

CLAIMS

What is claimed is:

- 5 1. A digital high voltage power supply comprising:
- a. a high voltage plant configured to receive a low voltage and generate a high voltage signal containing unwanted sinusoidal noise, the high voltage plant comprising at least one of: a transformer, a transistor, and a high voltage multiplier;
- 10 b. a plurality of filters, wherein at least one filter of the plurality of filters is connected to the high voltage plant, and at least one filter of the plurality of filters forms a high voltage output;
- c. a high voltage divider configured to receive the high voltage output and generate a scaled voltage feedback signal;
- 15 d. a processor with memory containing a plurality of operating set points, the processor connected to the low voltage and the high voltage plant, the processor configured to:
- (i) receive the scaled voltage feedback signal from the high voltage divider;
- (ii) compare the scaled voltage feedback signal to the plurality of operating set points in the memory;
- 20 (iii) compute and store in the memory, at least one revised operating set point using the compared scaled voltage feedback signal; and

- (iv) use the at least one revised operating set point to simultaneously and automatically regulate the high voltage output within all operating set points of the plurality of operating set points.
2. The digital high voltage power supply of claim 1, comprising simultaneously and automatically transmitting the alert 37 an alert through a communication protocol or discrete I/O signals.
3. The digital high voltage power supply of claim 1, comprising a temperature sensor connected to the processor.
4. The digital high voltage power supply of claim 1, wherein the plurality of operating set points is variable based on user defined parameters.
5. The digital high voltage power supply of claim 1, comprising a second feedback loop connected a current to voltage converter providing another feedback signal to the processor.
6. The digital high voltage power supply of claim 1, wherein at least one operating set points of the plurality of operating set points are analog operating set points, digital operating set points or analog and digital operating set points.
7. The digital high voltage power supply of claim 1, comprising a ripple and digital hunting mitigation in the memory.
8. The digital high voltage power supply of claim 1, comprising a second power supply electrically connected between the processor and the high voltage plant.
9. The digital high voltage power supply of claim 8, comprising a voltage divider configured to receive a second voltage output from the high voltage plant, and generate a second scaled voltage feedback signal.

10. The digital high voltage power supply of claim 9, wherein the second power supply comprises: a non-synchronous buck, a non-synchronous boost, a synchronous buck [[103]] or a synchronous boost.
- 5 11. The digital high voltage power supply of claim 1, wherein the alert comprises: a plurality of communication signals all operating simultaneously to convey different commands and data.
12. The digital high voltage power supply of claim 1, comprising a current to voltage converter providing a feedback signal to the processor used to adjust the at least one revised operating set point, and wherein the feedback signal does not exceed one
10 operating set point of the plurality of operating set points stored in the memory.
13. The digital high voltage power supply of claim 1, comprising a first preset value in the memory for adjusting a speed at which the output voltage reaches an operating set point of the plurality of operating set points after output is enabled of the high voltage power
15 supply.
14. The digital high voltage power supply of claim 1, comprising a second preset value in the memory for adjusting a speed at which the output voltage is adjusted due to changing load conditions.
15. The digital high voltage power supply of claim 1, wherein the processor configured to
20 generate an alert when output conditions exceed any operating set points of the plurality of operating set points.