

9 Performance Data

All measurements performed at room temperature, 50 Hz input frequency.

9.1 Efficiency

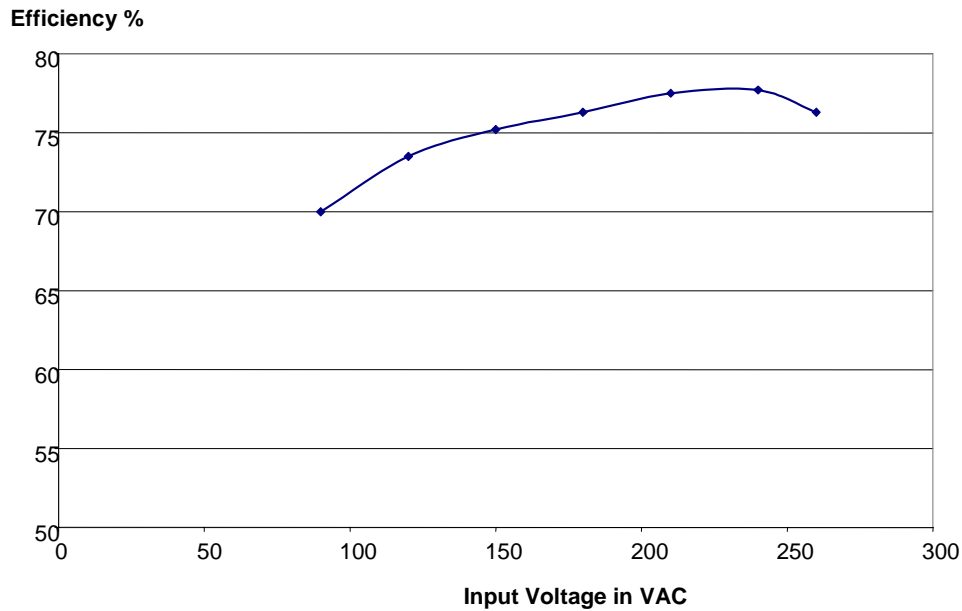


Figure 6- Efficiency vs. Input Voltage, Room Temperature, 50 Hz.

9.2 No-load Input Power

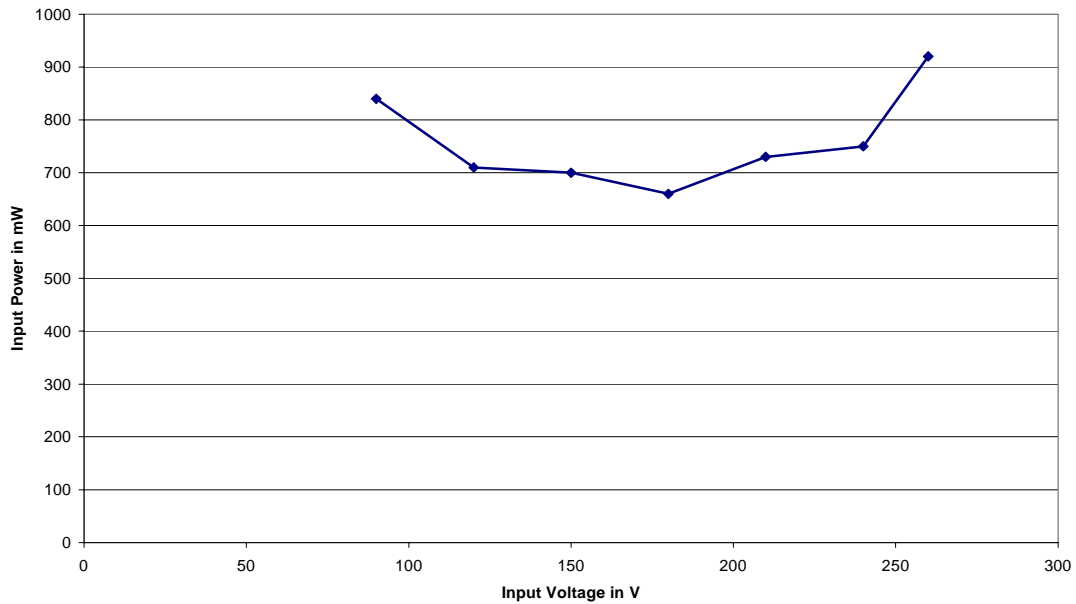


Figure 7- Zero Load Input Power vs. Input Line Voltage, Room Temperature, 50 Hz.



