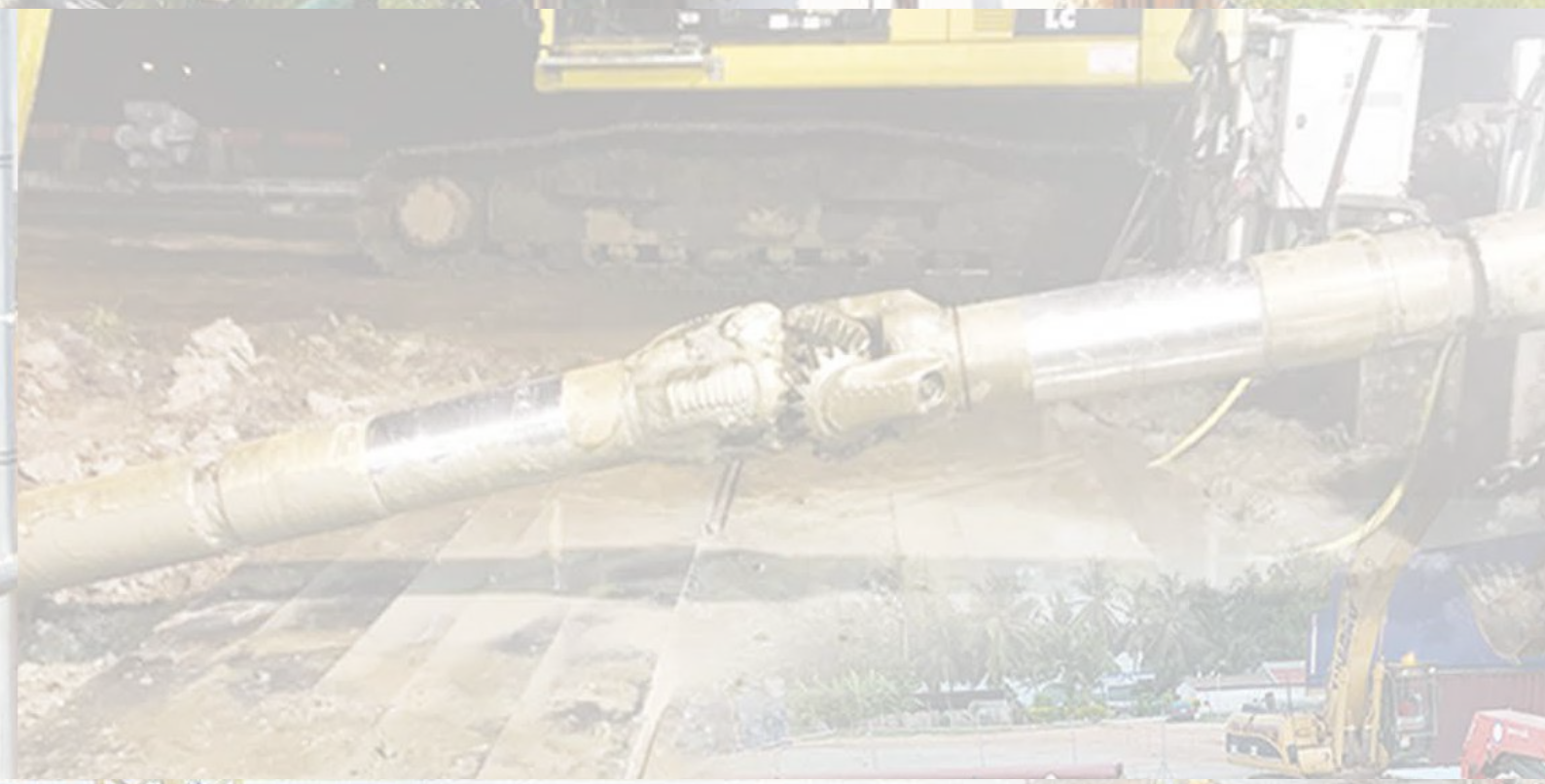
PRIMEHORIZONTAL

Innovation & Experience: Creating Confidence from Entry to Exit

GENERALBROCHURE

www.primehorizontal.com

ParaTrack & Gyro guidance services, downhole tooling, rig data recording systems & bespoke developments.



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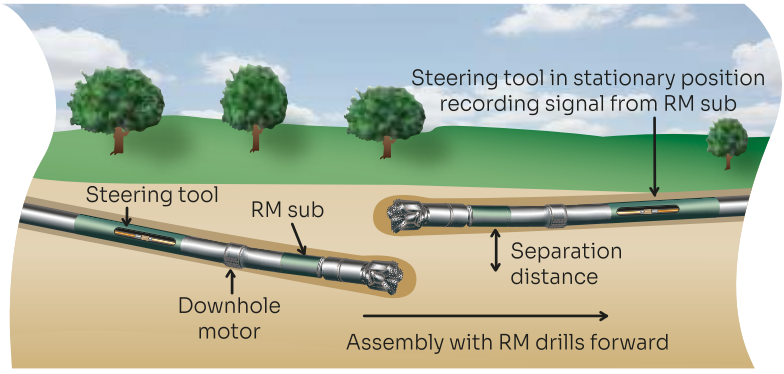
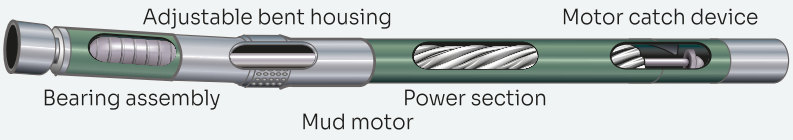
Company Profile

Prime Horizontal is fully focused upon providing steering services for HDD projects, whether this requires guidance services, downhole tooling, rig data recording systems, or bespoke developments. This includes steering tool systems or drilling equipment, mud motors, specialized rock reamers, hole openers and other specialized products to enhance the quality of the drilling operation.



Since its beginnings in 1998, Prime Horizontal has been World Record holders for longest HDD projects, small (lengthy highly accurate) pilot holes in freeze hole drilling application, with more than 70 HDD Intersects and 150 CBM successfully performed with the use of RMRS (Rotating Magnet Ranging System).


ABIA bit sub



Number One in meeting project accuracy requirements.

Several examples of its recent product developments are the development of rig data recording with its ProData product and its recent addition ParaTrack Gyro Module, Pressure Gravity Tool, At Bit Incliniation Assembly (ABIA) Sub, Wireless Driller Display Adaptor on top of the GyroTrack system for post survey measurement and archival storage of hole location.

