What is claimed is:

1. A system for running and setting a subsea wellhead component, comprising:

a running tool having an upper end for coupling to a running string, the running tool adapted to carry and set the subsea wellhead component;

wherein the running tool has a body, a stem having an axis, the stem passing through the body, and a piston circumscribing the body;

wherein the stem is rotatable relative to the body, and the piston may move axially relative to the body to set the subsea wellhead component;

an encoder positioned between the stem and the body and to detect relative rotation between the stem and the body;

an axial displacement sensor positioned between the piston and the stem to detect relative axial motion between the piston and the body;

a transmitter communicatively coupled to the encoder and the axial displacement sensor;

a receptor communicatively coupled to the transmitter, the receptor adapted to be located at a surface platform;

an operator interface device communicatively coupled to the receptor and adapted to be located on the surface platform; and

wherein the encoder and the axial displacement sensor communicate information regarding the relative number of turns and displacement, respectively, to the transmitter, the transmitter communicates the information to the receptor, and the receptor communicates the information to the operator interface device.

2. The system of Claim 1, wherein the axial displacement sensor comprises:

a tube positioned within the body, the tube having at least one solenoidal coil; and

a ferromagnetic core positioned partially within the tube so that movement of the core through the tube produces an electrical output;

wherein an end of the core interacts with the piston to move in response to axial displacement of the piston; and

wherein axial movement of the piston relative to the body to energize a casing hanger seal releasably secured to the running tool will move the core through the tube, generating an output signal conveying the amount of axial displacement of the piston relative to the body.

3. The system of Claim 1, wherein the encoder comprises:

a light source positioned on the stem so that the light source may direct a light radially outward; and

a code cylinder positioned on an inner diameter of the body so that the code cylinder may be exposed to the light produced by the light source to generate the rotation signal.

4. The system of Claim 3, wherein:

a photodiode is placed between the code cylinder and the body;

the code cylinder defines a plurality of windows permitting light from the light source to pass through the code cylinder to expose the photodiode to the light source; and

the photodiode is alternatingly exposed to and blocked from the light source during rotation of the stem relative to the body.

5. The system of Claim 1, wherein the encoder registers a number of rotations of the stem relative to the body.

6. The system of Claim 1, wherein the transmitter is an acoustic transmitter and the receptor is an acoustic receptor.

7. A system for running and setting a subsea wellhead component, comprising:

a running tool having an upper end for coupling to a running string, the running tool adapted to carry and set the component;

wherein the running tool has a body, a stem passing through the body, and a piston circumscribing the body;

wherein the body, the stem, and the piston are coaxial with an axis of the body;

wherein the stem is rotatable relative to the body, and the piston may move axially relative to the body;

an encoder positioned between the stem and the body to detect relative rotation between the stem and the body and generate a rotation signal in response;

a transmitter communicatively coupled to the encoder for transmitting the rotation signal to a surface platform;

a receptor adapted to be located at the surface platform and communicatively coupled to the transmitter for receiving the rotation signal at the surface;

an operator interface device communicatively coupled to the receptor; and

wherein the operator interface device is adapted to be located proximate to an operator of the drilling rig, so that the receptor may transmit the rotation signal to the operator interface device.

8. The system of Claim 7, further comprising:

an axial displacement sensor adapted to detect relative axial motion between the piston and the body and generate an axial signal in response; and

the axial displacement sensor communicatively coupled to the transmitter for transmitting the axial signal to the operator interface device through the receptor.

9. The system of Claim 7, wherein the encoder comprises:

a light source positioned on the stem so that the light source may direct a light radially outward; and

a code cylinder positioned on an inner diameter of the body so that the code cylinder may be exposed to the light produced by the light source to generate the rotation signal.

10. The system of Claim 9, wherein:

the code cylinder defines a plurality of windows permitting light from the light source to pass through the code cylinder to a surface behind the code cylinder;

a photodiode is placed on the inner diameter surface of the body; and

the photodiode is alternatingly exposed to and blocked from the light source through the plurality of windows of the code cylinder during rotation of the stem relative to the body.