9.3 Regulation

9.3.1 Line Regulation (Transformer Outputs only)

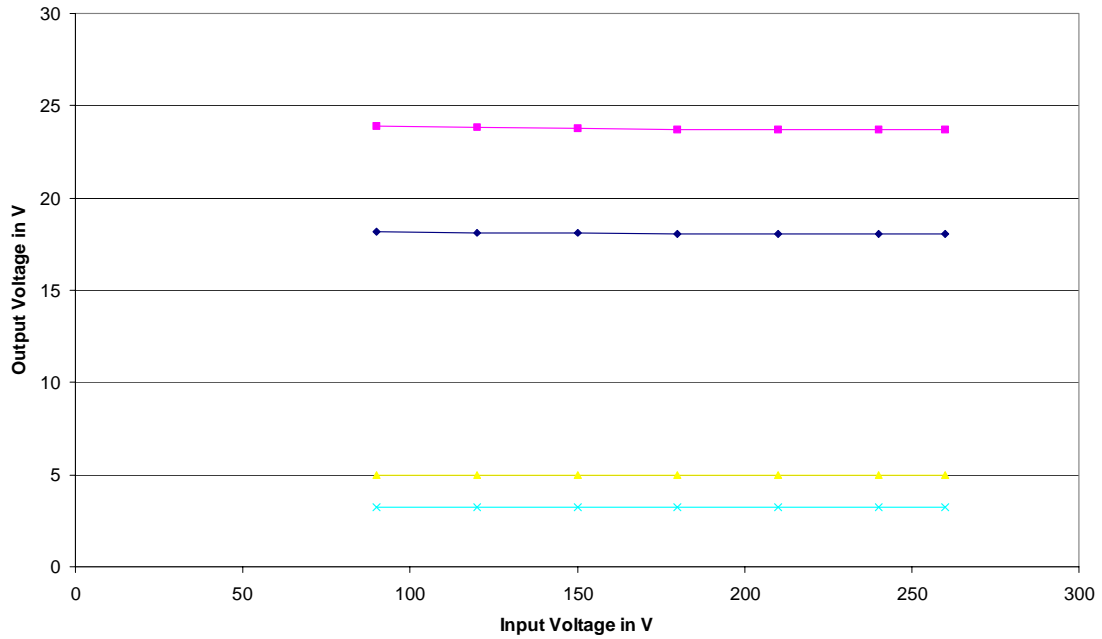


Figure 8 – Line Regulation, Room Temperature, Full Load.



9.3.2 Cross Regulation (18V Output)

	23V Rail (A)	5V Rail (A)	3V3 Rail (A)
Min Load (X)	0.2	0.55	0.23
Max Load (M)	0.6	1.8	1.3
Load Combinations	Voltage (V)	Voltage (V)	Voltage (V)
23V - 5V - 3V3			
XXX	23.24	5.01	3.26
XXM	24.3	5.2	3.2
XXM	24.01	4.84	3.32
MXX	22.73	4.98	3.25
XMM	24.88	5.01	3.23
MMX	23.16	4.86	3.29
MMM	23.76	4.99	3.22
Min (V)	22.73	4.84	3.2
Max (V)	24.88	5.2	3.32
% Below	-1.17	-3.20	-3.03
% Above	8.17	4.00	0.61

9.3.3 Cross Regulation (23V Output)

	18V Rail (A)	5V Rail (A)	3V3 Rail (A)
Min Load (X)	0.2	0.55	0.23
Max Load (M)	0.6	1.8	1.3
Load Combinations	Voltage (V)	Voltage (V)	Voltage (V)
18V - 5V - 3V3			
XXX	18.08	4.98	3.22
XXM	18.76	5.22	3.19
XXM	18.49	4.8	3.34
MXX	17.18	4.95	3.25
XMM	19.34	5	3.23
MMX	17.58	4.86	3.3
MMM	18.05	4.98	3.23
Min (V)	17.18	4.8	3.19
Max (V)	19.34	5.22	3.34
% Below	-4.56	-4.00	-3.33
% Above	7.44	4.40	1.21



Thermal Performance

Temperature		
Item	90 VAC	260 VAC
Ambient	25°C	25°C
Common Mode Choke (L5)	43.5°C	26°C
Bridge (D4, D5, D9, D10)	42.5°C	37°C
Transformer (T1)	56°C	53.5°C
Clamp Resistor (R5)	46°C	31°C
TOPSwitch (U1)	69.5°C	62°C
Rectifier D2	48.5°C	41°C
Rectifier D3	39.5°C	37°C
Rectifier D6	41.5°C	39°C
Rectifier D8	41°C	39.5°C
Resistor R21	56.5°C	56°C



10 Waveforms

10.1 Drain Voltage and Current, Normal Operation

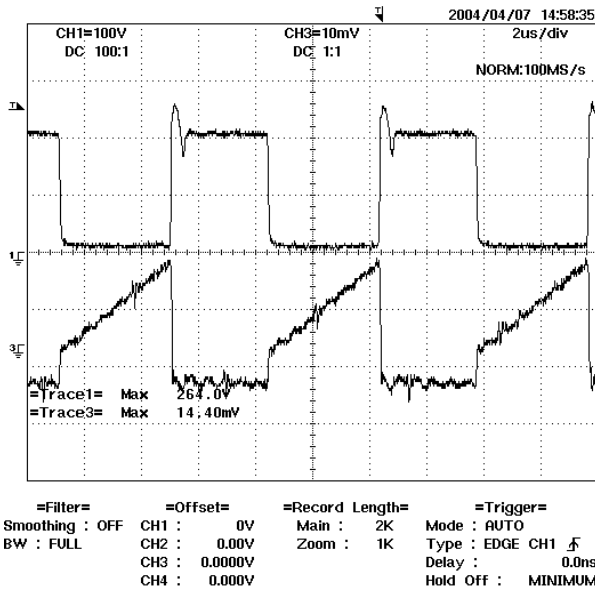


Figure 9 - 90 VAC, Full Load.