Prime recently embarked on its mud motor development program and is now in the process of introducing its mud motors to the market. Australia is going through a boom time in the production of coal bed methane (CBM) and Prime Horizontal's RMRS system is being used for drilling the CBM production holes.


GyroTrack

Another example of Prime's technology extension to other drilling areas is its development of the MicroCoil magnetic source used to guide the placement of parallel freeze holes with an accuracy of ± several centimeters for the freeze hole drilling of tunnel bores in soft formations to avoid hole collapse or to close off fracture channels in hard, highly fractured formations to avoid communication of drilling fluids to the surface.


MicroCoil in use

One of our largest growth areas has been the provision of drilling tools and related products to complement the service side of its business. Prime Horizontal routinely provides the individual rotary tools that make up drilling assemblies both for pilot hole drilling hole opening, and product line installation. We sell and support ParaTrack guidance systems and Mud Motors are now sold and supported,
including training for their use. To complement sales of its mud motors, mobile break-out units are provided for maintenance and repair of mud motors in-country, and in some cases on site.


Wireless Driller
Display Adaptors

In support of its customers in every country, experienced and professional steering engineers are employed. With its emphasis being on international service, English, German, Dutch, French, Polish, Portuguese, Indian, Greek, and Spanish-speaking field engineers located around the world, are routinely provided and field engineers who are fluent in many other languages, like Eastern European languages.

Global customers rely on our know-how to successfully complete a full range of HDD projects as the pioneer of HDD Intersect drilling & CBM projects with over 20 years of experience.

Now at your service!

Our dedicated team is ready to support all your HDD and CBM project needs.

HDD applications with ParaTrack

Horizontal Crossings with ParaTrack

- Use surface or underground guidewire installation
- Deploy as loop or single cable
- Handle extreme local magnetic interference with ease
- Use propietary ParaTrack-2 steering tool
- With **Gyro Module** that is immune to magnetic interferences and zeroes out drillstring vibrations

Parallel Drilling

- Use ParaTrack-2
- Use surface or underground guidewire installation with centers from 0.5 m to more than 80 m
- Use proprietary **Rotating Magnet Source** in first borehole
- Handles extreme local magnetic variations with ease

Tunnel Excavation

- Use ParaTrack-2
- Use underground guidewire installation with centers from 0.3 m to more than 10 m
- Use proprietary **MicroCoil Magnetic Source** for extreme precision

Vertical Underground Intersects

- Use ParaTrack-2
- Use Rotating Magnet Source or MGT
- Use **Coal Bed Methane** projects
- Use for drilling air and vent shafts in mines

Horizontal Underground Intersects

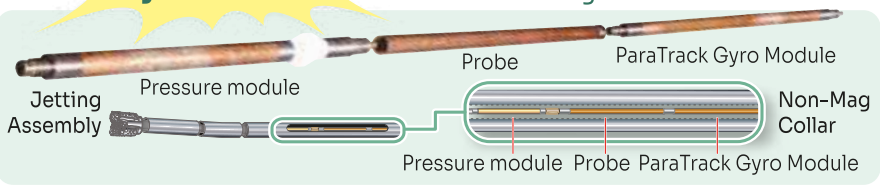
- Use ParaTrack-2
- Use surface or underground guidewire installation
- Use proprietary **Rotating Magnet Source** in vincinity of intersect
- Use proprietary **AC Beacon magnetic source** for long reach intercept drilling
- Use for drilling from casing to casing
- Use for long reach crossings

Shore Approaches

- Use ParaTrack-2
- Use proprietary AC Beacon magnetic source
- Use from beach or river bank to more than 100 m range
- Use for drilling from casing to casing
- Use for long distance crossings

New!!! **ParaTrack Gyro Module**

Immune to Magnetic Interference



Guidance Equipment

ParaTrack-2 Steering Tools

- New generation steering tools with AC magnetic field tracking

ParaTrack-2 Steering Tools with PWD Option

- Adds measurement of pilot hole and drill pipe annulus with the Pressure (PWD) Sub

Conventional Steering Tools

- Two different makes for sale or rental for jobs where ParaTrack service is not required

Drilling Equipment

Rock Reamers

- Premium and discount rock bits in stock
- 2 7/8" up to 12 1/4" TCI or Mill Tooth

Jetting Assemblies

- Custom jetting assemblies for alluvial formations
- 3 1/2" OD 8" OD from 3m to 9m in length

Non Magnetic Drill Collars

- Sizes from 2 3/8" OD through 8" OD
- 3 1/2" OD 8" OD from 3m to 9m in length

Substitue

- Over 200 Orienting and Crossovers available

Mud Motors

- An assorted range of Motors 2 7/8" to 8"

Lo Torque & Jumbo Lo Torque Hole Openers


Mud Motor

Split Bits & Segments

Rock Reamers

Centralisers

- 16" to 50" Hole Sizes

Crossovers

- An assortment of crossover subs, Firestick, Ditchwitch, Full Hole, from 2 7/8" Reg and IF to 7 5/8" Reg

Rock Reamers™

Hole Openers – Project Capable from 6 in. to 64 in.
Lo Torque Hole Openers

- TCI & Milled Tooth Inventory


Bi-directional Rock Reamer™

The Rock Reamer™ adds a new dimension to hole opening technology combining the best ideas for ease of use and rock cutting techniques.

The replaceable arm design allows field interchangeability of cutters to reduce the number of parts on location at one time. Different size arms allow hole sizes to be optimized to the best plan for both hole cleaning purposes and product line size. Milled Tooth and TCI Insert Cutters and arms are available in 2" increments cutting from a 6" pilot hole all the way to 60".

'TO BE THE LEADER ON GUIDANCE SERVICES, PRODUCTS, & SOLUTIONS, THAT ENABLE OUR CUSTOMERS TO ACHIEVE THEIR GOALS & OBJECTIVES' – Prime Horizontal's Vision Statement

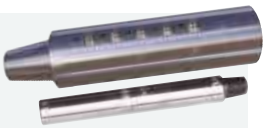
Innovations

Magnetic Sources with ParaTrack
ParaTrack-2 uses selectable magnetic sources to fit the requirements of the most exacting HDD or CBM project, and it is the only HDD steering system on the market designed for guidance with AC electromagnetic field sources.
The signal to electromagnetic noise ratio is much better for AC magnetic fields than for DC magnetic fields which allows better tracking accuracy at deeper depths and in noisy magnetic environments. The use of AC fields has also spurred the development of an entire suite of different magnetic sources by Prime Horizontal and Vector Magnetics used for different HDD
applications, each source having different specifications of accuracy and precision. It is not uncommon for the same HDD project to use several different magnetic sources, depending on the geometry and precision requirements of the project.

