

Deciding Between Linear and Switched-Mode Amplifier?

Must Know Facts

Both linear and switched-mode technology are suitable for a wide range of applications. However, for applications demanding higher precision, speed of response and stability, there are some important differences between these two technologies that should be carefully considered. Following are some of the advantages of the Linear Amplifiers:

Specification:

- Extremely low distortion on output voltage/current
- Very high stability
- Very fast response
- Very fast rise/fall time, typically in μs range (APS series $<5 \mu\text{s}$)
- Extremely low internal impedance

Application:

- **Realistic Simulated Grid:** In many grid applications it is necessary to model the Point of Interconnection (PoI) of the power grid to which the DUT is connected with accurate dynamics of the PoI. Here, the PoI and the DUT dynamics have instantaneous interaction. Because of the extremely low interface delay (high speed of response), linear amplifiers are as close to the physical connection with the real power grid as one can get. This also helps minimize the interface instability issues faced in many HIL applications.
- **Consistent for Widely Varying Loads:** Linear source's performance is mostly unaffected by loading conditions.
- **Stable for Load Types:** Linear amplifiers, like the APS series, can drive pure capacitive and inductive loads with the same stability as the resistive loads.
- **Capable of Wide Dynamic Power Rating:** Unlike switched mode inverter-based solutions, where the output power is hard-limited to the rated output power, linear amplifiers have very high short-term and peak-power capability. This might be important in certain test applications involving phenomena such as transformer inrush, motor starting, faults, etc.
- **Best for Power Hardware in Loop (PHIL) with Real-Time Power System Simulators:** APS series amplifiers are designed to work with real time power system simulators for PHIL via fiber optic interface link based on Aurora protocol. This provides the least close loop delay possible, as the control from the simulator to the amplifier, as well as the feedback of high precision current and voltage measurements to the simulator is done via the fiber optic link. This eliminates any analog connection between the amplifier and the simulator.
- **Efficient for Multiple Applications:** Because of their wide range of frequency, peak-power and stability, a single hardware system can often be used for multiple applications with just different software and firmware. This makes the test setup more efficient, economical and compact.

Switched-mode amplifiers: PWM Power Sources are usually more energy efficient and most PWM solutions can feed sink-power back into the grid without needing separate sink load or power recuperation unit. Usually, they also cost less and are smaller in size and weight.

Check out the following link to learn more about [PHIL requirements](#).