11. A system for running and setting a subsea wellhead component, comprising:

a running tool having an upper end for coupling to a running string, the running tool adapted to carry and set the component;

wherein the running tool has a body, a stem passing through the body, and a piston circumscribing the body;

wherein the body, the stem, and the piston are coaxial with an axis of the body;

wherein the stem is rotatable relative to the body, and the piston may move axially relative to the body;

an axial displacement sensor positioned between the piston and the body to detect relative axial motion between the piston and the body and generate an axial signal in response;

a transmitter communicatively coupled to the axial displacement sensor for transmitting the axial signal to a surface;

a receptor located at the surface platform and communicatively coupled to the transmitter for receiving the axial signal at the surface;

an operator interface device communicatively coupled to the receptor; and

wherein the operator interface device is located proximate to an operator of the drilling rig, so that the receptor may transmit the axial signal to the operator interface for further communication of the signal.

12. The system of Claim 11, wherein the axial displacement sensor comprises:

a tube positioned within the body, the tube having at least one solenoidal coil;

a ferromagnetic core positioned partially within the tube so that movement of the core through the tube produces an electrical output;

wherein an end of the core interacts with the piston to move in response to axial movement of the piston; and

wherein axial movement of the piston relative to the body to energize a casing hanger seal releasably secured to the running tool will move the core through the tube, generating the axial signal conveying the amount of displacement of the piston relative to the body.

13. The system of Claim 11, further comprising an encoder positioned between the stem and the body to detect relative rotation between the stem and the body and generate a rotation signal in response for communication through the transmitter and the receptor to the operator interface device.

14. The system of Claim 13, wherein the encoder comprises:

a light source positioned on the stem so that the light source may direct a light radially outward; and

a code cylinder positioned on an inner diameter of the body so that the code cylinder may be exposed to the light produced by the light source to generate the rotation signal.

15. The system of Claim 14, wherein:

the code cylinder defines a plurality of windows permitting light from the light source to pass through the code cylinder to a surface behind the code cylinder;

a photodiode is placed on the inner diameter surface of the body; and

the photodiode is alternatingly exposed to and blocked from the light source through the plurality of windows of the code cylinder during rotation of the stem relative to the body.

16. A method for running a subsea wellhead device, comprising:

(a) providing a running tool connected to the subsea wellhead device, the running tool having an encoder and axial displacement sensor coupled within a running tool for detecting running tool relative rotation and displacement;

(b) running the running tool from a surface platform to a subsea riser on a running string and positioning the subsea wellhead device in a subsea wellhead assembly;

(c) operating the running tool to set the subsea device in the subsea wellhead assembly;

(d) generating a signal in the encoder and the axial displacement sensor in response to setting of the subsea device;

(e) transmitting the signal from the encoder and the axial displacement sensor to a display at the drilling rig; then

(f) presenting the signal in a manner understood by an operator.

17. The method of Claim 16, wherein step (c) comprises rotating the running string to rotate a stem of the running tool relative to a body of the running tool to generate a signal in the encoder.

18. The method of Claim 16, wherein step (c) comprises applying a hydraulic pressure down the running string to move a piston of the running tool axially relative to a body of the running tool to generate a signal in the axial displacement sensor.

19. The method of Claim 16, further comprising:

connecting a receptor into the running string at a position above sea level; wherein

step (e) comprises acoustically transmitting the signal to the receptor (79).

20. The method of Claim 19, wherein acoustically transmitting the signal comprises transmitting the signal through a tubular of the running string.

