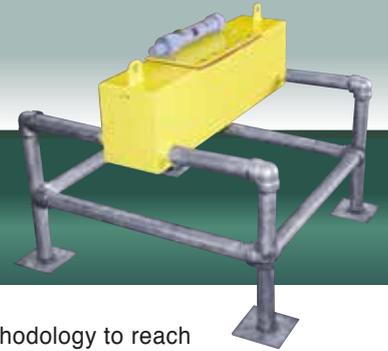




RM Benchmark

Prime Horizontal



There exists a need in the Horizontal Directional Drilling Industry to assist standard guidance methodology to reach acceptable accuracy requirements when drilling long water sections where it is not possible to utilize other guidance methods. These other methods may include, wireline installation on sea floor, sunken ParaTrack AC beacons, standard azimuth drilling, etc.



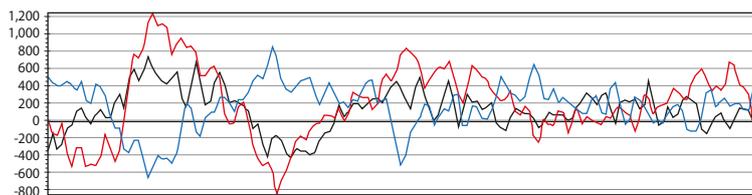
Using a Mechanical Rotating Magnet deployed in a known position on the sea bed or river bottom will generate an AC magnetic field observable by the ParaTrack sensors in the steering tool to a distance in excess of 70 meters below the location of the RM Benchmark. Elevation and more importantly, the left/ right position of the bore can then be measured at deployed points along the axis of the bore path thus guaranteeing positional accuracy when reaching areas of more conventional methods of determining positions.

The RM Benchmark System was developed to provide a navigation beacon at known locations underwater along the centerline of the bore path. These positions are then used to fine tune or calibrate the base line azimuth which can suffer magnetic interference from the motor, drill pipe or various local magnetic anomalies in the area.

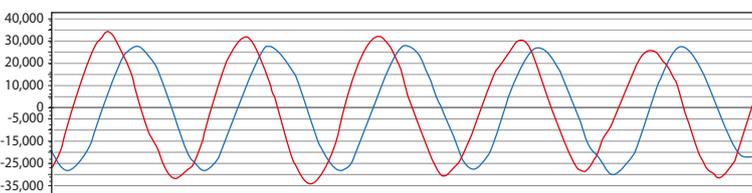
RM Benchmarks allow navigation corrections at positions where conventional surface guidewires are impossible or impractical to install. Intersect Drilling, Shore Approaches and Long Distance water crossings will benefit from use of the RM Benchmarks.

The system consists of 3 watertight stainless steel boxes, with rotating magnets, which are controlled by an acoustic transmitter and separate receivers for under water operation. Acoustic receiver has a built-in 10 minute delay after being mechanically switched on and will rotate the magnets for 15 minutes after receiving an acoustic code from the transmitter.

The ParaTrack steering tool in the drillstring of the pilot hole will detect the electromagnetic field from the rotating magnets in the RM Benchmark, allowing correction of the position of the drillstring with respect to the location of the RM benchmark. Use of successive benchmarks on very long crossings will keep the pilot hole on its intended track, maintaining the proper positional accuracy along the entire track.



Background noise measured by the ParaTrack steering tool in the pilot hole prior to switching on the RM Benchmark.



Electromagnetic trace from the RM Benchmark

RM Benchmark specifications

Stand Footprint	915mm x 915mm
Box	1041mm x 203mm x 280mm
Weight	125kg
Materials	Non magnetic stainless steel
Omni-directional acoustical actuator	
Operation time per actuation: 15mins	
30 day reserve to first actuation	
Signal strength accuracy to -70m	
160 hour operating time reserve	
100m water depth maximum	

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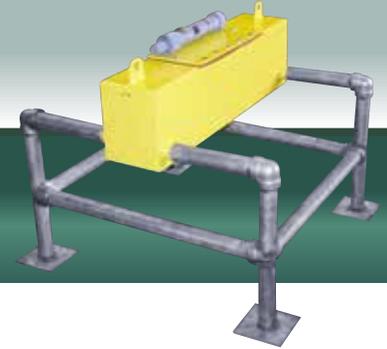
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RM Benchmark

Prime Horizontal



Acoustic Deck Unit and Acoustic Actuator

- Lightweight, portable and very rugged
- Easy to operate and maintain
- Affordable
- Provides full command and range capability
- Rugged and splash proof
- Deck unit uses standard alkaline batteries
- Diver activation switch
- Secure command coding
- Field proven reliability

Acoustic Deck Unit specifications

Frequencies:	Interrogate and Receive frequencies select 7.5 to 15 kHz
Default transmit:	9.0 and 11.0 kHz
Default receive:	10.0 and 12.0 kHz
Transmit source level:	185 dB re 1 micro-Pascal at 1 meter - Controllable by operator
Receive sensitivity:	-80 dB re 1 micro-Pascal at 1 meter
Transmit pulse width:	10 milliseconds
Timing accuracy:	1 millisecond
Range units:	Meters
Command codes:	BACS commands (ORE Offshore, EdgeTech, and EG&G)
Status receive:	Automatic time-line display of acoustic status replies
Beeper:	Audio confirmation of received signals
Case:	Sealed, portable, splash-resistant
Size:	27 cm x 25 cm x 19 cm (10.5 in x 10.0 in x 7.5 in)
Weight:	3.2 kg (7.0 lbs)
AMD200 Transducer	
Acoustic frequency:	7.5 to 15 kHz
Beam pattern:	Omni-directional in the lower hemisphere
Cable length:	9 meters (30 feet)
Weight in air:	3.2 kg (7.0 lbs) including cable
Size:	Diameter 11.4 cm (4.5 in); height 10 cm (4.0 in)



The RM Benchmark is a system that together with the 80+ rare earth magnets in its waterproof housing; includes the Acoustic Actuator and the Acoustic Deck Unit to remotely activate the submerged device.

The actuator energizes a relay for control applications, turning on and off the magnet rotation.

The actuation system is reliable at a range exceeding 5 kilometers. The deck unit is field-proven and is highly versatile in controlling and ranging the actuator. The rugged, lightweight deck unit provides a highly intuitive user interface that allows one to go right to work with little learning curve.

The system is powered by internal, readily available, off-the-shelf, alkaline batteries.

Acoustic Actuator specifications

Operating depth: 100 meters	Operational life: 30 days & 1 discharge or 1 day & 100 discharges
Operating modes: Programmable delayed acoustic operation Programmable timed fire (actuation)	Storage life (off): 8 years Storage life (on): 180 days
Exposed materials: CPVC, BUNA-N, Polyurethane, Neoprene	Magnetic signature: ~26 gamma @ 12 inches
ON / OFF: Internal on/off switch with positive on indicator (LED)	Output pulse: 9 volt 65 milliseconds (2.4 joules)
External activation: Hand Operated rotary safety diver switch	Command structure: ARM and Fire : 16 bit frequency encoded BACS command
Power source: 1 each 9 volt battery (easily replaceable)	



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