

Claims:

1. An optical temperature sensor system for detecting a temperature in an environment, the optical temperature sensor system comprising:
 - a temperature probe comprising a fiber optic temperature sensor; and
 - a convertor to generate a temperature output using solid-state electronic components without software.
2. The system of claim 1, wherein:
 - the fiber optic temperature sensor generates a signal in response to sensing the temperature of the environment, the signal fluctuating according to a decay rate responsive to the temperature;
 - the convertor comprises a signal processing system comprising the solid-state electronics configured to:
 - transform the signal into an intermediate signal representative of the decay rate by comparing one or more signal properties to one or more expected signal properties; and
 - convert the intermediate signal into a temperature output by comparing the intermediate signal to an expected decay rate associated with reference temperatures.
3. The system of claim 1 or claim 2, wherein the temperature output is in a form of an output of a thermocouple or a thermistor.
4. The system of any one of claims 1 to 3 wherein the fiber optic sensor is a phosphor based or a GaAs based fiber optic sensor.
5. The system of any one of claims 1 to 4, wherein the signal processing system comprises:
 - a logarithmic amplifier configured to:

transform the signal into the intermediate signal having a rate of change inversely proportional with the decay rate.

6. The system of claim 5, wherein the signal processing system comprises:

one or more comparators configured to generate one or more pulses in response to the intermediate signal crossing one or more thresholds; and

wherein the temperature output is generated based on the decay rate observed between the one or more pulses.

7. The system of claim 5, wherein the signal processing system comprises a discrete non-volatile memory which converts the intermediate signal into the temperature output based on a pre-programmed conversion.

8. The system of any one of claims 1 to 8, further comprising:

a secondary temperature sensor configured to generate a further signal in response to sensing the temperature of the environment, wherein the further signal is provided to a temperature limiting protection circuit as a redundant temperature reading.

9. An optical temperature sensor system for detecting a temperature in an environment, the system comprising:

a temperature probe comprising a fiber optic temperature sensor; and

a convertor to generate, separately by two or more readout electronics in parallel, a first temperature output and a second temperature output based on a signal from the fiber optic temperature sensor.

10. The system of claim 9, wherein the two or more readout electronics in parallel are solid-state electronic components without software.

11. The system of claims 9 or 10, wherein the first temperature output or the second temperature output are indicative of an over-temperature condition.
12. The system of claims 9 or 10, wherein the first temperature output or the second temperature output are indicative of a fault condition.
13. The system of any one of claims 9 to 12, wherein at least one of the two or more readout electronics includes programmable hardware.
14. The system of any one of claims 9, 10 or 14, wherein the first temperature output or the second temperature output is in a form of an output of a thermocouple or a thermistor.
15. The system of claim 14, wherein the first temperature output or the second temperature output is a K type thermocouple voltage value.
16. The system of any one of claims 9 to 15, wherein the temperature probe contains a single thermally conductive tip single probe to measure a surface temperature of an object in the environment.
17. The system of any one of claims 9 to 15, wherein the temperature probe is housed inside a sheath to measure the temperature inside a liquid or gas.
18. A system, for sensing a temperature of an object, the system comprising:
 - a fiber optic temperature sensor generating a signal in response to sensing the temperature, the signal fluctuating according to a decay rate responsive to the temperature;
 - a redundant temperature sensor configured to generate a redundant signal in response to sensing the temperature;
 - a signal processing system configured to:

transform the signal into an intermediate signal representative of the decay rate by comparing one or more signal properties to one or more expected signal properties; and

convert the intermediate signal into a temperature output based on comparing the intermediate signal to an expected decay rate; and

outputting the redundant signal and/or the temperature output to a temperature limiting protection circuit.

19. The system of claim 18, wherein the signal processing system consists of one or more solid state components.

20. The system of claims 18 or 19, wherein the fiber optic temperature sensor and the redundant temperature sensor are within a single probe.

21. The system of claim 20, wherein the fiber optic temperature sensor and the redundant temperature sensor are housed inside a single thermally conductive tip of the single probe to measure a surface temperature of the object.

22. The system of claim 20, wherein the fiber optic temperature sensor and the redundant temperature sensor are housed inside a single sheath to measure the temperature inside a liquid or gas.

23. The system of any one of claims 18 to 22, wherein the temperature output is a K type thermocouple voltage.

24. The system of any one of claims 18 to 23, wherein the fiber optic temperature sensor is a phosphor based or a GaAs based fiber optic sensor.

25. The system of any one of claims 18 to 24, wherein the redundant temperature sensor is a phosphor based or a GaAs based fiber optic sensor.

26. The system of any one of claims 18 to 24, wherein the redundant temperature sensor is a thermocouple or thermistor, and the signal processing system comprises a programmable memory used to convert the signal into the temperature output.

27. The system of any one of claims 18 to 26, wherein the programmable memory includes one or more parameters and/or calibration values associated with one or more of the object and the redundant temperature sensor.

28. A heating system comprising:

- a heating element coupled to a heating element controller;

- a temperature probe comprising a fiber optic temperature sensor;

- a convertor which:

- generates a first temperature output based on a signal from the temperature probe using solid-state electronic components without software;

- generates a second temperature output based on processing the signal with one or more memories; and

- outputs the first temperature output and second temperature output to the heating element controller; and

- wherein the heating element controller adjusts the operation of the heating element based on the received first temperature output and second temperature output.

29. The system of claim 28, wherein:

- the heating element is a radio frequency heater powered by a radio frequency power supply; and

- wherein the first temperature output is a UL listed or IEC 61508 programmable readout interpretable by the heating element controller.