



Watson Industries Application Notes

Undersea Cable Laying Instrumentation

Since a remotely piloted robotic cable burying machine, sometimes called a trencher, can cost several million dollars, the safety of the machine is of utmost importance. Secondly, consistent productivity and trouble-free operation is a primary concern because the cost of at-sea operations can approach \$100,000 per day.



Piloting the trencher requires a full attitude sensor. Heading data is necessary to navigate the vehicle to the site. Pitch and roll data is required to assure the robot maintains a level orientation in transit and once it begins burying operations.

Watson Industries manufactures an Attitude and Heading Reference System (AHRS) that is perfectly suited for this highly technical application. The Watson AHRS provides bank, elevation and heading data. Additionally, the AHRS can output roll, pitch and yaw rates, X, Y and Z accelerations and X, Y and Z magnetometer data if requested.

Technical Challenges:

The primary difficulty in providing a sensor for this application is the difficult magnetic environment of the trencher. Undersea vehicles cannot use GPS for their heading reference, so a magnetometer is required. The problem with using magnetometers in this application is that cable laying vehicles have large steady state magnetic fields and also create large variable magnetic fields.

Magnetometers provide a heading reference by sensing the Earth's magnetic field. This means that any extraneous magnetic fields in the vicinity will induce heading errors. Cable burying vehicles can have steady state magnetic fields of over 400 milliGauss. Considering that the Earth's field is only about 650 milliGauss, considerable heading errors can result. These vehicles also have motors, relays and high current carrying conductors that can create a highly variable magnetic field that again can induce heading errors. The two keys to solving these problems are mounting location and a highly sensitive magnetometer.



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The Watson AHRS has one of the best magnetometers on the market. The primary concern is finding the best mounting location on the vehicle. See our magnetometer mounting location paper online at www.watson-gyro.com for more information on finding the best location. We also provide free software for calibrating the magnetometer after it has been installed to help to remove any remaining heading errors that may result from its mounting environment.

Watson Experience:

Watson Industries has been manufacturing AHRS since 1993. We have produced AHRS specifically for this application since 1999.

Requirements:

- Bank: $\pm 45^\circ$, 2° accuracy
- Elevation: $\pm 45^\circ$, 2° accuracy
- Heading: 4° accuracy
- Installation magnetic calibration

Applicable Products:

- AHRS-E304
- AHRS-S305

Typical Options:

We are able to accommodate your custom needs. Shown below is a listing of our most common custom modifications.

- Digital velocity input – Watson can support digital velocity inputs in many formats such as GPS and Airspeed Indicators.
- External GPS reference – We have built custom units that utilize GPS data as a reference.
- Custom specifications – For certain applications, customers require specifications that are different from our standard units. Watson Industries engineering is willing and able to accommodate these needs.
- Input Voltage – Many different input voltages can be accommodated.
- Output Format – Communications Protocols RS-422, USB, ARINC, Syncro
- Data Format – We have made many products with custom formatted data outputs.
- Sensor Ranges – The ranges for most of our sensors can be expanded or reduced to meet your requirements. Some of our gyros can have ranges of up to $\pm 3000^\circ/\text{sec}$.

Options specific to this application:

- The Watson AHRS can be used for vehicle stabilization as well as for a remote piloting instrument
- Package Configuration – This unit can be repackaged to fit different profiles including installation inside a pressure vessel.



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