CLAIMS

1. A system for running and setting a subsea wellhead component, comprising:

a running tool having an upper end for coupling to a running string, the running tool adapted to carry and set the subsea wellhead component;

wherein the running tool has a body, a stem having an axis, the stem passing through the body, and a piston circumscribing the body; and

wherein the stem is rotatable relative to the body, and the piston may move axially relative to the body to set the subsea wellhead component;

an encoder positioned between the stem and the body to detect relative rotation between the stem and the body, the encoder comprising:

a light source positioned on the stem so that the light source may direct a light radially outward;

a code cylinder positioned on an inner diameter of the body so that the code cylinder may be exposed to the light produced by the light source, the code cylinder defining a plurality of windows that are elongated in an axial direction, the windows permitting light from the light source to pass through the code cylinder; and

a photodiode placed radially outward of the code cylinder such that the photodiode is operable to detect light from the light source passing through the plurality of windows;

an axial displacement sensor positioned between the piston and the body to detect relative axial motion between the piston and the body;

a transmitter communicatively coupled to the encoder and the axial displacement sensor;

a receptor communicatively coupled to the transmitter, the receptor adapted to be located at a surface platform;

an operator interface device communicatively coupled to the receptor and adapted to be located on the surface platform; and

wherein the encoder and the axial displacement sensor communicate information regarding the relative number of turns and displacement, respectively, to the transmitter, the transmitter communicates the information to the receptor, and the receptor communicates the information to the operator interface device.

2. The system of claim 1, wherein the axial displacement sensor comprises:

a tube positioned within the body, the tube having at least one solenoidal coil; and

a ferromagnetic core positioned partially within the tube so that movement of the core through the tube produces an electrical output;

wherein an end of the core interacts with the piston to move in response to axial displacement of the piston; and

wherein axial movement of the piston relative to the body to energize a casing hanger seal releasably secured to the running tool will move the core through the tube, generating an output signal conveying the amount of axial displacement of the piston relative to the body.

3. The system of claim 1, wherein:

the photodiode is placed between the code cylinder and the body; and

the photodiode is alternatingly exposed to and blocked from the light source during rotation of the stem relative to the body.

4. The system of claim 1, wherein the encoder registers a number of rotations of the stem relative to the body.

5. The system of claim 1, wherein the transmitter is an acoustic transmitter and the receptor is an acoustic receptor.

6. A system for running and setting a subsea wellhead component, comprising:

a running tool having an upper end for coupling to a running string, the running tool adapted to carry and set the component;

wherein the running tool has a body, a stem passing through the body, and a piston circumscribing the body;

wherein the body, the stem, and the piston are coaxial with an axis of the body;

wherein the stem is rotatable relative to the body, and the piston may move axially relative to the body;

an encoder positioned between the stem and the body to detect relative rotation between the stem and the body and generate a rotation signal in response, the encoder comprising:

a light source positioned to direct light in a radial direction;

a light sensor radially spaced from the light source and operable to detect a light from the light source; and

a code cylinder positioned radially between the light source and the light sensor, the code cylinder defining a plurality of windows that are elongated in an axial direction, the windows permitting light from the light source to pass through the code cylinder;

a transmitter communicatively coupled to the encoder for transmitting the rotation signal to a surface platform;

a receptor adapted to be located at the surface platform and communicatively coupled to the transmitter for receiving the rotation signal at the surface;

an operator interface device communicatively coupled to the receptor; and

wherein the operator interface device is adapted to be located proximate to an operator of the drilling rig, so that the receptor may transmit the rotation signal to the operator interface device.

7. The system of claim 6, further comprising:

an axial displacement sensor adapted to detect relative axial motion between the piston and the body and generate an axial signal in response; and

the axial displacement sensor communicatively coupled to the transmitter for transmitting the axial signal to the operator interface device through the receptor.

8. The system of claim 6, wherein the light source is positioned on the stem so that the light source may direct the light radially outward; and wherein the code cylinder is positioned on an inner diameter surface of the body so that the code cylinder may be exposed to the light produced by the light source.

9. The system of claim 8, wherein the light sensor is a photodiode placed on the inner diameter surface of the body; and the photodiode is alternatingly exposed to and blocked from

the light source through the plurality of windows of the code cylinder during rotation of the stem relative to the body.