Upper: I_{DRAIN} , 0.5 A / div
Lower: V_{DRAIN} , 100 V, 2 μ s / div

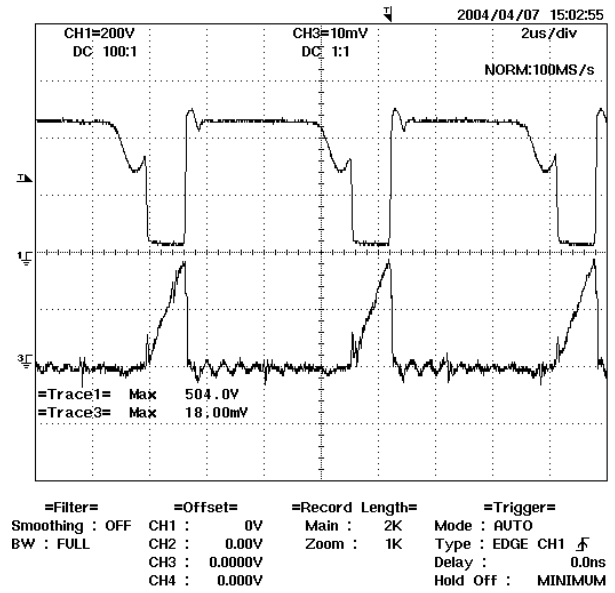


Figure 10 - 265 VAC, Full Load

Upper: I_{DRAIN} , 0.5 A / div
Lower: V_{DRAIN} , 200 V / div

10.2 Output Voltage Start-up Profile (from Transformer Outputs only)

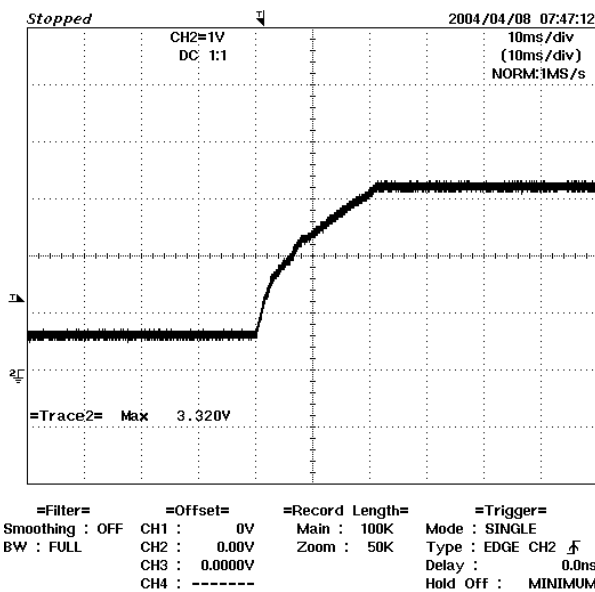


Figure 11 - 3V3 Start-up Profile, 90VAC
1 V, 10 ms / div.

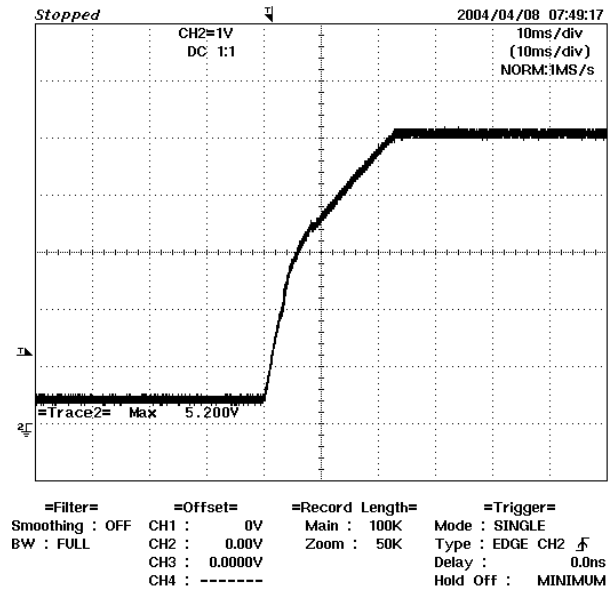


Figure 12 - 5V Start-up Profile, 90 VAC
1 V, 10 ms / div.



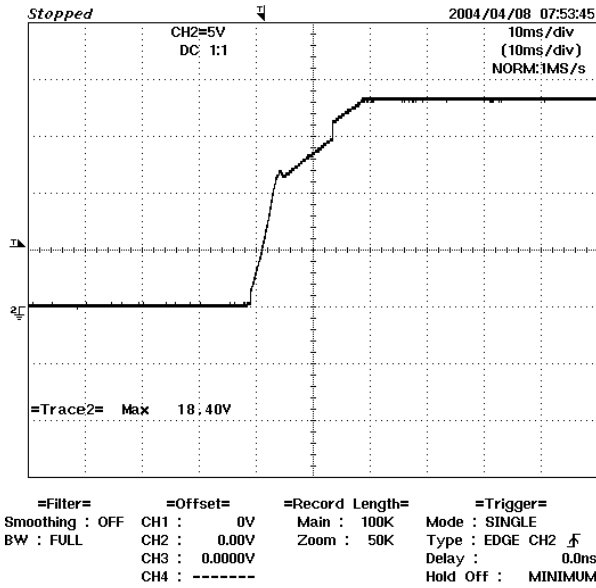


Figure 13 – 18V Start-up Profile, 90VAC
5 V, 10 ms / div.

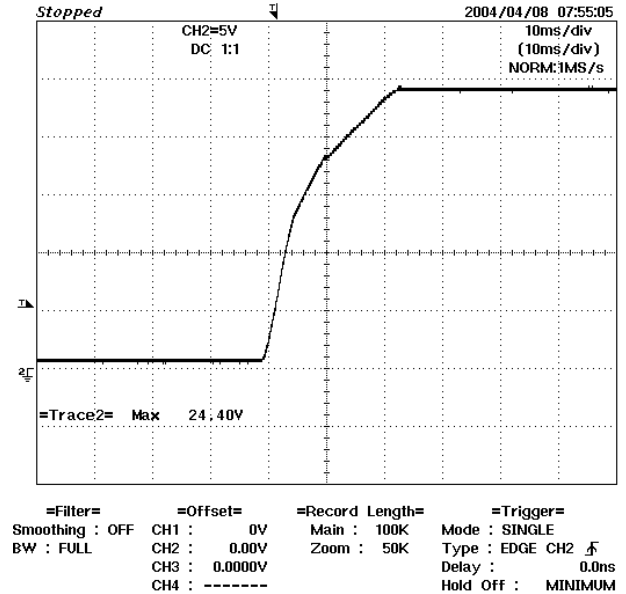


Figure 14 – 23V Start-up Profile, 90 VAC
5 V, 10 ms / div.

