CLAIMS

1. A system comprising:

a device (56) configured for movement;

a position sensor (34) comprising a sensor housing (110) and a transducer module (112) disposed within the sensor housing and configured to transmit an ultrasonic signal (122) through a fluid medium (120) toward a surface of the device; and

processing logic (36) configured to determine the velocity of the ultrasonic signal through the fluid as a function of the temperature and pressure of the fluid, determine a propagation time of the ultrasonic signal from the position sensor to the surface of the device, and determine the distance traveled by the ultrasonic signal as it propagates from the position sensor to the surface of the device based upon the velocity and the propagation time, wherein the determined distance corresponds to the position of the device relative to the location of the position sensor.

2. The system of claim 1, wherein the position sensor comprises a connector coupled to the sensor housing, wherein the connector is configured to electronically couple the transducer module to the processing logic.

3. The system of claim 2, wherein the transducer module comprises a temperature sensing device (114) configured to determine the temperature of the fluid.

4. The system of claim 3, wherein the temperature sensing device comprises a two-wire resistance temperature detector (RTD) or a four-wire RTD.

5. The system of claim 3, wherein the temperature sensing device transmits temperature data to the processing logic using the connector.

6. The system of claim 1, wherein the device is part of an oilfield component (32).

7. The system of claim 6, wherein the oilfield component comprises a housing portion (58) having an opening (108) extending therethrough in which the position sensor is configured to be installed.

8. The system of claim 7, wherein the opening of the housing portion and the sensor housing both include threads, and wherein the position sensor is configured to be installed within the housing portion by rotating the position sensor until the threads of the position sensor engage the threads of the opening.

9. The system of claim 8, wherein the position sensor is configured to be installed from the outside of the housing portion with respect to the oilfield component.

10. The system of claim 6, wherein the oilfield component comprises a blowout preventer, and wherein the device comprises a piston of the blowout preventer.

11. A method for determining the position of a component configured for movement comprising:

using a first ultrasonic position sensor (34b) to transmit a first ultrasonic signal through a fluid medium to a reference point (80), wherein a first distance (170) between the first ultrasonic position sensor and the reference point is generally constant;

measuring the round-trip transit time of the first ultrasonic signal between the first ultrasonic position sensor and the reference point;

determining the acoustic velocity of the first ultrasonic signal through the fluid medium based upon the first distance and the round-trip transit time;

using a second ultrasonic position sensor (34a) to transmit a second ultrasonic signal through the fluid medium to a surface (82) of the component;

measuring the round-trip transit time of the second ultrasonic signal between the second ultrasonic position sensor and the surface of the component; and

determining a second distance (172) between the second ultrasonic position sensor and the surface of the component based upon the measured round-trip transit time of the second ultrasonic signal and the acoustic velocity of the first ultrasonic signal, the second distance being indicative of the location of the component relative to the position of the second ultrasonic position sensor.

12. The method of claim 11, wherein the first ultrasonic position sensor and the second ultrasonic position sensor are oriented perpendicularly with respect to each other.

13. The method of claim 11, wherein the reference point comprises another surface of the component, wherein the distance between the other surface of the component and the first ultrasonic sensor remains generally constant even when the component is moving.

14. The method of claim 13, wherein the component comprises a piston (56), wherein the surface of the piston toward which the second ultrasonic signal is transmitted is a flange of the piston and wherein the surface of the piston towards which the first ultrasonic signal is transmitted is a shaft of the piston.

15. The method of claim 14, wherein the piston is a component of a blowout preventer (32) of a resource extraction system.

CLAIMS

1. A position sensor comprising:

a sensor housing configured to be installed on a component having at least one device being monitored by the position sensor; and

a transducer module having a piezoelectric material, a window comprising a plastic material, and a temperature sensing device, wherein the transducer module is configured to be disposed within the sensor housing, to transmit an ultrasonic signal through the window and through a fluid medium toward a surface of the device being monitored, to receive a reflection of the ultrasonic signal from the surface of the device, and to transmit an electrical signal corresponding to the ultrasonic signal to processing logic configured to calculate the velocity of the ultrasonic signal as a function of pressure and temperature and to use the calculated velocity to calculate the distance between the position sensor and the device as a function of the velocity of the ultrasonic signal.

2. The position sensor of claim 1, comprising a connector coupled to the sensor housing, wherein the connector is configured to electronically couple the transducer module to the processing logic.

3. The position sensor of claim 2, wherein the temperature sensing device is configured to determine the temperature of the fluid medium and to provide the temperature to the processing logic via the connector.

4. The position sensor of claim 1, wherein the plastic material comprises at least one of a polyetherimide, organic polymer thermoplastic, or a polyimide-based plastic.

5. The position sensor of claim 1, wherein the piezoelectric material comprises lead zirconate titanate.

6. The position sensor of claim 1, comprising an alumina wear plate interposed between the piezoelectric material and the window.

7. The position sensor of claim 1, wherein the transducer module comprises a plastic casing in which the piezoelectric material is disposed, and wherein the plastic casing is configured to be enclosed within the sensor housing.

8. The position sensor of claim 1, wherein the sensor housing comprises a metal, alloy, or super-alloy, configured to allow the position sensor to operate at pressures of between 14 pounds per square inch (PSI) to 14,000 PSI.

9. A method for determining the position of a component configured for movement comprising:

using a first ultrasonic position sensor to transmit a first ultrasonic signal through a fluid medium to a reference point, wherein a first distance between the first ultrasonic position sensor and the reference point is generally constant;

measuring the round-trip transit time of the first ultrasonic signal between the first ultrasonic position sensor and the reference point;

determining the acoustic velocity of the first ultrasonic signal through the fluid medium based upon the first distance and the round-trip transit time;

using a second ultrasonic position sensor to transmit a second ultrasonic signal through the fluid medium to a surface of the component;

measuring the round-trip transit time of the second ultrasonic signal between the second ultrasonic position sensor and the surface of the component; and

determining a second distance between the second ultrasonic position sensor and the surface of the component based upon the measured round-trip transit time of the second ultrasonic signal and the acoustic velocity of the first ultrasonic signal, the second distance being indicative of the location of the component relative to the position of the second ultrasonic position sensor.

10. The method of claim 9, wherein the first ultrasonic position sensor and the second ultrasonic position sensor are oriented perpendicularly with respect to each other.

11. The method of claim 9, wherein the reference point comprises another surface of the component, wherein the distance between the other surface of the component and the first ultrasonic sensor remains generally constant even when the component is moving.

12. The method of claim 11, wherein the component comprises a piston, wherein the surface of the piston toward which the second ultrasonic signal is transmitted is a flange of the piston and wherein the surface of the piston towards which the first ultrasonic signal is transmitted is a shaft of the piston.

13. The method of claim 12, wherein the piston is a component of a blowout preventer of a resource extraction system.