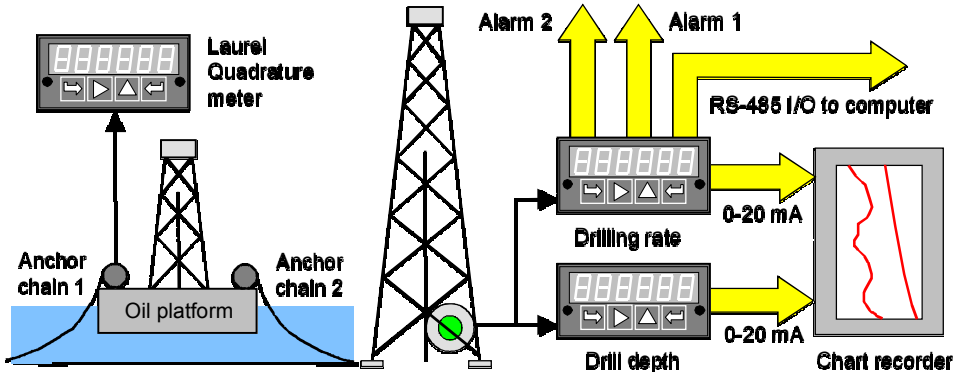
Using Laurel quadrature meters for oil drilling in the Gulf of Mexico

The problem: measuring length and bidirectional rate in a high vibration environment.

Floating oil drilling platforms must be positioned accurately over undersea oil deposits before the platform's four legs can be dropped to secure the platform. Fine position control is achieved by dropping four widely-spaced anchors to the seabed, then using power winches at the four corners of the platform to pull in the anchor chains under computer control.

There is a high degree of vibration as the anchor chains move, and chain movement may be in both directions depending on the position of the platform relative to the desired end position, prevailing winds, and roughness of the sea. High vibration and bidirectional movement preclude use of conventional magnetic pickups and pulse totalizers.



Once drilling has begun, there is the additional challenge of accurately measuring the length of drilling shaft that has been sunk into the seabed and reading out the rate of drilling in feet per hour as the drill makes it way through different layers of sedimentary rock. High vibration would give false counts with conventional pulse counters.

For both the platform position control and drilling status, the monitoring equipment must be able to transmit serial data to the platform's computer center.

The solution: Laurel's QD quadrature position and rate meter for use with quadrature encoders.

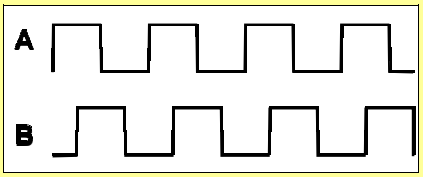
The motion of each anchor chain was monitored by a capstan equipped with a quadrature shaft encoder. This transducer generates two signals that are 90° out of phase, such that the sequence of phase transitions provides direction as well as count information. This allows counts to be incremented or decremented automatically based on direction, whether caused by vibration or true movement.

The Laurel L80102QD quadrature meter was chosen as a low-cost and highly reliable instrument to process the signal. This is a six-digit extended counter with red LEDs, 120V AC input, dual 10A contact relays, RS-485 serial communications, and a quadrature signal conditioner. Each meter was easily scaled to read out the anchor chain length in feet. All four meters were set up with their own digital address for multidrop from a single RS-485 data line. The relays were used for alarm, with setpoints downloaded from the control room.

Drilling action was monitored by a shaft encoder, whose output was applied to two Laurel L80112QD quadrature meters. One of the meters was programmed to read out depth in feet, the other to read out drilling rate in feet per hour. Low and high drilling rates were alarmed, since both can signify a malfunction.

Model L80112QD provides 0-20 mA and 0-10V isolated analog outputs that track the display. The drilling operators were delighted by the analog output capability, which is available for all Laurel meters and counters, and is unique for counters. This allowed two strip chart recorder to plot drilling depth and drilling rate against elapsed time, providing an easy visual indication and a permanent paper record of drilling progress.

Understanding Quadrature



A quadrature signal consists of two square waves A and B that are 90° out of phase. The phase transitions specify direction to allow dynamic up/down totalizing.