10.3 Drain Voltage and Current Start-up Profile

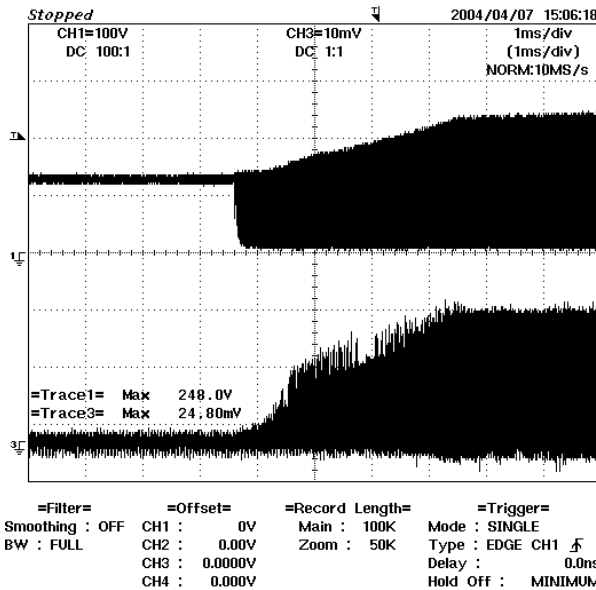


Figure 15 - 90 VAC Input and Maximum Load.
Upper: I_{DRAIN} , 0.5 A / div.
Lower: V_{DRAIN} , 100 V & 1 ms / div.

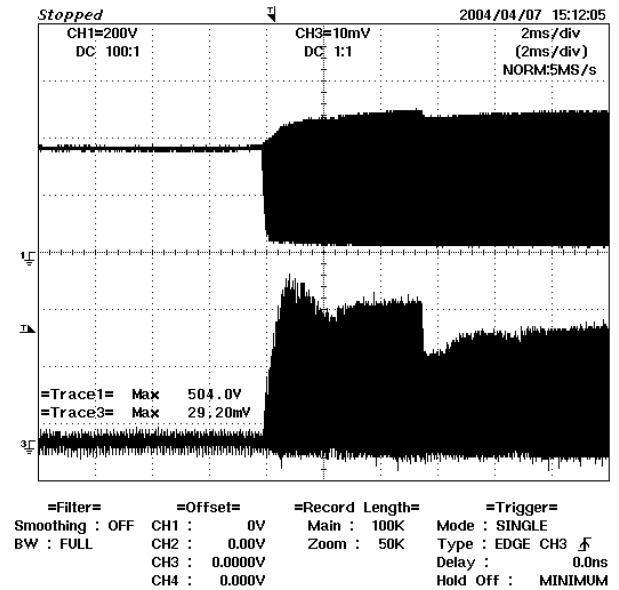


Figure 16 - 265 VAC Input and Maximum Load.
Upper: I_{DRAIN} , 0.5 A / div.
Lower: V_{DRAIN} , 200 V & 1 ms / div.

10.4 Load Transient Response

In the figures shown below, signal averaging was used to better enable viewing the load transient response. The oscilloscope was triggered using the load current step as a trigger source. Since the output switching and line frequency occur essentially at random



with respect to the load transient, contributions to the output ripple from these sources will average out, leaving the contribution only from the load step response.

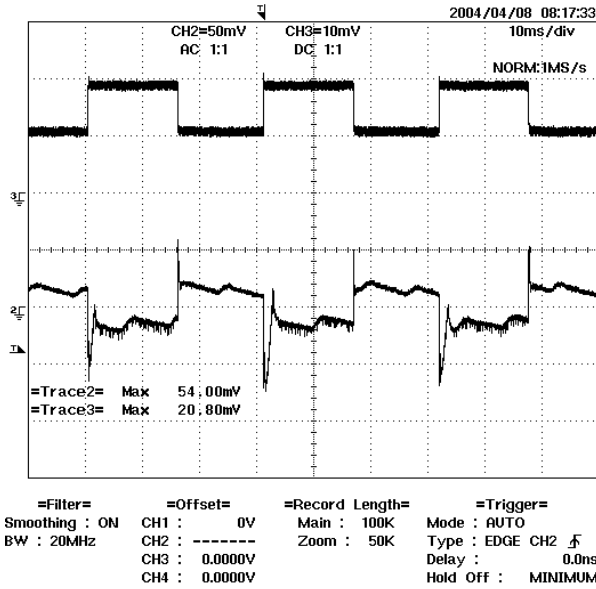


Figure 17 – Transient Response, 90 VAC, 60-100-60% Load Step.
Top: Load Current, 1 A/div.
Bottom: 3V3 Output Voltage
10 mV, 10 ms / div.

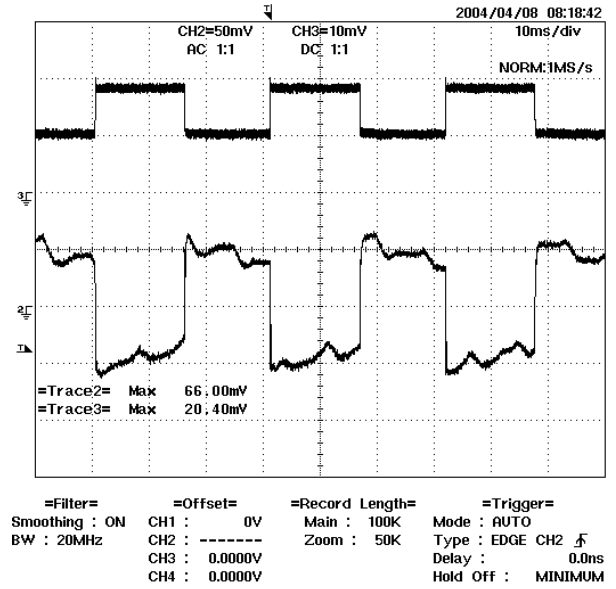


Figure 18 – Transient Response, 90 VAC, 60-100-60% Load Step
Upper: Load Current, 1 A/ div.
Bottom: 5V Output Voltage
10 mV, 10 ms / div.