Guidewire Magnetic Source
For many crossing projects, a guidewire is deployed all the way from entry to exit, either on the surface or on the sea bottom, through which is passed a DC electromagnetic field (ParaTrack-1) or an AC electromagnetic field (ParaTrack-2) to enable pilot hole tracking accurately along its length. The guidewire may be deployed as a single wire or as a closed loop for better precision. The continuous tracking reduces the probability of pull-backs, sidetracks and corrections.

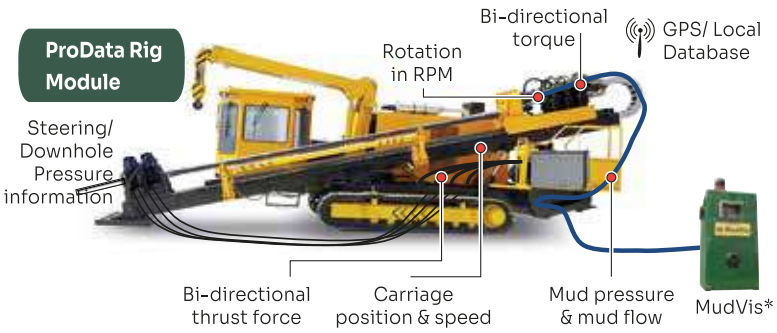
AC Beacon
The AC Beacon is used primarily for shore approaches and long crossings. The AC beacon provides accurate positioning up to 100 meters so installing a beacon periodically along a traverse allows the use of shorter guidewires.

Rotating Magnet Sub and Axial Magnet Sub
The Rotating Magnet (RM) Sub uses cylindrical magnets in a spinning sub to produce an extremely high resolution AC magnetic field which is used to complete underground intersects both for the HDD crossing market and for the coal bed methane production market. The Axial Magnet Sub is similar to the RM sub except it uses rare earth magnets in a different configuration in the sub. As an intersection is approached, the magnetic source is switched from a guidewire to the rotating magnet to guide all the
way to the intersection point. Its precision is a matter of several centimeters.



MicroCoil
The MicroCoil is a closed 50 meter loop deployed inside a pilot hole with a very small separation between the two long coil axes. It is used for close proximity parallel drilling when centimeter accuracy is required and where other sources cannot meet the required precision. The MicroCoil was originally developed for guiding the drilling of closely parallel freeze drilling pilot holes in the Naples Metro project and was later used in the Hallandsas
Rail Tunnel project in Sweden.

Pressure Measurement While Drilling (PWD)
In addition to magnetic guidance, ParaTrack-2 optionally includes a Pressure while Drilling (PWD) sub to measure the pilot hole annulus and the internal pipe pressure at the steering tool. By monitoring the pilot hole annulus pressure, the driller can significantly limit environmental damage caused by formation fractures.

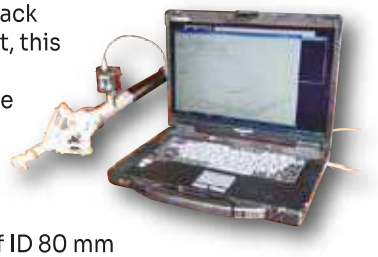


* Denotes non-standard component

ProData
Whether you operate a single horizontal directional rig or a fleet of rigs, you want to keep your investment working for you 24/7, and you don't like breakdown surprises.
You need Prime Horizontal's ProData System.
The ProData system automatically gathers, stores and transmits its modular suite of HDD rig site data ti an on-site database (Local). The data is also transmitted via the cell network to the Prime Horizontal cloud-based database (Remote).
Both remote and local database archives make all logged data available for on-demand access by means of theintuitive and user-friendly client access portals, vai which customers gain access to either historical or live data.

Downhole Motors
Prime Horizontal's Mud motor (or Drilling Motor) is a Progressive Cavity Positive Displacement Pump (PCPD) placed in the Drill string to provide power to the bit while drilling by using the drilling mud to create eccentric motion in the power section of the motor. The Mud Motor uses different rotor and stator configurations to provide greater horsepower for the desired drilling operation, as the eccentric motion in the power section is transferred as concentric power to the drill bit. The rotation rate of the bit is proportional
to the volumetric flow rate of drilling mud through the motor and normal rotation rates are from 60 rpm, to over 150 rpm.

GyroTrack
GyroTrack is a multi-purpose pipeline mapping system. With a proven track record on virtually every continent, this multi-diameter system has easy handling features and provides the most accurate results on pipeline location. A unique system of exchangeable centralizing wheel units gives GyroTrack an operational range of ID 80 mm (3.15") to ID 1200 mm (48"). GyroTrak is at home in steel, concrete, PE or PVC pipes.



It is pulled by a hand operated wireline or a mechanical winch. Data are uploaded to the office through GPRS after survey data integrity is checked.
An immediate on site Survey Report is optionally provided that includes a 3D pipeline profile, Bend radius report per customer defined intervals, Inclination analysis, Job specification and Job locations. Output data can be exported to open platform formats for seamless integration in common GIS platforms such as AutoCAD, Excel, MicroStation or Text.

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ParaTrack-2

ParaTrack is an underground tracking system with unique up to date capabilities. This offers considerably more flexibility in coil positionand dimensions than older magnetic guidance systems. ParaTrack's surface deployment will normally be along centreline with a return cable placed well offline, where its signal is nominal.

