
Technical Bulletin

Understanding and Monitoring Power Variables

For all projectors

UNDERSTANDING POWER VARIABLES

Maintaining proper incoming power is necessary for most standard electrical equipment, and particularly crucial for high brightness and high wattage projectors. Even when you are confident that you are using the proper power source, it helps to remember that numerous variables can affect the *level* and *quality* of this power source, sometimes resulting in poor power arriving at the projector. With a good understanding of these variables and how they may interact, you can take reasonable steps to monitor their status so that your projector consistently receives the power it needs. This will reduce the likelihood of power problems that can lead to poor projector performance or even failure.

The following variables can affect the quality of *line* power (a.k.a. *mains* power) reaching your projector:

- **VOLTAGE (AMPLITUDE)** — Typical symptoms of abnormally high or low incoming voltage include lamp shutdown and/or triggering of thermal sensors. In Christie projectors, most of which have a Xenon ballast supply with power factor correction, a dip in voltage draws higher current and results in poor efficiency and more heat dissipation. Low incoming voltage may also slow any AC fans, leading to an over-temperature condition. Note that extreme out-of-range voltage may even damage certain components.
- **WAVEFORM SHAPE (QUALITY) and FREQUENCY** — A main power feed normally exhibits a nearly perfect sinusoidal waveform. If too much other equipment is drawing from the line, the shape and symmetry of the wave are subject to distortion and can damage components and/or cause a lamp shutdown. Although rare, deviation of more than ± 3 Hz from the international frequency standards of 50 Hz or 60 Hz could also cause a shutdown.
- **DUTY CYCLE** — Normally, the positive and negative portions of the waveform are equal in duration. A variation of over 10%, however, can be caused by too much equipment either added or shut down on the power line, or by using a poor or over-loaded power generator. This can also cause a shutdown.
- **SPIKES and TRANSIENTS** — Sudden changes in the line voltage, such as those caused by adding or removing overloads, can also affect projector performance. In extreme cases, such as a nearby lightning strike, internal components may even be damaged.

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MONITORING & CONTROLLING POWER VARIABLES

Depending on the degree of fluctuation and the interaction between variables, line power may degrade enough to be out-of-spec for your projector. To determine the quality of incoming line power, you **must**:

- Measure with an isolated oscilloscope— i.e., **not** a multimeter. This requires extreme caution.



**Use extreme caution when using isolated oscilloscopes!
Exposure to high voltage and/or electric shock
can cause injury or death.**

- Measure under the actual loaded conditions— i.e., with **all** other equipment up-and-running.

An ideal waveform exhibits consistent amplitude and duration with minimal AC ripple (noise). If you diagnose a power problem and the power source cannot be re-wired or changed, the appropriate correction device must be added to help ensure reliable projector performance:

- **SPIKE AND SURGE PROTECTION:** These devices monitor incoming power level and include integral power supplies that can take over when the input is too high. They monitor *only* incoming power, differing primarily in response times, maximum voltage input and limiting range, and are readily available from electronics retailers. Protection from a sudden spike requires a protection device that can respond virtually instantaneously to suppress the extra voltage from reaching the projector.
- **POWER CONDITIONING:** Power conditioners protect against most amplitude changes as well as certain spikes, and are most useful when all other waveform factors (shape, frequency, and duty cycle) are stable, but line voltage amplitude fluctuation and spikes are chronic. Their limited range may be inadequate for severe spikes or significant changes in amplitude.
- **UPS (ON-LINE):** An “Un-interruptable Power Supply” offers the greatest protection against poor power conditions. A projector connected to a large on-line UPS always receives perfect power that has been synthesized by the UPS. If the line power (to which the UPS is connected) falters or even fails entirely, the internal UPS battery immediately takes over for as long as its charge allows (an hour or so, typically). It is important to remember that the video/graphic source should also be powered by an on-line UPS.

To determine what on-line UPS you need, compare the power requirements of your projector to the power factor of the on-line UPS under consideration. Power requirements are provided in the *Specifications* section of the *User's Manual* for your projector.

For more information about power requirements, please see also TB00-09 and TB00-26. Feel free to contact Christie Technical Support for additional information.