VCCS300 Series 400Hz Operation

Application Note

Overview

The purpose of this document is to inform customers of the performance characteristics of the VCCS300 series power supplies when used at 400Hz input voltage frequency.
The VCCS300 power supply characteristics are measured under various line and load conditions for both 50Hz and 400Hz. Efficiency, Power Factor and input current waveforms will be measured over the load range for input voltages of $85V_{RMS}$, $120V_{RMS}$ and $220V_{RMS}$.

Method

The plots below compare typical efficiencies, power loss, and power factors for 50Hz and 400Hz input voltages. The plots are from a VCCS300 power supply configured for its maximum output power configuration and derated output power configuration. They include the full load range for $85V_{RMS}$, $120V_{RMS}$ and $220V_{RMS}$. The unit has a nominal output voltage of 24V, output current of 12.5A and an output power of 300W. The derated output current is 8.9A and derated output power is 213.6W, when Vin = $85V_{RMS}$.

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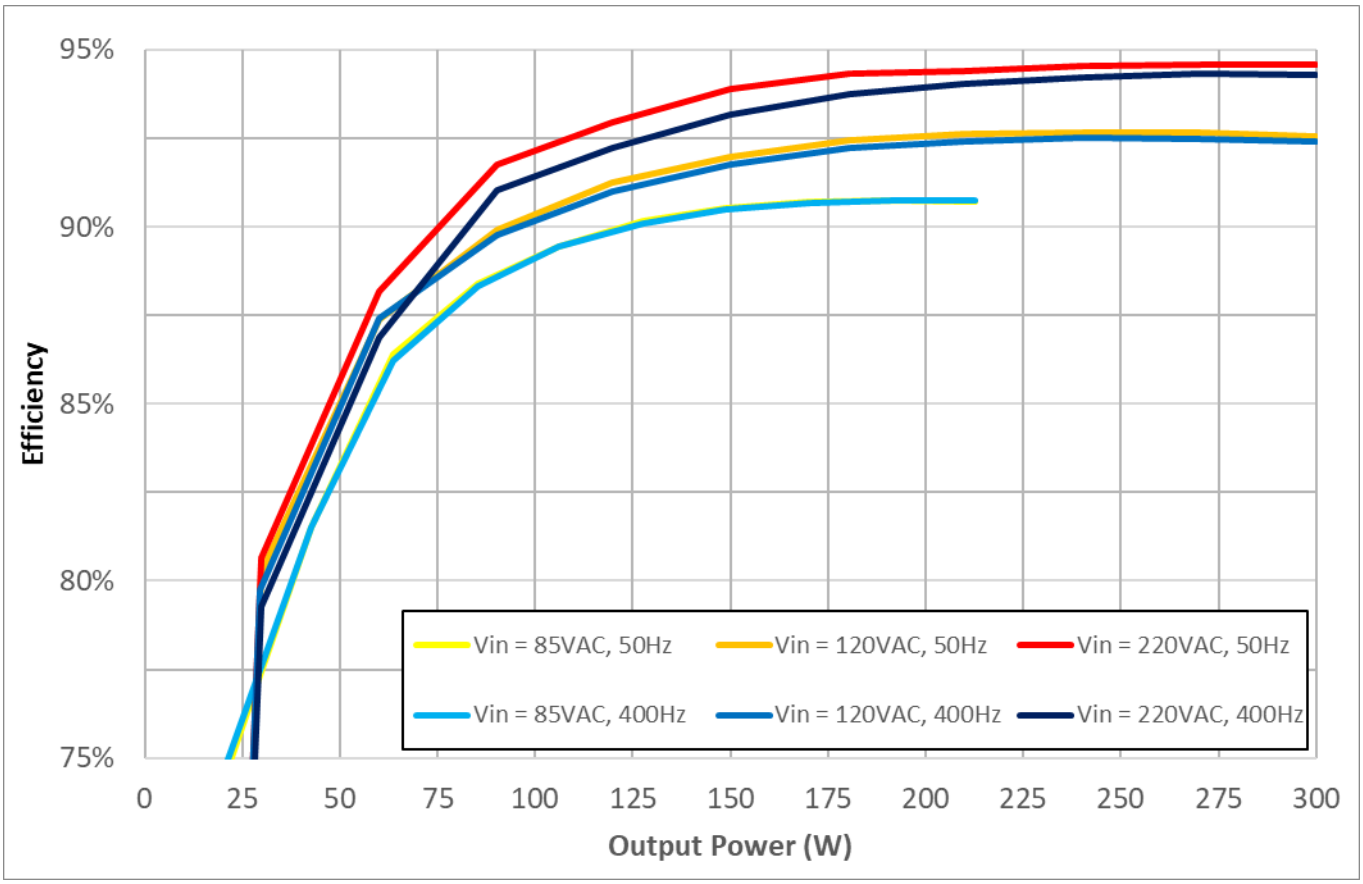
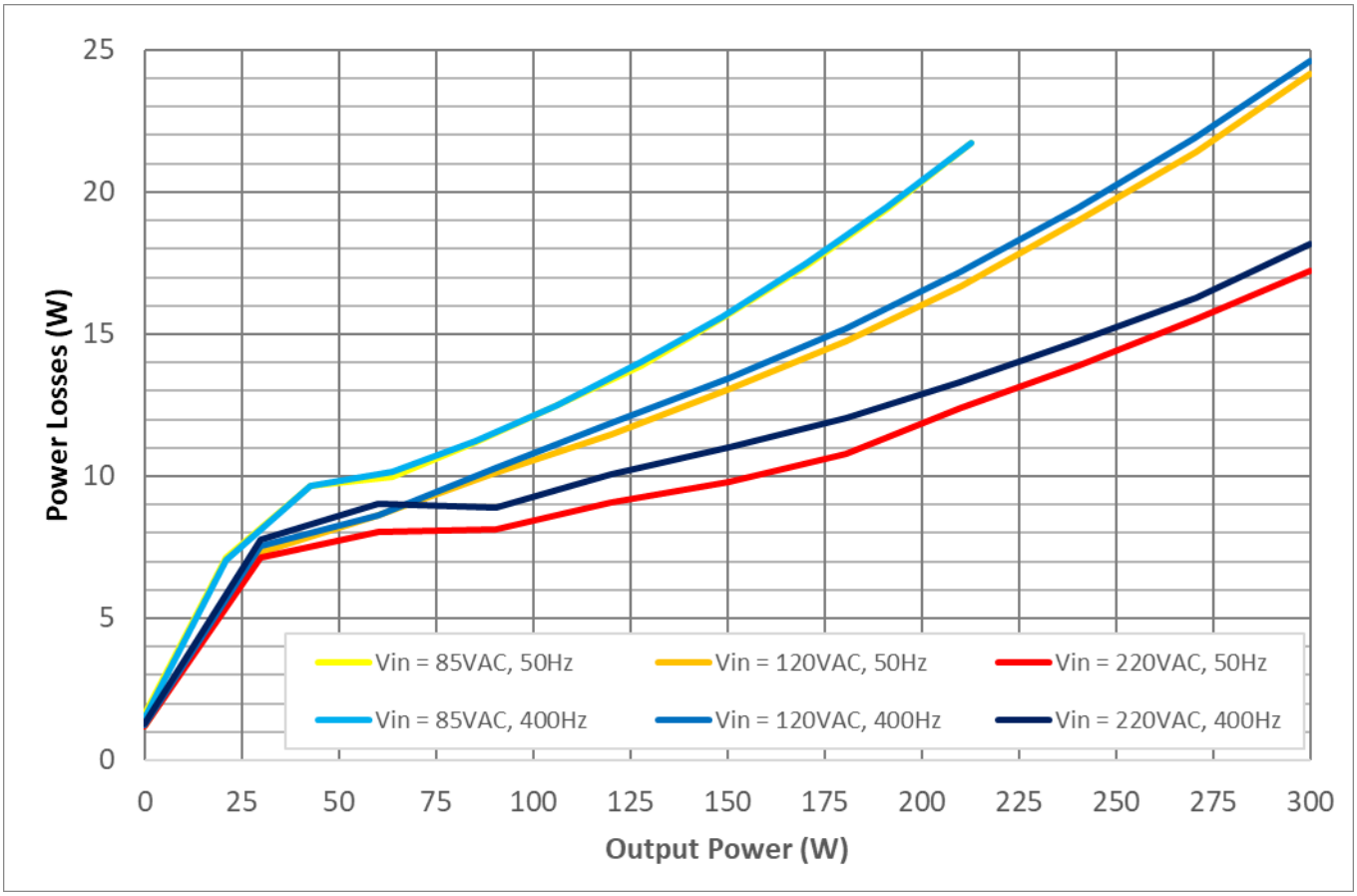
VCSS300 24V