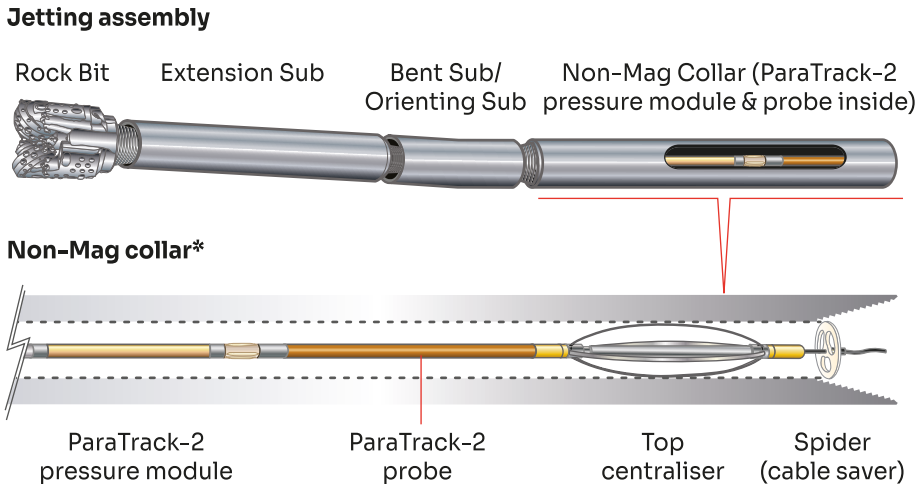
Benefits

- Can be set up as a single cable from entry to exit
- Can range against other pipelines in certain circumstances
- Can use alternative magnetic sources in order for technical guidance solutions to be tailored to each job:
  - Rotating magnetic sub
  - Single centerline cable
  - MGT Source
  - AC Beacon
- Can measure annulus and internal pipe pressure
- Has positively guided large 110 degree curves
- Has guided a number of pilot holes in magnetic environments where it was not possible for other systems
- Guided a number of parallel crossings where center to center spacing was of paramount importance
- Has positively guided underground intersects from each side

In specific circumstances, the centreline cable may be earthed on each side of the crossing, negating the need for a return path and its significant loss of time.

ParaTrack can be deployed underground in an offset parallel borehole and earthed thus creating a known magnetic field to use for guidance. Each pilot hole thereafter will use the same original bore location as the base line. Parallel bores may now be drilled with confidence, all the way from entry to exit.

ParaTrack is the only tracking system able to utilise many different magnetic sources. Not only can we use guide wires on surface or underground, we also utilise the AC Beacon, a Rotating Magnet tool and MGT tool. One or a combination of these choices will fit the exact needs of most crossings.



ParaTrack which utilises a DC or AC secondary locating system, has been operated in the HDD market by Prime Horizontal since 1999. Primarily developed as an underground parallel drilling locating system, it's use has been enhanced by development of the Rotating Magnet (RM) Sub and lately by inclusion of Pressure while Drilling (PWD) gauges measuring not only the pilot hole annulus but also the internal pipe pressure at the steering tool.

The addition of non-wire based magnetic sources allows better approach accuracy for intersecting another bore by developing a known magnetic field down hole essentially to act as a target for final intersect drilling.

By measuring the pilot hole annulus pressure, the driller has much better control of down hole pressures to limit the incidence of formation fractures causing environmental damage.

ParaTrack operations gives HDD operators the confidence to plan and execute the most challenging drilled crossings in the market.

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ParaTrack-2

Shock mounted triaxial accelerometers and magnetometers, temperature sensor and digitising circuitry contained in 1.750 in. dia. x 55 in. long beryllium copper pressure barrel. Telemetry and power via single conductor wire line.

ParaTrack-2
pressure module

ParaTrack-2
probe

LCD driller's display

LCD Digital Display with Operator Selectable Screens

RS232 Communications

Wireless or Wired for Ease of Operation

Pressure Module

Length: 600 mm (24")

Drill Pipe annulus gauge: 350 bar (5000 psi)

Pilot hole annulus gauge: 35 bar (500 psi)

Orienting pressure sub: 600 mm (24")

Specifications

Temperature Rating: 85°C (185˚F)

Pressure Rating: 1200 bar (17400 psi)

Sensor Accuracy:

- Inclination: ± 0.1°
- Azimuth: ± 0.3°
- Tool face: ± 0.25°
- OD: 450 mm (1.75")
- Length: 1405 mm (55")

Maximum Wire line Length: 5000 meters (16000 ft)

Interface unit

Small footprint Probe Power Supply and interface between probe, laptop and driller's display face controls mounted in front while all wire connections are side mounted for ease of hook up and worktop organization.

Input: 85-265 VAC 50-60 HZ

Output: 48VDC, 50 mA—1000 mA

Power Fused on Input and Output

Analog Amperage Display

Connection for secondary laptop used as drillers display

Connection for existing driller's display

Guide wire supply

Small footprint guide wire supply for location on top of the interface unit in the control cab or on the exit side to power the guide wire.

Unit Input: 85-265 VAC 50-60 HZ

Unit Output: 3 or 6 Amps p-p max.

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ParaTrack Gyro Module

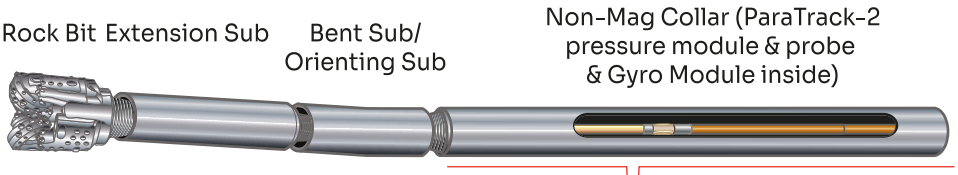
The ParaTrack Gyro Module is the latest in a long line of innovations for the HDD market. With no concern of magnetic interference from nearby active utility lines, shorepiles, ship traffic or other transportation activity, drilling may be carried out confidently, regardless of surrounding conditions. The ParaTrack Gyro Module runs in conjunction with the ParaTrack Steering Tool, providing the ability to tie in with the entire ParaTrack System of tools and software.

When pin point accuracy is necessary prior to punch-out, the position may be verified via the ParaTrack-2 Guide Wire or Beacon Tracker, providing confidence that the drill head will come out where expected.