10. A system for running and setting a subsea wellhead component, comprising:

a running tool having an upper end for coupling to a running string, the running tool adapted to carry and set the component;

wherein the running tool has a body, a stem passing through the body, and a piston circumscribing the body;

wherein the body, the stem, and the piston are coaxial with an axis of the body;

wherein the stem is rotatable relative to the body, and the piston may move axially relative to the body;

an axial displacement sensor positioned between the piston and the body to detect relative axial motion between the piston and the body and generate an axial signal in response;

a transmitter communicatively coupled to the axial displacement sensor for transmitting the axial signal to a surface platform;

a receptor located at the surface platform and communicatively coupled to the transmitter for receiving the axial signal at the surface platform;

an operator interface device communicatively coupled to the receptor;

wherein the operator interface device is located proximate to an operator of the drilling rig, so that the receptor may transmit the axial signal to the operator interface device for further communication of the signal; and

an encoder comprising:

a light source positioned to direct light in a radial direction;

a light sensor radially spaced from the light source and operable to detect a light from the light source; and

a code cylinder positioned radially between the light source and the light sensor, the code cylinder defining a plurality of windows that are elongated in an axial direction, the windows permitting light from the light source to pass through the code cylinder.

11. The system of claim 10, wherein the axial displacement sensor comprises:

a tube positioned within the body, the tube having at least one solenoidal coil;

a ferromagnetic core positioned partially within the tube so that movement of the core through the tube produces an electrical output;

wherein an end of the core interacts with the piston to move in response to axial movement of the piston; and

wherein axial movement of the piston relative to the body to energize a casing hanger seal releasably secured to the running tool will move the core through the tube, generating the axial signal conveying the amount of displacement of the piston relative to the body.

12. The system of claim 10, wherein the encoder is positioned between the stem and the body to detect relative rotation between the stem and the body and generate a rotation signal in response for communication through the transmitter and the receptor to the operator interface device.

13. The system of claim 12, wherein the light source is positioned on the stem so that the light source may direct the light radially outward; and wherein the code cylinder is positioned on an inner diameter surface of the body so that the code cylinder may be exposed to the light produced by the light source to generate the rotation signal.

14. The system of claim 13, wherein the light source is a photodiode placed on the inner diameter surface of the body; and the photodiode is alternatingly exposed to and blocked from the light source through the plurality of windows of the code cylinder during rotation of the stem relative to the body.

15. A method for running a subsea wellhead device, comprising:

(a) providing a running tool connected to the subsea wellhead device, the running tool having an encoder and axial displacement sensor coupled within the running tool for detecting running tool relative rotation and displacement, wherein the encoder comprises a code cylinder defining a plurality of windows that are elongated in an axial direction, the windows permitting light directed radially outward from a light source of the encoder to pass through the code cylinder and be detected by a light sensor of the encoder throughout an axial displacement of the light source with respect to the code cylinder;

(b) running the running tool from a surface platform to a subsea riser on a running string and positioning the subsea wellhead device in a subsea wellhead assembly;

(c) operating the running tool to set the subsea device in the subsea wellhead assembly;

(d) generating a signal in the encoder and the axial displacement sensor in response to setting of the subsea device;

(e) transmitting the signal from the encoder and the axial displacement sensor to a display at the drilling rig; then

(f) presenting the signal in a manner understood by an operator.

16. The method of claim 15, wherein step (c) comprises rotating the running string to rotate a stem of the running tool relative to a body of the running tool to generate a signal in the encoder.

17. The method of claim 15, wherein step (c) comprises applying a hydraulic pressure down the riser string to move a piston of the running tool axially relative to a body of the running tool to generate a signal in the axial displacement sensor.

18. The method of claim 15, further comprising: connecting a receptor into the running string at a position above sea level; wherein step (e) comprises acoustically transmitting the signal to the receiving unit.

19. The method of claim 18, wherein acoustically transmitting the signal comprises transmitting the signal through a tubular of the running string.