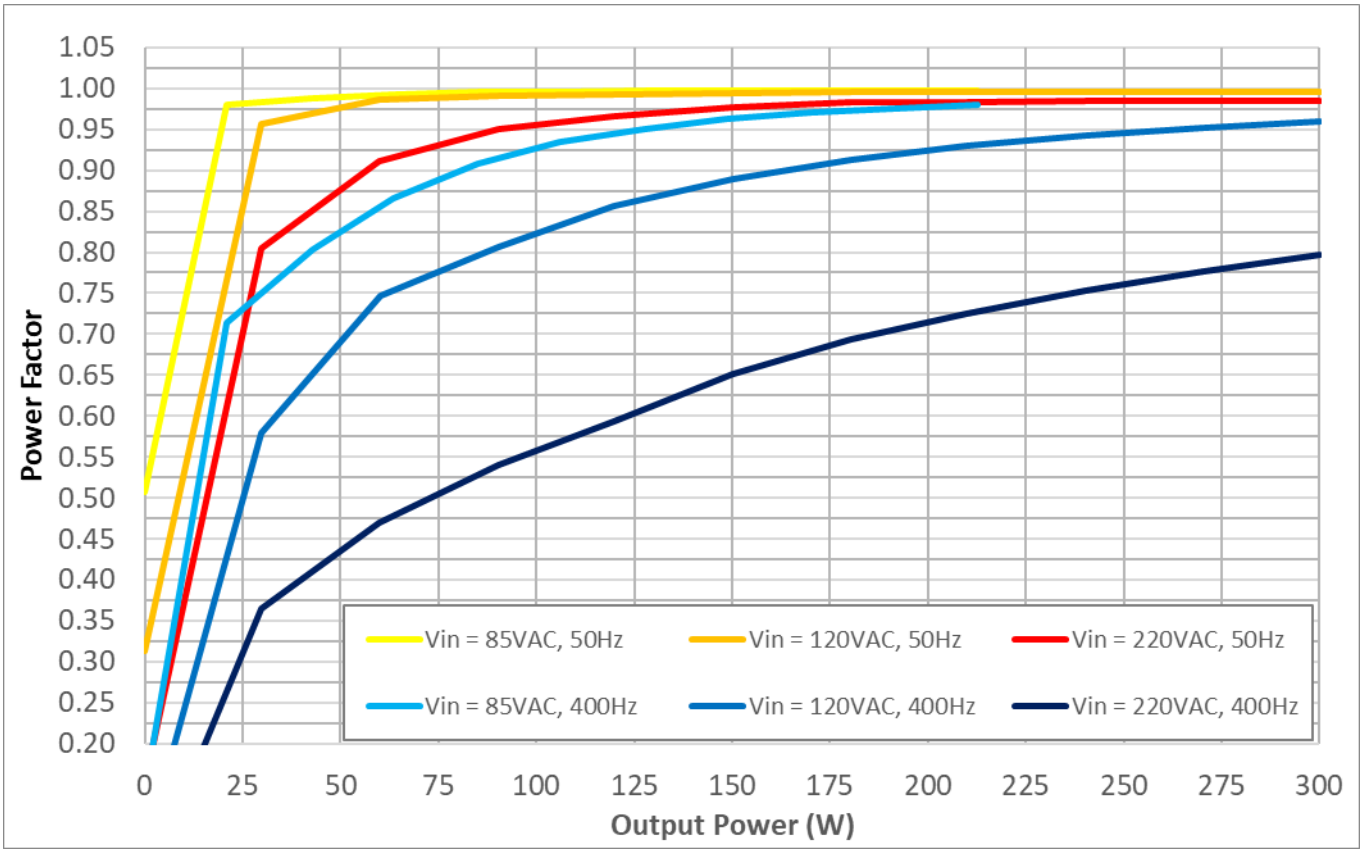
Efficiency



Power Loss

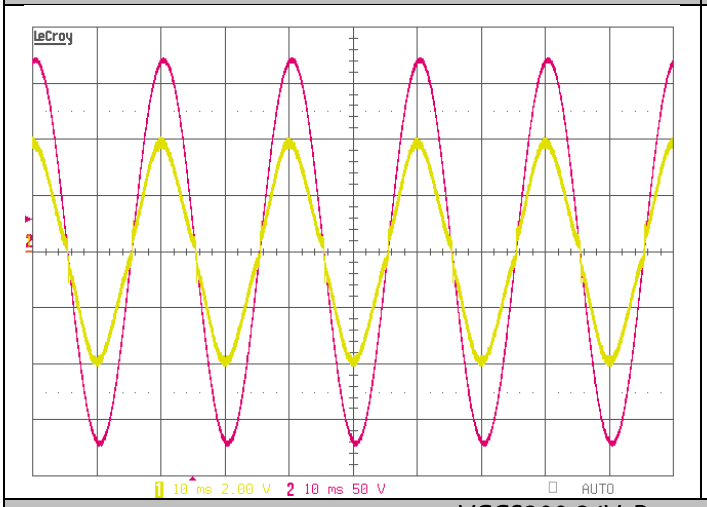
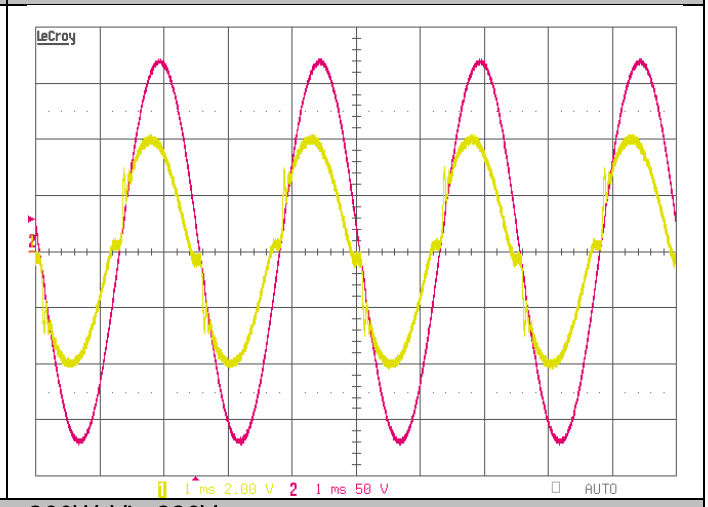
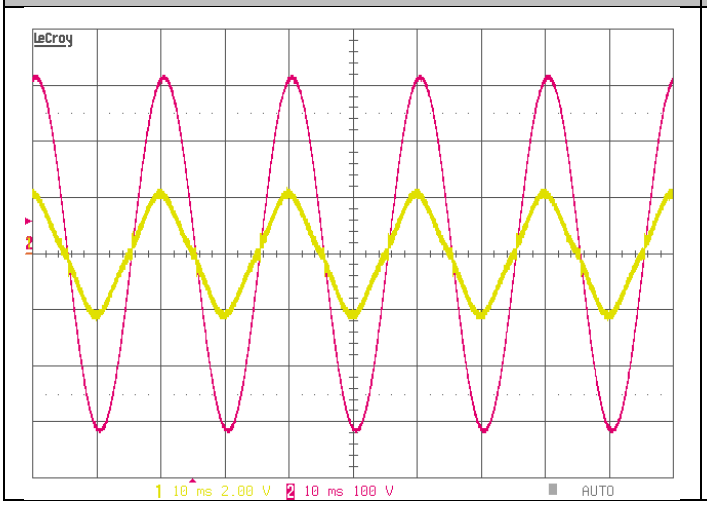
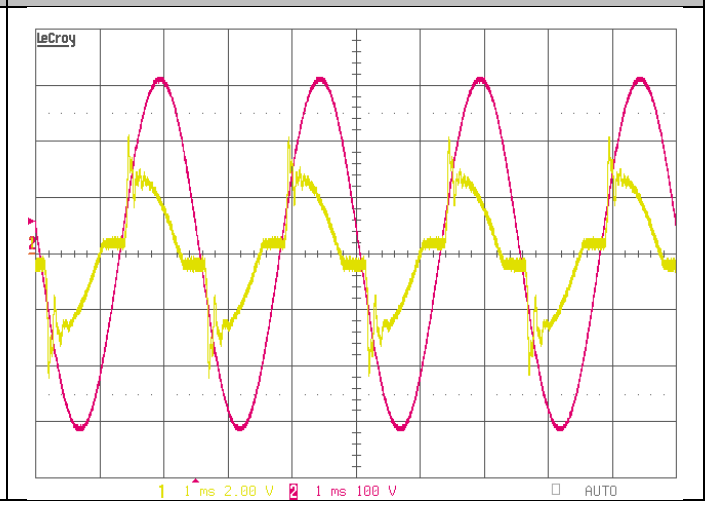

25
20
15
10
5
0
Power Losses (W)
0
25
50
75
100
125
150
175
200
225
250
275
300
Output Power (W)
Vin = 85VAC, 50Hz
Vin = 120VAC, 50Hz
Vin = 220VAC, 50Hz
Vin = 85VAC, 400Hz
Vin = 120VAC, 400Hz
Vin = 220VAC, 400Hz

Power Factor



Waveforms

In the graphs below channel 1 (2A/division) in yellow is the input current waveform and channel 2 in pink is the input voltage waveform. For 50Hz the time is 10ms/division and for 400Hz it is 1ms/division.

VCCS300 24V, Pout = 300W, Vin $120V_{RMS}$	
50Hz	400Hz
	
VCCS300 24V, Pout = 300W, Vin $220V_{RMS}$	
50Hz	400Hz
	

Other Considerations

Customer should be aware that input to earth leakage currents will increase in proportion to the input voltage frequency.

Conclusions

1. The VCCS300 Series power supplies show a small decrease in efficiency when operated at 400Hz input voltage frequency. An additional 10% power derating is recommended.
2. The power factor can be severely reduced at 400Hz input voltage especially at high input voltages and low loads. The data provided in this document should be examined carefully when specifying the VCCS300 series in 400Hz systems.