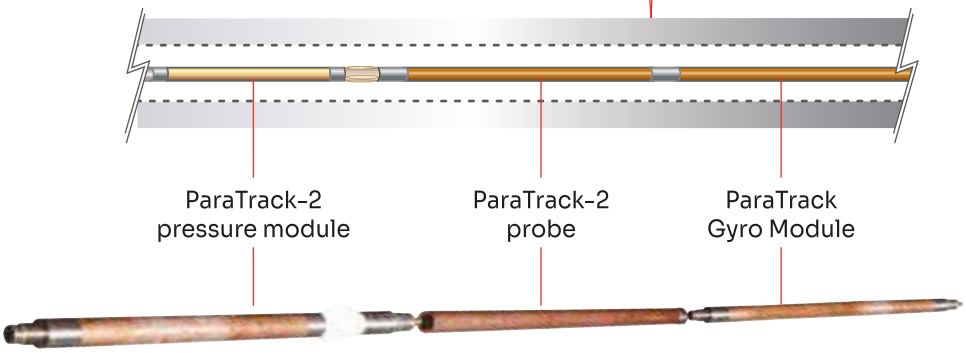
Benefits

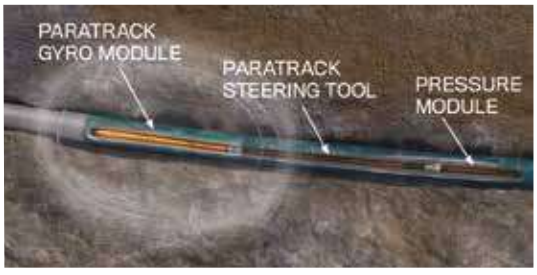
- Compatible with the entire range of ParaTrack Steering, Tracking, and Surveying Tools
- Reliable even in high-vibration environments with no additional calibration (North seeking) time
- Pressure rating up to 690 bar (10,000 Psi)
- No specialized handling or personnel required
- No lengthy down-hole re-orientations
- Reduces the need of secondary tracking systems (coil, Beacon, etc.). However, secondary tracking will be used on Entry side and on Exit side when high accuracy is expected to overcome drift, inclination bias and Formation effects.
- Hand carried (not the Non Mags)

Jetting assembly



Non-Mag collar*





Specifications

Outside Diameter: 2.75” (requires 3.5” ID collar)
Length: Head to foot - 48” (122 cm)
Weight: 39 lbs (17.7 kg)
Electrical Connection: 1-3/16” 12tpi female (standard wet connect)
Internal Operating Temperature: 0-70° C (32 - 158˚F)
Pressure Rating: 10,000 psi (690 bar)
Survey Precision
Inclination: +/-0.02°
Azimuth: +/-0.1°
Toolface: +/-0.5°

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AC Beacon

The Beacon Tracker is a two solenoid AC system for tracking the directional drilling of cable and pipeline boreholes under rivers, buildings, highways, etc.

The precise drill bit location and drilling direction are measured with 300ft/100m range.

Benefits

- Can be used without a surface guidewire
- Can be used to complement existing guidance methods
- When installed at the edge of a water source, will give guidance information up to 100 meters offshore
- Can be installed inside buildings while drilling underneath
- Has assisted the establishment of the Initial Line Azimuth for drilling away from an entry guidewire
- Has positively guided large 110 degree curves
- Has guided entire crossings without use of a surface cable
- Has benchmarked crossings under golf courses
- Determines drilling positions under buildings

Wire wound steel core solenoids mounted on a two degree of freedom table. The table doubles as a transport case holding the electronics, table legs and controls.

A 12 vDC deep discharge battery can handle an all day operation and recharge in the evenings.

The solenoid stack is installed on or offset to the centerline. It is oriented to a known azimuth, normally the line azimuth, and leveled using bubble levels provided.

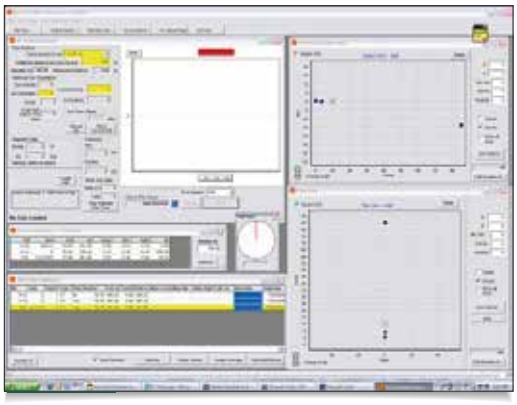
Remote actuation of the AC Beacon is accomplished from the laptop keyboard by clicking a button on the software screen causing a tone to be generated through a radio left at the ac solenoid location.

After actuation, data is saved on the main ParaTrack-2 screen and the tracking algorithm used to determine elevation, left/right position and a confirmed away distance from entry.

To date, the AC Beacon has been used more than a 100 meters offshore where normal coil layout is impossible. The Beacon has been deployed on golf courses where unsightly surface cables were prohibited. We have mobilized the AC Beacon in order to locate the drilling path accurately before crossing the exit side coastline to ensure accuracy and limit the real possibility of damage.

Outfalls are a major planned use of the AC Beacon where surface wires are difficult to install in the surf zone and inaccurate where unseen.

In conjunction with other tracking methods, the AC Beacon will assist long reach intercept drilling by ensuring the two approaching bores are within tolerance of each other to ensure no pullbacks.



Reading on screen

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AC Beacon

Operation guide

1. Hand carry the support stand, the solenoids and the battery shown to a surveyed surface location.
2. Adjust the telescoping legs to level the solenoids.
3. Rotate the solenoids to a surveyed direction using the telescope and freely rotating solenoid table included in the support stand.
4. Start a survey manually at the solenoid site or with a telephone touch tone transmitted by a walkie talkie.
5. The left/right, away and elevation coordinates of the drill bit and the azimuth of drilling are computed and displayed 20 seconds after the start of a survey. The magnetic fields of the beacon are measured with a steering tool near the bit.

Specifications

Solenoid length: 49 inches (2 per system)
Solenoid weight: 62 lbs. (2 per system)
Input voltage: 12 vDC, 7 Amps (typical small automotive type battery)
Excitation frequency: between 2 and 3 Hz.
Compass interference: none
Radio interference: N/A
FCC regulation: N/A
Maximum Range: 100 meters
Precision: Away, Elevation and Right +/- 2% of BTS to Probe distance
Drilling Azimuth Determination (relative to solenoid axis) : +/- 1°
Remote or manual activation Survey time: 20 seconds

Temperature Rating: 85°C (185˚F)
Pressure Rating: 1200 bar (17400 psi)

Sensor Accuracy:

- Inclination: ± 0.1°
- Azimuth: ± 0.3°
- Tool face: ± 0.5°
- Length: 1245 mm (49”)

Maximum Wire line Length: 5000 meters (16000 ft)

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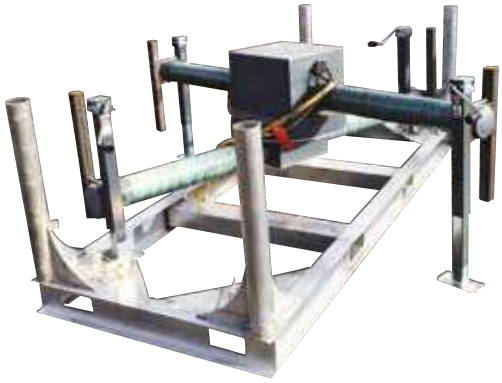
Large Field Beacon



Benefits

- Increased Range
- Radio Controlled
- Operating parameters transmitted wirelessly & automatically
- Single unit packed for easy shipment

The Large Field Beacon (LFB) is a larger version of the standard AC Beacon Tracker System providing increased detection range.

