

CLAIMS

What is claimed is:

1. An arc detection system comprising:
a level detector module configured to generate a level signal in accordance with
5 an AC signal applied to a non-linear load, wherein the level signal includes at least one
of a first state or a second state in accordance with a magnitude of the AC signal; and
a timer module configured to receive the level signal and to generate a timing
signal in accordance with a duration of one of the first state or the second state of the
level signal,
10 wherein an arc condition in the non-linear load is indicated when the timing signal
meets a selected criteria.
2. The arc detection system of claim 1 wherein the selected criteria is met
when the timing signal is at least one of less than a first threshold or greater than a second
threshold.
- 15 3. The arc detection system of claim 1 wherein the AC signal is generated by
a first RF power supply.
4. The arc detection system of claim 1 wherein the level detector module is
configured to convert the AC signal from an analog signal to a binary signal and the binary
signal includes the first state and the second state, wherein the first state or the second
20 state occurs when the magnitude of the AC signal is one of greater than or less than a
level threshold and the second state occurs when the magnitude of the AC signal is an
other of greater than or less than the level threshold.
5. The arc detection system of claim 1 wherein the level detector module
comprises a circuit receiving the AC signal and generating the level signal in accordance
25 with the AC signal and the circuit includes a zero-crossing detector.
6. The arc detection system of claim 1 wherein the level detector module
comprises an analog-to-digital converter configured to receive the AC signal and convert
the AC signal to a plurality of digital values in accordance with the magnitude of the AC

signal, wherein a first plurality of the digital values defines the first state and a second plurality of the digital values defines the second state.

7. The arc detection system of claim 1 further comprising:
a first power source generating the AC signal; and
5 a second power source generating a second AC signal applied to the non-linear load,
wherein the arc condition is indicated in accordance with power reflected from the non-linear load to the second power source and the timing signal.

8. The arc detection system of claim 7 wherein:
10 the AC signal is a first RF signal and the second AC signal is a second RF signal,
and
the first RF signal and the second RF signal are one of same frequencies or different frequencies.

9. The arc detection system of claim 1 wherein the non-linear load is a plasma
15 chamber.

10. The arc detection system of claim 1 wherein the AC signal operates at a first frequency, and the AC signal operates at a second frequency during the arc condition, and the second frequency is at least double the first frequency.

11. A RF power generator system comprising:
20 a first RF power source configured to generate a first RF signal to a non-linear load;
a second RF power source configured to generate a second RF signal to the load;
and
an arc detector configured to receive a sense signal that varies in accordance with
25 the first RF signal, the arc detector further configured to:
determine whether a frequency of the sense signal is one of less than a first selected threshold or greater than a second selected threshold; and
indicate an arc condition when the frequency of the sense signal is one of less than the first selected threshold or greater than the second selected threshold.

12. The RF power generator system of claim 11 wherein the arc detector further comprises:

5 a level detector configured to receive the sense signal and to generate a level signal in accordance with the sense signal, wherein the level signal is assigned to at least one of a first state or a second state in accordance with a magnitude of the first RF signal; and

10 a counter configured to receive the level signal and to generate a frequency signal in accordance with a duration of at least one of the first state or the second state, wherein the frequency signal varies in accordance with the frequency of the sense signal, and wherein the frequency of the sense signal varies in accordance with the frequency of the first RF signal.

13. The RF power generator system of claim 11 wherein the arc detector further comprises:

15 a filter configured to receive the sense signal and filter out at least a portion of components from the second RF signal to generate a filtered signal;

a level detector configured to receive the sense signal and to generate a level signal in accordance with the sense signal, wherein the level signal is assigned to at least one of a first state or a second state in accordance with a magnitude of the first RF signal; and

20 a counter configured to receive the level signal and to generate a frequency signal in accordance with a duration of at least one of the first state or the second state, wherein the frequency signal varies in accordance with the frequency of the sense signal, and wherein the frequency of the sense signal varies in accordance with the frequency of the first RF signal.

25 14. The RF power generator system of claim 13 wherein the level detector is configured to convert the first RF signal from an analog signal to a binary signal and the binary signal includes the first state and the second state, wherein one of the first state is assigned when the magnitude of the first RF signal is one of greater than or less than a level threshold and the second state is assigned when the magnitude of the first RF
30 signal is an other of greater than or less than the level threshold.

15. The RF power generator system of claim 11 wherein the arc detector further comprises:

an analog-to-digital converter configured to receive the sense signal and to output a digital signal that varies in accordance with a magnitude of the sense signal; and

5 a counter configured to receive the digital signal and determine a period of a portion of the sense signal in accordance with the digital signal, wherein the period of the portion of the sense signal varies in accordance with the frequency of the digital signal, and wherein the frequency of the sense signal varies in accordance with the frequency of the first RF signal.

10 16. The RF power generator system of claim 11 wherein the frequency of the frequency of the sense signal is determined using a Fast Fourier Transform (FFT).

17. A method for detecting an arc in a non-linear load, comprising:

detecting an AC signal applied to the load;

determining a frequency of the AC signal applied to the load; and

15 indicating an arc condition if the frequency meets a selected criteria.

18. The method of claim 17 wherein the selected criteria is met when the frequency is at least one of less than a first threshold or greater than a second threshold.

19. The method of claim 17 wherein determining the frequency further comprises:

20 converting a sensed signal that varies in accordance with the AC signal to a digital signal, wherein the digital signal includes one of a pair of states or a plurality of states, and wherein the plurality of states are assigned into one or another of the pair of states; and

25 determining a duration of at least one of the pair of states in order to determine the frequency of the AC signal applied to the load.

20. The method of claim 17 wherein determining the frequency further comprises:

converting a sensed signal that varies in accordance with the AC signal to a binary signal, wherein the binary signal includes a pair of states; and

determining a duration of at least one of the pair of states in order to determine the frequency of the AC signal applied to the load,

wherein the converting further includes using applying the sensed signal to a zero-crossing detector.

5 21. The method of claim 17 wherein if the frequency meets the selected criteria, comparing supplemental arc indicating parameters against selected supplemental arc indicating criteria in order to determine whether the comparing further indicates the arc condition.

10 22. The method of claim 17 wherein a first power source generates the AC signal and a second power source generates a second AC signal, further comprising:
 comparing a parameter associated with the second power source to a second selected criteria; and
 indicating the arc condition in accordance with the frequency meeting the selected criteria and the comparing the parameter associated with the second power source to
15 the second selected criteria.

 23. The method of claim 17 wherein determining the frequency further comprises:
 converting a sensed signal that varies in accordance with the AC signal to digital values using an analog-to-digital converter, wherein a first set of digital values defines a
20 first state and a second set of digital values defines a second state; and
 determining a duration of at least one of the first state and the second state in order to determine the frequency of the AC signal applied to the load.

 24. The method of claim 17 wherein determining the frequency of the AC signal applied to the load further comprises using a Fast Fourier Transform (FFT) function.