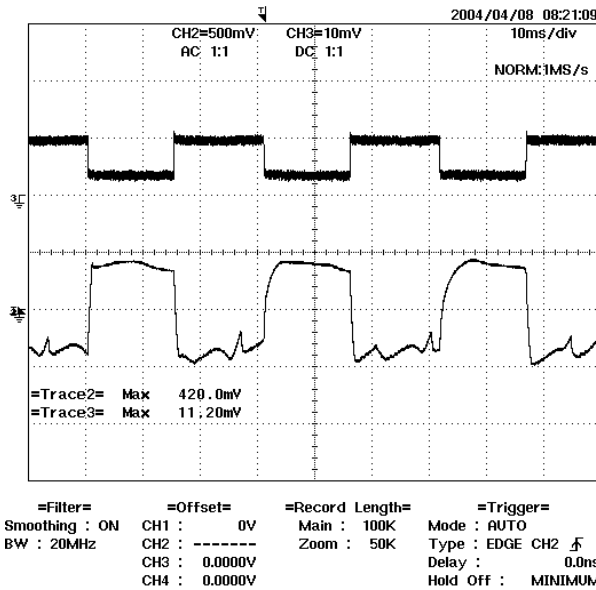


Figure 19 – Transient Response, 90 VAC, 50-100-50% Load Step.
Top: Load Current, 0.5 A/div.
Bottom: 18V Output Voltage
10 mV, 10 ms / div.

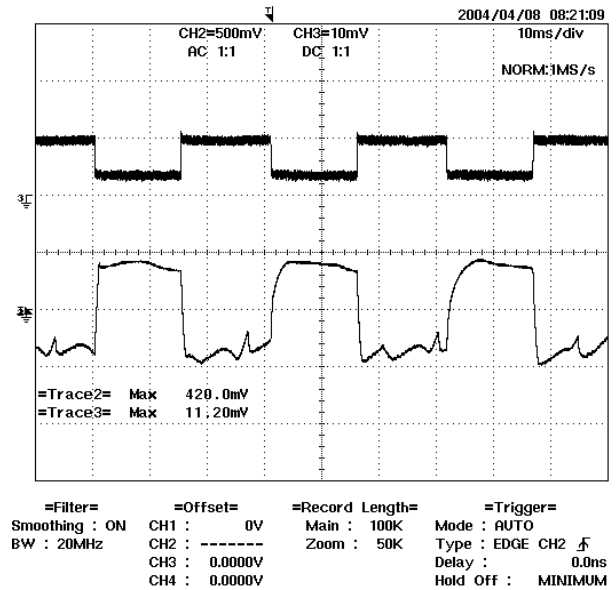


Figure 20 – Transient Response, 90 VAC, 50-100-50% Load Step
Upper: Load Current, 0.5 A/ div.
Bottom: 23V Output Voltage
10 mV, 10 ms / div.

Output Ripple Measurements

10.4.1 Ripple Measurement Technique

For DC output ripple measurements, a modified oscilloscope test probe must be utilized in order to reduce spurious signals due to pickup. Details of the probe modification are provided in Figure 21 and Figure 22.

The 5125BA probe adapter is affixed with two capacitors tied in parallel across the probe tip. The capacitors include one (1) 0.1 $\mu\text{F}/50\text{ V}$ ceramic type and one (1) 1.0 $\mu\text{F}/50\text{ V}$ aluminum electrolytic. **The aluminum electrolytic type capacitor is polarized, so proper polarity across DC outputs must be maintained (see below).**

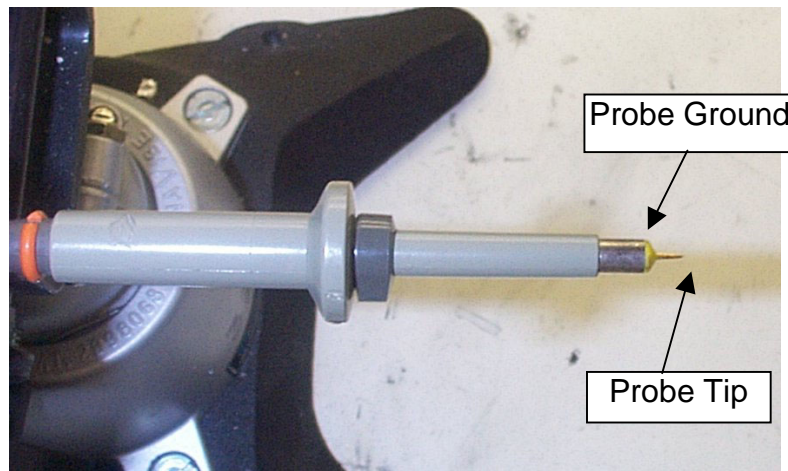


Figure 21 - Oscilloscope Probe Prepared for Ripple Measurement. (End Cap and Ground Lead Removed)

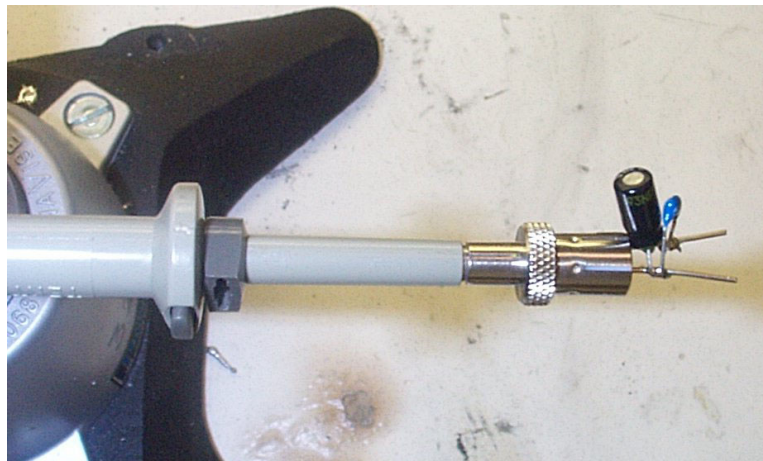


Figure 22 - Oscilloscope Probe with Probe Master 5125BA BNC Adapter. (Modified with wires for probe ground for ripple measurement, and two parallel decoupling capacitors added)