It operates under the same principles as the standard AC Beacon, and uses the same software interface for operation. Unlike a standard AC Beacon, however, it requires a mechanical lift to deploy, a 6kW generator to power, and it uses large solenoids and a different electronics control box.

Once an LFB is set up, its location & direction needs to be surveyed accurately and entered into RivCross. This provides the known location from which all steering decisions are made. LFB has the option to be generally operated remotely using a radio modem kit, which allows two-way communication without needing to connect the LFB directly to the computer running RivCross, or manually.

Overview of project using Big Beacon

Overview, Aberdeen, Hong Kong

The Big Beacon consists of:

- Skid with inbuilt solenoids attached on a rotary table
- 4 adjustable leveling feet
  - 4 c-clamps for the feet
  - 4 Cords to secure the feet to the Beacons
- Power supply
- Radio modem kit for remotely triggering Beacon

Specifications

Solenoid Length:	92” x 92” (2.3 x 2.3 m) deployed [92” by 30” (2.3 x 0.7 m) stowed]
Weight:	1540 lbs (700 kg)
Ships (on its own skid):	Skid weight 200 lbs (90 kg)
Setup Area Required:	A flat, level, magnetically clean surface, 98.5” x 98.5” (2.5 x 2.5m) or larger
Input voltage:	11.5 - 12v
Power Supplies:	90-240v AC, 50-60hz. 15 amps, 6kW generator OK
Maximum range:	1300 ft (400 meters)
Precision:	Away, Elevation, and Right +/- 2% of LFB to Probe distance
Drilling Azimuth Determination (relative to solenoid axis):	+/- 1˚
Remote or manual activation Survey time: 20 seconds	
Compass Interference:	None
Radio Interference:	None
FCC Regulation:	None

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HDD Intersect Services

Casing to Casing

- Restricted Entry/Exit positions
- Gravel formation
- Intersect Casing direction or along the borehole

Environmental

- If hole cleaning or formation conditions require a lower annular pressure (monitored by Pressure While Drilling) than has been estimated over the length of the bore, it can be significantly reduced by drilling from both sides.

Torque & Drag Relief

- For various reasons, there are instances where it appears impossible to punch out. In some situations a relief bore from the opposite side can relieve the push and torque values allowing completion of the hole.

While 'Casing to Casing' intersects generated the first opportunity to succesfully prove intersect techniques and technologies. Prime Horizontal was the pioneer of this technology.

We have now completed over 100 successful intersects using multiple magnetic sources for guidance.

Each source gives us additional capabilities to ensure a first time success.

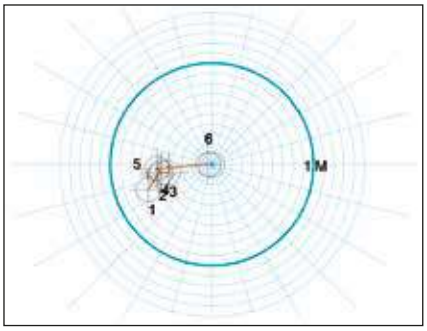
Longest Intersect: 3935m with 14" product pipe.

Shortest Intersect: 350 m.

Largest Intersect: 1100m with 48" product pipe.

Drilling elevation Intersect: 690m

Smallest product pipe diameter: 4".



Intercept vector plot

AM & RM subs accuracy

RM &AM Subs	2 7/8" OD—9 1/2" OD
RM & AM Accuracy	5cm at <3m depending on S/N Ratio

Benchmark in use

Various Magnetic Sources

ParaTrack-2 Axial Magnet sub

The AM sub is generally utilised in soft formation/ jetting. Where tracking systems enables a close proximity for the first range as distance is limited to 5m. Applications include close spaced boreholes, freeze drilling, & tunneling projects.

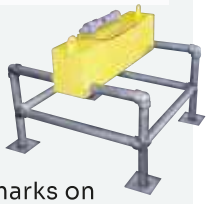
AM Final Approach	Up to 5m

ParaTrack-2 Rotating Magnet sub

The RM sub is generally utilised in harder formations & longer crossings & where the surface tracking systems are limited. Ideal for long crossings under a large body of water or obstruction, where coil or beacon cannot be utilised.

RM Initial Approach	Up to 70m

Benchmark



The Benchmark is used for under river Intersects by deploying 3 Benchmarks on the riverbed over the drill line.

- Stand Footprint: 915mm x 915mm
- Box: 1041mm x 203mm x 280mm
- Weight: 125kg
- Materials: Non mag stainless steel
- Omni-directional acoustical actuator
- Op time per actuation: 15mins
- 30 day reserve to first actuation
- Signal strength accuracy: to -50m
- 160 hour operating time reserve
- 100m water depth maximum.

PRIMEHORIZONTAL

Rotating Magnet Ranging System

The HDD RMRS System and the production of Coal Bed Methane

In recent years, the production of coal bed methane (CBM) with a combination of vertical and horizontal wells has become cost effective, especially when used with HDD methodologies.

Visit our website to see our FAQ #9 for a discussion of Coal Bed Methane and our FAQ #10 for a discussion of Drilling for CBM.

Accurate horizontal to vertical well intersections

The Rotating Magnet Ranging System (RMRS) system as supplied by Prime Horizontal is a cutting edge magnetic downhole ranging system for use in Vertical/Horizontal and Horizontal/Horizontal well intersects. When being used for a Vertical/Horizontal well intersect the particular advantage it has over other technologies is the ability to locate the drill bit up to 60m before the intersect point has been reached. This enables the necessary changes in direction to be made before reaching the intersect point and increasing significantly the possibilities of a successful intersect on the first attempt.

All other current downhole ranging technologies rely on the use of a pass-by, in which the downhole assembly in the horizontal well must be drilled past the vertical well to locate it. Once the horizontal well has been located it must then be pulled back and sidetracked for a second attempt, causing lost time, and possibly introduce hole quality issues. Being able to range directly to the bit significantly increases the possibility of a first attempt intersect. Success rates for first time CBM intersects run at around 90%.

The signal can be detected from 50-60 m away and a corrected vertical target location can be calculated. This technique is different from the technique using a single wire conventional HDD source, where the steering tool is located in the vertical well, because the rotating magnet at the bit is the source and the steering tool is located in the horizontal well. The steering tool works independently of the MWD system used in the drill string. The rotating magnet has minimal effect on the magnet field of the MWD tool as it is located far behind the motor with adequate spacing. If the directional driller has concerns about the interference then a full BHA roll test can be performed to calculate the BHA flux.

