatically by the APS and is dependent on the connected electrical devices. The APS achieves this by sensing both current and outlet voltage to determine the exact power switching threshold for the connected devices.

Remote Switch Power Strip – A power strip that the user can turn off via distant switches, without making physical contact with the strip.

Timer Power Strip – A power strip that automatically turns off outlets based on a preset schedule.

Vacancy Timer - An occupant-controlled timer that turns on the power strip for a set period and automatically turns off at the end of this period.

Hardware Requirements

For a power strip to be considered an APS, it must:

- ▶ Have a feature that automatically **de-energizes** plug-in electrical devices according to APS product manufacturer specifications.

- ▶ Connect and reconnect power[2] according to the product specifications.[6]

Safety Features

The following are safety features and hardware requirements that must be included for an APS to meet this specification. The APS must:

- ▶ Comply with UL 1363 (Relocatable Power Taps) Standards if corded. [6]

- ▶ Comply with UL 498A (Current Tap) Standards if non-corded. [7]

- ▶ Include an electromagnetic interference/radio frequency interference (EMI/RFI) filter.

- ▶ Feature a resettable circuit breaker.

- ▶ Incorporate **power switching** devices that are rated for 100,000 switching cycles at full load (equivalent to roughly 10 years of use).

- ▶ *Optional: Comply with UL 1449-3 (Surge Protective Devices)*

    - o *Rated for 1080-Joule surge protection or higher*
    - o *≥ 72,000 amp protection*
    - o *A light to indicate grounding status.[3]*

Physical Configuration

The following physical features are required to comply with this specification:

- ▶ Clearly labeled and/or color-coded **always on outlets**.

- ▶ Clearly labeled and/or color-coded **controlled outlets**.

Optional: physical features:

- ▶ A light to indicate that the APS has power supplied to it.

- ▶ A light to indicate when the **controlled outlets** are turned on.

- ▶ Manual on/off or user override control.*[4]*

- ▶ A form factor or mounting hardware that will allow the APS to be held securely in place on a desktop.

- ▶ Wire management and/or retractable power cords to control longer power cord lengths.

- ▶ A bar code on each APS for inventory management.

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[2] The term *connect and reconnect power* is synonymous with *turning on and turning off power to the* **controlled outlets.**
[3] Improper grounding renders surge protection ineffective.
[4] Some utility companies will not provide rebates for APSs that have user override control.

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- ▶ A "Commercial/Standard" lifetime warranty.

- ▶ A statement of offered "connected equipment" warranty of at least $50,000 to cover damages from electrical surges to electrical devices that are plugged into an APS.

- ▶ Built-in power factor correction functionality (for distortion power factor). [8]

Ease of Installation

The following required features allow for easy installation, have a high likelihood of user acceptance, and promote high energy savings.

- ▶ Packaging must contain user instructions that specify how to properly install, set up, and troubleshoot the APS to maximize energy savings. User instructions must provide guidance on specific electrical devices that should not be plugged into **controlled outlets**. For **activity monitor** APSs, instructions should include information about where to place the motion sensor and how to adjust its timeout settings.

- ▶ *Optional: Packaging features and user instructions should include:*

    - o *Guidance on National Electric Code and International Fire Code compliant installation with packaging.*
    - o *Dynamic and interactive Web-based instructions. This would include "standard configurations" for a set of applications (e.g., office computer workstation, office printer room, office break room).*
    - o *Labels on the APS make and model to make it easy for users to look up Web-based instructions.*
    - o *Labels on the APS and packaging describing the control strategy that the APS uses; this will help users purchase APSs that have the best control strategy for their needs.*
- ▶ *Optional: For APSs with metering and/or control, and remote accessibility via a computer (or other smart device):*

    - o *Map plugged-in equipment to outlets on the APS during installation and streamline locations in a local or Web-based user interface (e.g., Web-based portal). Provide users with standard options for equipment types (laptop, printer, monitor, etc.).*
    - o *Map APSs to building areas (floor, wing, room number, etc.) during installation and streamline locations in a local or Web-based user interface (e.g., Web-based portal).*

Usability

The following required features make APSs easier to use.

- ▶ The **power switching** feature of the APS functions with desktop and laptop personal computers.

- ▶ For APSs with local control (not internet-protocol-based): the power strip must be intuitive and user friendly so that a "non-expert" user can make adjustments to the installation and control settings (e.g., change the clock on the APS to Daylight Saving Time).

- ▶ *Optional: Power/current sensing APSs (**master-controlled** or **masterless**) adjusts automatically to each plug-in electrical device and automatically determines the correct **power switching threshold.***

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Energy Saving Functionality

There are two ways to maximize the energy savings potential of an APS: minimize its parasitic load, and select the optimal built-in control functionality for a given application.

Maximum Parasitic Load

▶ The APS must use less than 1 Watt at all times while connected to the wall outlet unless also providing wireless communications.

Control Strategy

To be considered an APS, a power strip must have at least one of the control features listed in the following sections. These features increase the energy savings potential of the built-in control functionality of the APS. The APS options are described briefly in Section 2 "Definitions".[5]

Timer Power Strip

There are two types of timer power strips: programmable timer power strips and vacancy timer power strips.

▶ For programmable timer power strips:

    o The user must be able to program the days and times that a circuit can be **energized** and **de-energized** (pre-programmed schedules are preferred).
    o The user must be able to program a different schedule for each day of the week (e.g., weekdays and weekends).
    o The internal clock must be accurate within ±15 seconds per month.
    o The internal clock must be visible.
    o The internal clock must be backed up by a battery so that settings are not lost during a power outage.

▶ For **vacancy timer** power strips:

    o The user must be able to power up the device (e.g., with the push of a button) to stay on for a set period. A maximum of 12 hours is allowed.
    o *Optional: The user must be able to set the period that the APS stays on.*

Master-Controlled Power Strip

▶ No additional steps are needed to operate the plugged in electrical devices (e.g., waking the APS by pressing a button is not required to turn on the master device).

▶ *Optional: The APS has a **power switching threshold**. This can be manually or automatically set.*

Masterless Power Strip

▶ **Power switching threshold** must be manually adjustable **(fixed power switching threshold) or** set automatically **(dynamic power switching threshold)** to accommodate multiple electrical devices being plugged in to the APS.

Remote Switch Power Strip

▶ **Remote switches** must be easily accessible (i.e., designed to sit on a desktop).

Activity Monitor Power Strip

▶ Printed instructions with the APS packaging must include information on where to place the motion sensor, and how to adjust the timeout settings.

Life Cycle Impacts

Optional: The following features should be related to the embodied energy and life cycle impacts of APSs.

▶ The APS comes in environmentally sustainable and/or recycled packaging.

▶ The APS is made from environmentally sustainable and/or recycled materials.

▶ The APS is designed to be easily disassembled for recycling at end-of-life.

▶ The manufacturer offers a "take back" or recycle program.

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