10.4.2 Measurement Results (Transformer Outputs only)

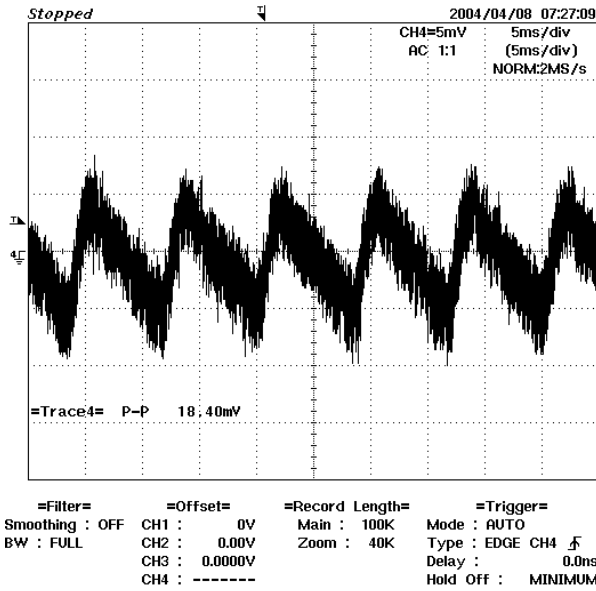


Figure 23 – 3V3Ripple, 90 VAC, Full Load.
5 ms, 5 mV / div

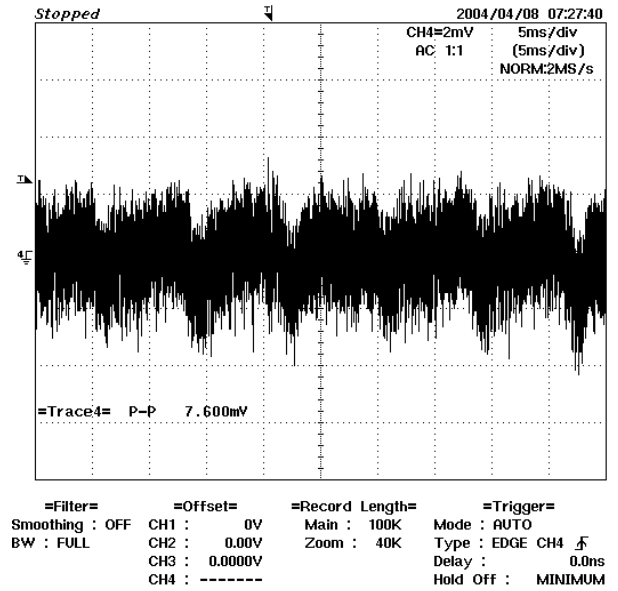


Figure 24 – 3V3 Ripple, 265 VAC, Full Load.
5 ms, 5 mV / div

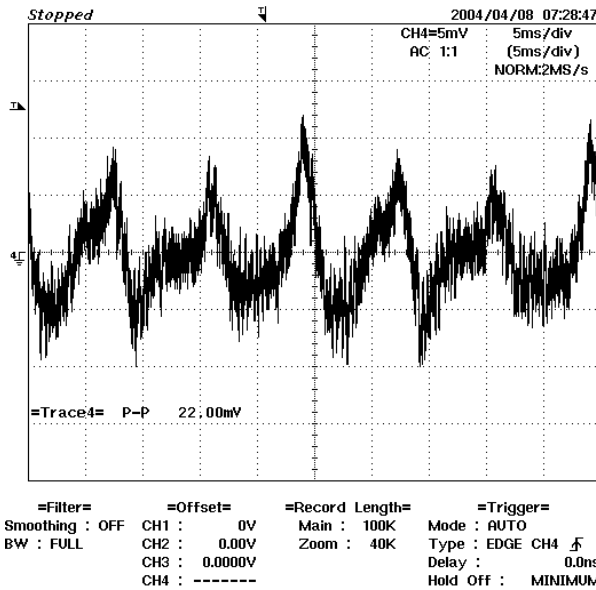


Figure 25 – 5V Ripple, 90 VAC, Full Load.
2 ms, 5 mV / div

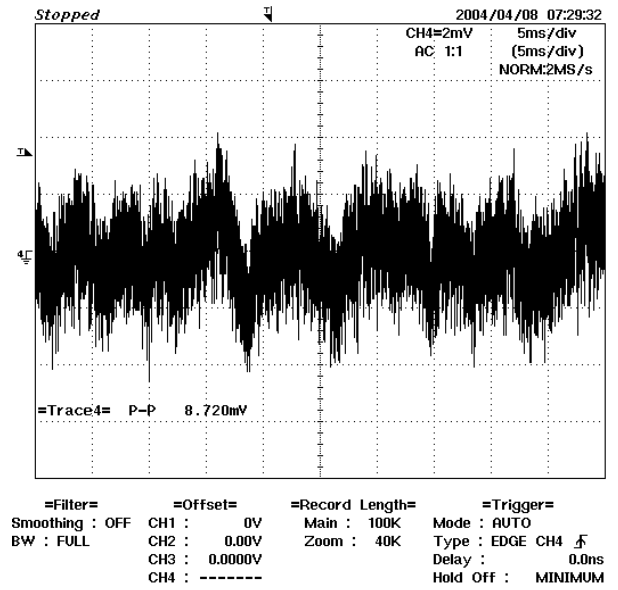


Figure 26 - 5 V Ripple, 265 VAC, Full Load.
2 ms, 2 mV / div

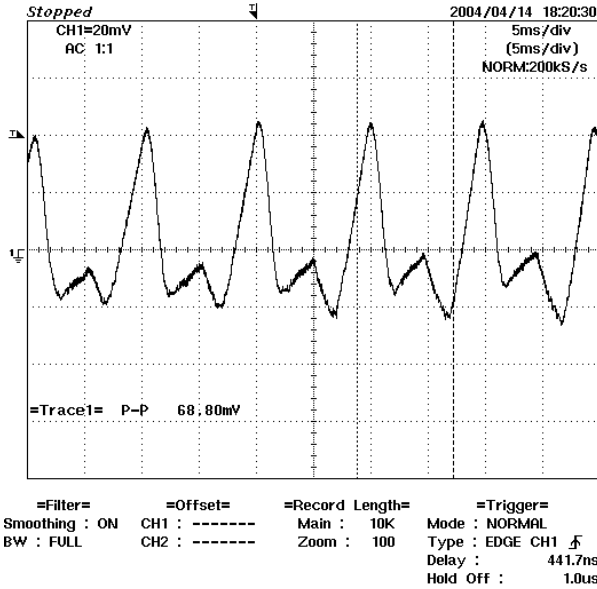


Figure 27 – 18V Ripple, 90 VAC, Full Load.