The RMRS sub is located just behind the bit in this picture of a conventional, cantilever drilling rig. You can see the eight slots that contain the bar magnets. When the bit spins, the spinning magnets create the AC magnetic field.

Smart tools, precise and efficient operations, proven results

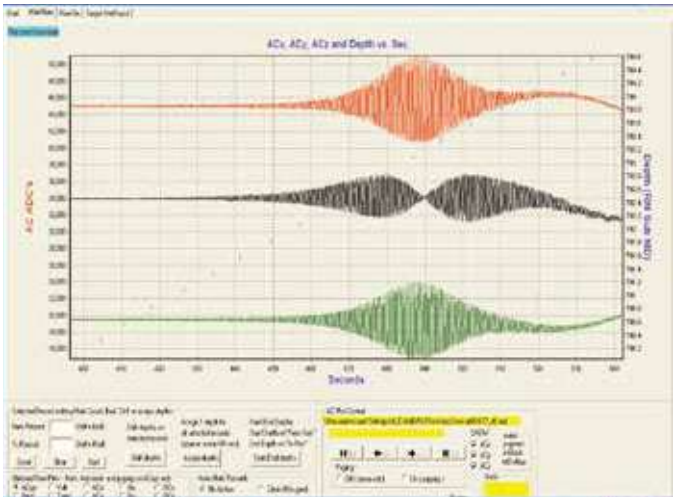
Prime Horizontal's RMRS system is unique in its design and its ranging precision. It uses Prime Horizontal's RM or AM sub, near-bit subs that have a number of magnets aligned in the sides of the sub. When the bit spins, the magnets create an AC magnetic field which can be detected from a reasonable distance to allow correction of the trajectory for vertical well intersection without doing an initial ranging pass by as required by all other technologies. This geometry is diagrammatically shown in above and the RMRS sub is shown on the right.

PRIMEHORIZONTAL

Rotating Magnet Ranging System

Benefits

- Ability to reduce costs associated with drilling and intersecting vertical wells
- Intelligent ranging tool – can steer to the target from distances of 70m
- Can intersect well cavities of 4” and greater
- Slim tool will fit in casing from 2 7/8 and greater – assembly diameter is 1¾”
- Modular vertical well tool, can be assembled slick or with centralisers when required
- Simplicity with different MWD systems – no data is required from the MWD tool, can work with EM or Mud Pulse tools
- Captures data while drilling, no need to shut down pumps to collect data
- Can work to any depth without complications from wireline loop resistance
- Potential to intersect vertical wells without having to pass by and sidetrack
- Uses AC Active Magnetic Ranging technology, works in formations with existing magnetic distortions
- Prime Horizontal is an experienced company in intersection technology in vertical and horizontal wells.



Shown are 3-component magnetic data from the rotating magnet sub. These data are analyzed for range and azimuth information for a single “shot.”

Specifications

Nominal tool OD	44.45mm (1.75")
Minimum target well ID	50.8-22.2mm (2-7/8")
Sonde length	1.4m (55.12")
Weight bar length	1.2m (3.9')
Centraliser length	0.4m (1.3') each
Typical length of assembly	**3.4m (11.2')**
Magnet bit sub connections	2-3/8" Reg and up
Operating temperature range	85°C (185°F)
Max operating pressure	1034 bar (15000 psi)
Accuracy 0-15m	2-3%
Accuracy 15-25m	2-3%
Accuracy beyond 25m	5%
Max operating range	70m (229.7')

PRIMEHORIZONTAL

Rotating Magnet & Axial Magnet

Benefits

Rotating Magnet (RM)

Uses:

- Initial approach of target bore
- Final approach during intersect
- Tracking parallel bores in tunnels
- Can be used vertically

Axial Magnet (AM)

Uses:

- Final approach during intersect
- Tracking parallel bores in tunnels
- Can be used vertically

Both the RM & AM

- Been used on the Final Approach of 10 HDD Intersects
- Been used on initial Approach of 4 HDD Intersects
- Positively guided parallel freeze holes inside rail and auto tunnels
- Benchmarked crossings under golf courses, using a ParaTrack probe on Surface
- Measured parallel drilling positions in vertical boreholes

The Axial Magnet, shown below, is made for low field strength operations where close tolerance is required. These applications include final approaches for HDD intersects and close spaced boreholes in tunnels. Any bore may be guided offset from a known borehole. Vertical operations are possible where the AM Sub is raised and lowered on a wire line. Centimeter measurement accuracy is obtained when operated within specification.

The Rotating Magnet can be run as a Bit Sub used as a target for HDD Intersect Operations. The field strength may be changed by the operator and optimized for use on each job, based on that jobs unique characteristics used on an approach the Rotating Magnet's field can be seen up to 70 meters in front of the bit.

Used for the final approach, the RM gives centimeter accuracy of its relative position to the target bore.

The Rotating Magnet, optimized in a different way, can be used to accurately track parallel boreholes in horizontal tunnels or vertical holes.

The Axial Magnet when used on HDD Intersects, is used strictly as a final approach target due to its much lower field strength. It operates much the same as the Rotating Magnet and yields the same centimeter accuracy relative to the target bore.

Both tools may be used both vertically and horizontally to track parallel bores and inside tunnels.

Rotating Magnet Sources can be made to operate with any number of Rare Earth Magnets, as shown above. Since the field strength of magnetism drops off quickly, an optimum number is normally chosen for Initial Approach operations while a small number is chosen for final approaches.

Specifications

Shock mounted triaxial accelerometers and magnetometers, temperature sensor and digitising circuitry contained in 1.750" diameter x 55.3" long beryllium copper pressure barrel. Telemetry and power via single conductor wire line.

