Claims

1. A system for testing circuit operation, the system comprising:

a circuit comprising a power source (310; 312), a switching element (306a; 306b), and a load (350; 352);

characterized in that the system comprises:

an analog to digital converter (304) configured to receive electrical values from a first node between the switching element (306a; 306b) and the load (350; 352), the analog to digital convertor (304) communicatively coupled to a microcontroller (302), wherein the microcontroller (302) is configured to perform a diagnostic operation for the circuit comprising:

obtaining, by the analog to digital converter (304), first data associated with the load (350; 352) responsive to operating the switching element (306a; 306b) to turn ON, wherein the first data comprises electrical values from a second node, wherein the second node is between a first resistor (332; 334) connected to the first node and a second resistor (338) connected to a reference voltage;

obtaining, from the analog to digital convertor (304), second data associated with an output of the switching element (306a; 306b), wherein the second data comprises electrical values obtained at the output of the switching element (306a; 306b); and

analyzing the first data and the sensor data to determine a fault condition for the circuit.

2. The system of claim 1, wherein analyzing the first data comprises:

comparing the electrical values from the second node to an operational range of values for the load (350; 352).

3. The system of claim 2, wherein analyzing the second data comprises:

comparing the electrical values obtained at the output of the switching element (306a; 306b) to an operational range of values for the output of the switching element (306a; 306b).

4. The system of claim 3, wherein the diagnostic operation for the circuit further comprises:

associating the fault condition with the load (350; 352) based on:

a determination that the electrical values from the second node are outside the operational range of values for the load (350; 352); and

a determination that the electrical values obtained at the output of the switching element (306a; 306b) are inside the operational range of values for the output of the switching element (306a; 306b).

5. The system of claim 3, wherein the system further comprises:

a sensing element arranged between the power source (310; 312) and the switching element (306a; 306b), the sensing element communicatively coupled to the analog to digital convertor (304), wherein the diagnostic operation for the circuit further comprises:

obtaining, from the sensing element, sensor data associated with the power source (310; 312), wherein the sensor data comprises electrical values associated with the power source (310; 312); and

comparing the electrical values associated with the power source (310; 312) to an operation range of values for the power source (310; 312).

6. The system of claim 5, wherein the diagnostic operation for the circuit further comprises:

associating the fault condition with the switching element (306a; 306b) based on:

a determination that the electrical values associated with the output of the switching element (306a; 306b) are outside the operational range of values for the output of the switching element (306a; 306b); and

a determination that the electrical values associated with the power source (310; 312) are inside the operational range of values for the power source (310; 312), or

associating the fault condition with the power source (310; 312) based on:

a determination that the electrical values associated with the power source (310; 312) are outside the operational range of values for the power source (310; 312).

7. The system of claim 1, wherein the diagnostic operation for the circuit further comprises:

generating an alert based on the fault condition; and

displaying, on a display device, the alert.

8. The system of claim 5, wherein the sensing element comprises a voltage sensing circuit.

9. The system of claim 1, wherein the circuit is a control system (86) for a trailer refrigeration unit (64).

10. A method for testing circuit operation, the method comprising:

obtaining, by a processor (302) from an analog to digital convertor (304) in a circuit, first data associated with a load (350; 352) on the circuit, wherein the circuit comprises a power source (310; 312) and a switching element (306a; 306b), and the analog to digital convertor (304) is configured to receive electrical signals from a first node between the switching elements (306a; 306b) and the load (350; 352);

wherein the first data is obtained responsive to operation of the switching element (306a; 306b) to turn ON;

wherein the first data comprises electrical values from a second node, wherein the second node is between a first resistor (332; 334) connected to the first node and second resistor (338) connected to a reference voltage;

obtaining, from the analog to digital convertor (304), second data associated with an output of the switching element (306a; 306b), wherein the second data comprises electrical values obtained at the output of the switching element (306a; 306b); and

analyzing the first data and the second data to determine a fault condition for the circuit.

11. The method of claim 10, wherein analyzing the first data comprises comparing the electrical values from the second node to an operational range of values for the load (350; 352); and

wherein analyzing the second data comprises comparing the electrical values obtained at the output of the switching element (306a; 306b) to an operational range of values for the output of the switching element (306a; 306b).

12. The method of claim 11 further comprising:

associating the fault condition with the load (350; 352) based on:

a determination that the electrical values from the second node are outside the operational range of values for the load (350; 352); and

a determination that the electrical values obtained at the output of the switching element (306a; 306b) are inside the operational range of values for the output of the switching element (306a; 306b).

13. The method of claim 11 further comprising:

obtaining, from a sensing element in the circuit, sensor data associated with the power source (310; 312), wherein the sensor data comprises electrical values associated with the power source (310; 312); and

comparing the electrical values associated with the power source (310; 312) to an operation range of values for the power source (310; 312).

14. The method of claim 13 further comprising:

associating the fault condition with the switching element (306a; 306b) based on:

a determination that the electrical values obtained at the output of the switching element (306a; 306b) are outside the operational range of values for the output of the switching element (306a; 306b); and

a determination that the electrical values associated with the power source (310; 312) are inside the operational range of values for the power source (310; 312)

associating the fault condition with the power source (310; 312) based on:

a determination that the electrical values associated with the power source (310; 312) are outside the operational range of values for the power source (310; 312).

15. The method of claim 10 further comprising:

generating an alert based on the fault condition; and

displaying, on a display device, the alert.