 5 ms, 20 mV / div

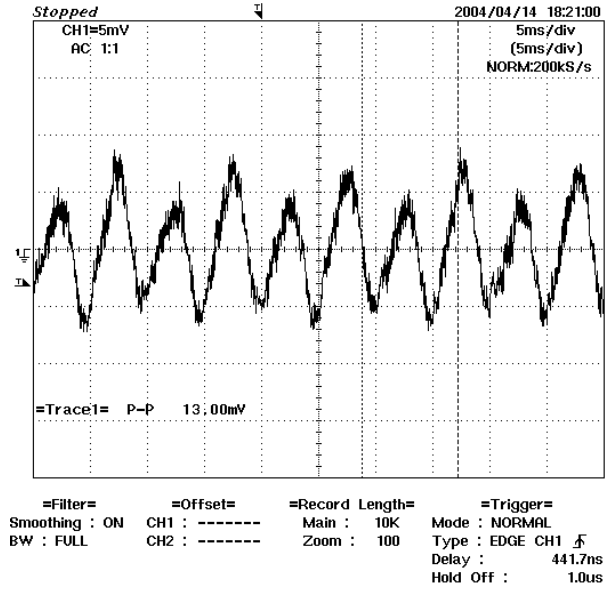


Figure 28 - 18V Ripple, 265 VAC, Full Load.
 5 ms, 20 mV / div

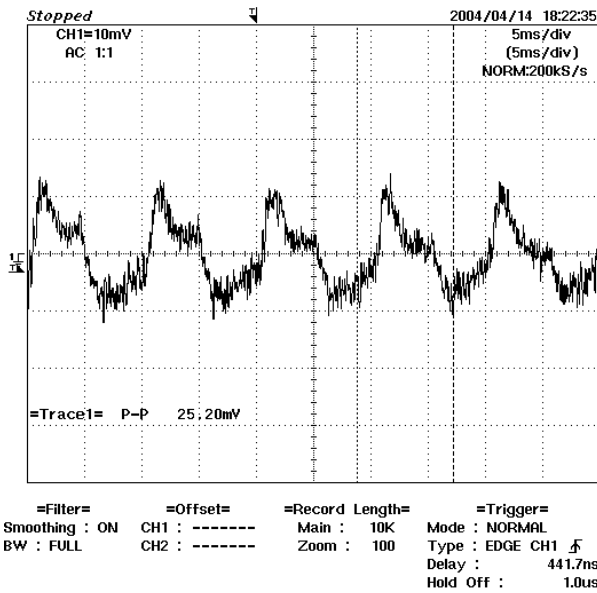


Figure 29 – 23V Ripple, 90 VAC, Full Load.
 2 ms, 50 mV / div

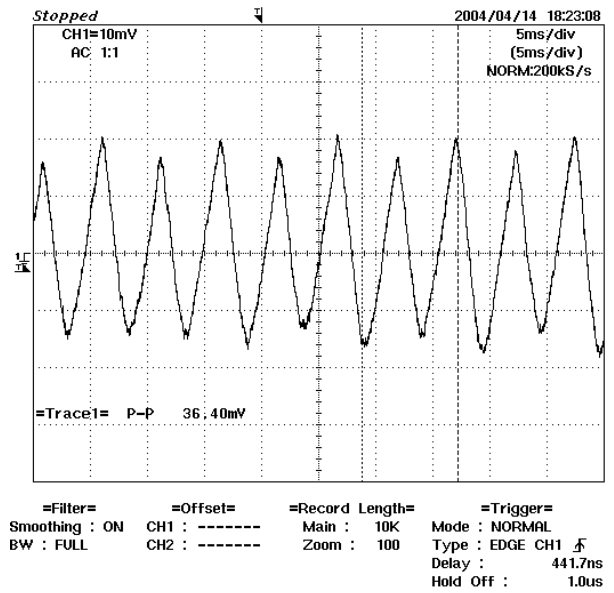


Figure 30 – 23V Ripple, 265 VAC, Full Load.
 5 ms, 20 mV / div



11 Conducted EMI

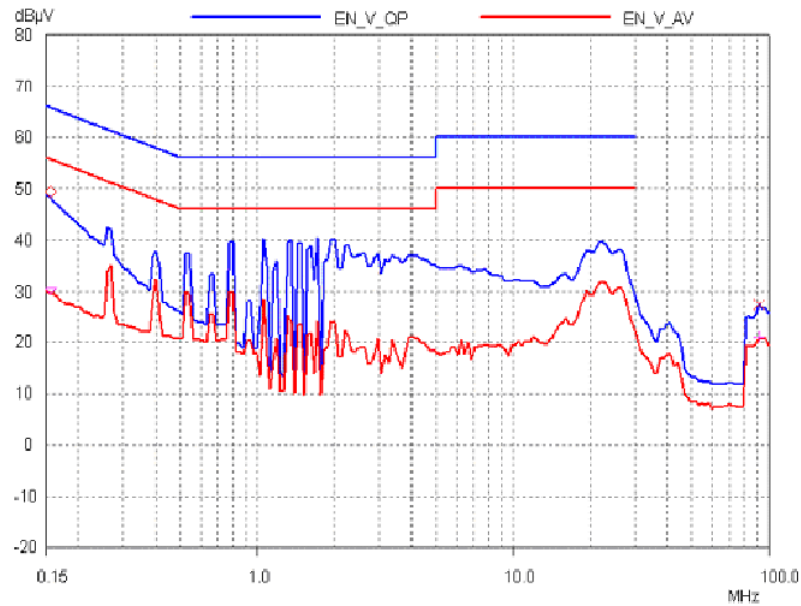


Figure 32 - Conducted EMI, Maximum Steady State Load, 115 VAC, 50 Hz, and EN55022 B Limits, Artificial Hand not connected

