



Storage Power Measurement

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SNIA Emerald™ Training

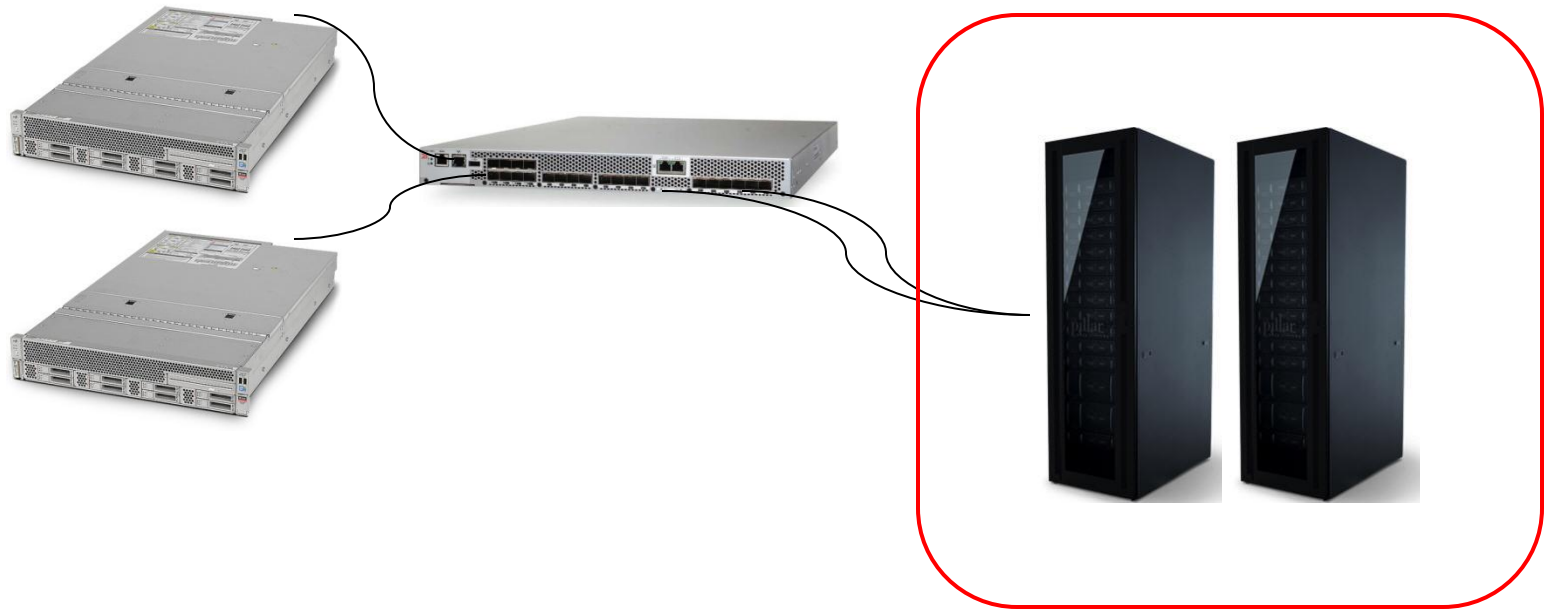
*SNIA Emerald Power Efficiency
Measurement Specification,*
for use in EPA ENERGY STAR®

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Black box boundary

- Clearly define the system which requires power measurement



Black box boundary continued

- ▶ I/O generator server may be in the same rack
 - ◆ Rack level fans, rack level controller, switch
 - ◆ What is the real system under test



Redundancy in power supplies

- Measure both power feeds
- Both power supplies operational



Systems get large

- Multiple racks of equipment to measure
- Use a clamp on the main line feed



Double check

- Power should be close to what is expected
- Verify power factor
- Voltage sense close to the load
- If using current transformer
 - ◆ Has the correct phase
 - ◆ Settings on the power meter
- Three phase setup (double check)
 - ◆ Wire correct
 - ◆ Settings on the power meter
- Syncing clocks between power meter and Vdbench

Input power requirements

➤ Input power requirements

NOMINAL INPUT VOLTAGE RANGE	Phases	AC INPUT FREQUENCY RANGE
100-120 VAC RMS	1	47 – 63 Hz
200 – 240 VAC RMS	1	47 – 63 Hz
200 - 480 VAC RMS	3	47 – 63 Hz

Power meter requirements

➤ Power Meter accuracy

Power Consumption (p)	Minimum Accuracy
$p \leq 10 \text{ W}$	$\pm 0.01 \text{ W}$
$10 < p \leq 100 \text{ W}$	$\pm 0.1 \text{ W}$
$p > 100 \text{ W}$	$\pm 1.0 \text{ W}$

- Sampling period of 5 second or less
- Sampling rate of 0.2 samples/second or greater

Environmental monitoring

- Monitor temperature during the test
 - ◆ Measure in degrees Celsius
 - ◆ Measured in 0.1 degree resolution
 - ◆ Sample in a period not greater than 1 minute
 - ◆ Measured at primary air inlet
 - › Center of the storage configuration

Difference between Emerald and ENERGY STAR

- ENERGY STAR has tighter input voltage requirements
 - ◆ For systems Equal to or less than 1500W
 - › Standard input voltages with $\pm 1.0\%$
 - › Total Harmonic Distortion (THD) of 2.0%
 - ◆ For systems greater than 1500W
 - › Standard input voltage $\pm 5.0\%$
 - › Total Harmonic Distortion (THD) of 5.0%
- With tight THD requirements need to get the power meter as close to the System Under Test
- Temperature sensor
 - ◆ Overall accuracy of $\pm 0.5\text{C}$ or better
 - ◆ 50 mm in front of the main airflow inlet