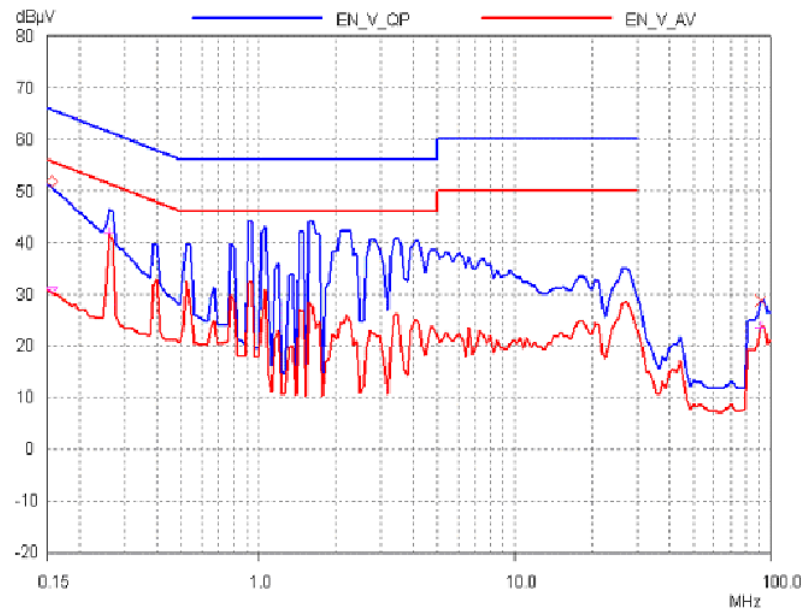


Figure 33 - Conducted EMI, Maximum Steady State Load, 230 VAC, 50 Hz, and EN55022 B Limits. Artificial Hand connected



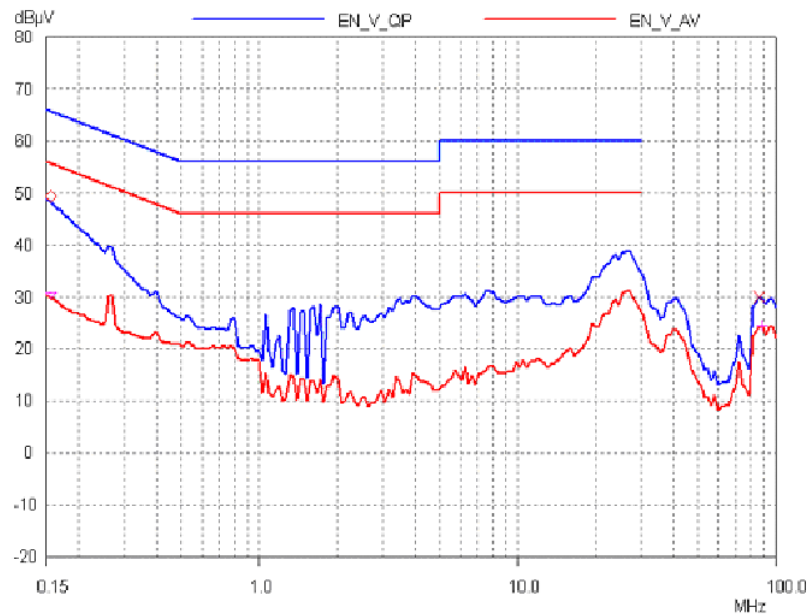


Figure 34 - Conducted EMI, Maximum Steady State Load, 115 VAC, 50 Hz, and EN55022 B Limits, Artificial Hand connected to secondary ground

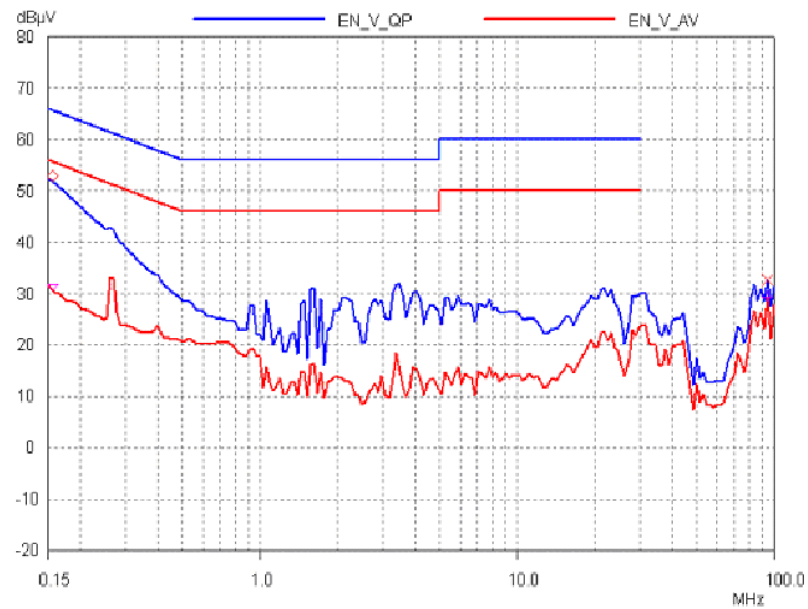


Figure 35 - Conducted EMI, Maximum Steady State Load, 230 VAC, 50 Hz, and EN55022 B Limits. Artificial Hand connected to secondary ground



12 Revision History

Date	Author	Revision	Description & changes	Reviewed
April 20, 2005	HM	1.0	Initial Release	VC / AM



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