Temperature Rating	85°C (185°F)
Pressure Rating	1200 bar (17404 psi)
Sensor Accuracy	
Inclination	± 0.1°
Azimuth	± 0.4°
Tool face	± 0.5°
Length	1256 mm (49")
Maximum Wire line Length	5000 m (16000')
RM and AM Subs	2 7/8" OD—9 1/2" OD
RM Initial Approach	Up to 70m
AM Final Approach	Up to 5m
RM & AM Accuracy	5cm at <3m depending on S/N Ratio

PRIMEHORIZONTAL

Cable Saver

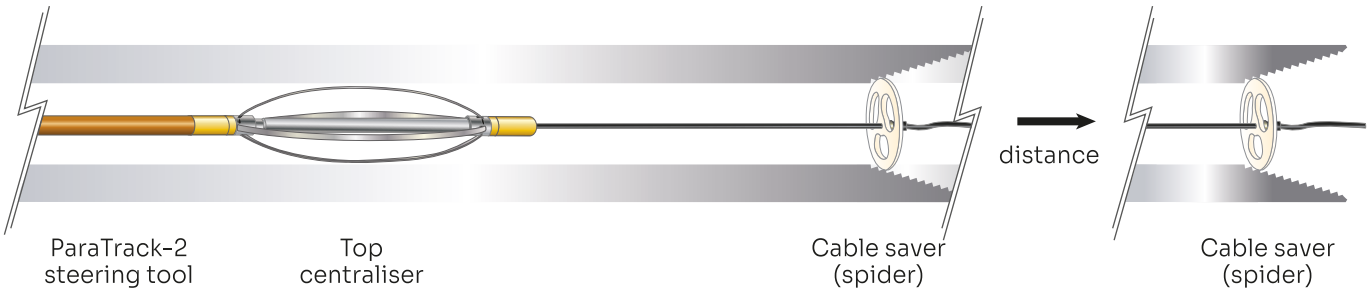
Benefits

- Reduces possible short circuits/cable breaks
- Reduces tripping due to reduced cable breaks
- Should a break occur, tripping is only necessary to the spider below the break
- Increases overall confidence on long and difficult crossing

Cable savers or 'Spiders' as they are commonly known, are used in the horizontal drilling industry during the pilot hole drilling procedure. Typically a wire is installed through the drill string to allow communication with the steering tool, located behind the BHA.

During long drillings or crossings where a high mud flow and pressure are present in the drill string. It is recommended to place a spider at the first connection behind the steering tool and at regular intervals thereafter.

The first spider prevents any slack or stretch from coming into contact with the sharp centraliser blades of the steering tool hence preventing eventual short circuits. After a predetermined interval the next spider is positioned on the wire prior to a wire connection being made and any slack pulled out before the Spider is clamped to the wire and allowed to rest in the bottom of the box connection.



Cable saver (spider) as situated in the box of the pipe

Specifications

Sizes available	Material
2 7/8" IF	Epradur Multilene (Abrasion resistance, Water absorption resistance)
3 1/2" IF	**Minimum operational temperature:** -50˚C
4 1/2" IF	**Maximum operational temperature:** 80˚C
6 5/8" FH	**Tensile strength at yield:** 20 N/mm²
5 1/2" FH	
6 5/8" Reg	

* Spiders only fit in standard shouldered API connections and not suitable in double shouldered connections

PRIMEHORIZONTAL

Mud Motor

Based on the reverse Moineau pump principle Prime Horizontal positive displacement motors deliver predictable torque and RPM directly to the bit. With a full range of motor diameters from 3 3/4" up to 8".

These versatile motors can be configured to meet drilling requirements for steerability, build rates, torque, bit speed, flow rate and string rotation. A variety of configurations are available for steerable drilling and long, medium and short radius drilling.

Benefits

- Easy to set adjustable bent housing:
  - 0-3 degrees on motors larger than 3 3/4"
  - 0-4 degrees on 3 3/4" motors
- Motor catch device (sizes larger than 3 3/4")
- Variety of lobe configurations
- Mud lubricated bearing assembly
- In-house maintenance
- Low flow high torque power sections
- Short radius drilling motors
- Time/date of usage reporting

The choice of Prime Horizontal power sections (stator/ rotor) determine the bit speed and torque output of the motor.

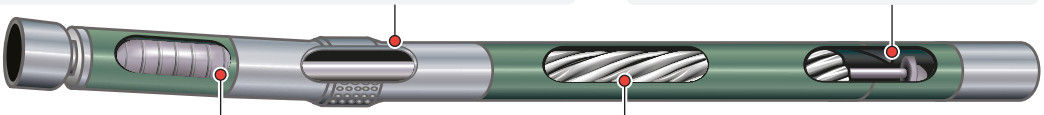
Generally the motors are classified as low to medium speed, and within each category a wide range of power sections are available.

Adjustable bent housing

The adjustable bent housing is available in 0°-3° settings (with a 0°-4° on 3 ¾" motors). The housing is easily adjustable and allows the operator to reset angles on the rig, eliminating the need to change assemblies or motors. Always follow the specifications for proper torquing of the assembly.

Motor catch device

The motor catch device prevents leaving the motor downhole in the unlikely situation of a motor connection failure. The catch device reduces the chance for possible fishing operations.

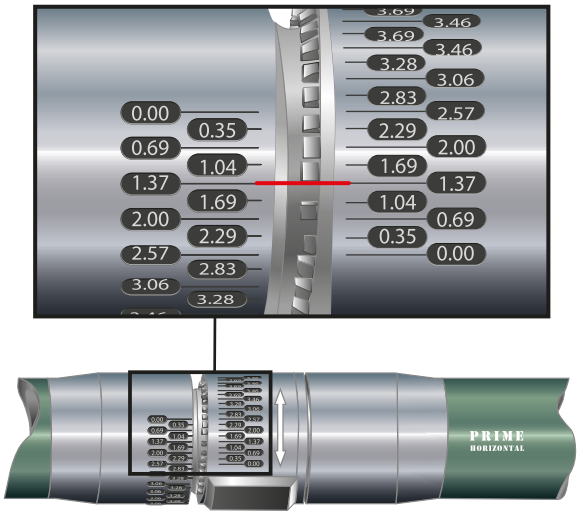


Bearing assembly

Each motor comes equipped with a specially designed thrust bearing stack for axial loading and radial bearings to support radial loading.
A small percentage of the drilling fluids (5% - 7%) bypasses the bearings to cool and lubricate the thrust and radial bearings. The remaining drilling fluid exits through the nozzle ports of the drill bit.

Power section

The power section is made up of a lobed rotor that fits inside a elastomer lined housing (stator). The rotor has one less lobe than the stator, creating a continuously sealing chamber. Drilling fluid is forced through the motor, thereby turning the rotor and generating torque. The lower the speed (higher number of lobes), the more torque is provided, and vice versa.



Adjustable section

9/10 lobe – (Low speed motor feature High Torque output, which is ideal for use in steerable applications.)

5/6 lobe – (Medium speed motor increase rate of penetration while maximizing the bit life, primarily in long interval drilling.)

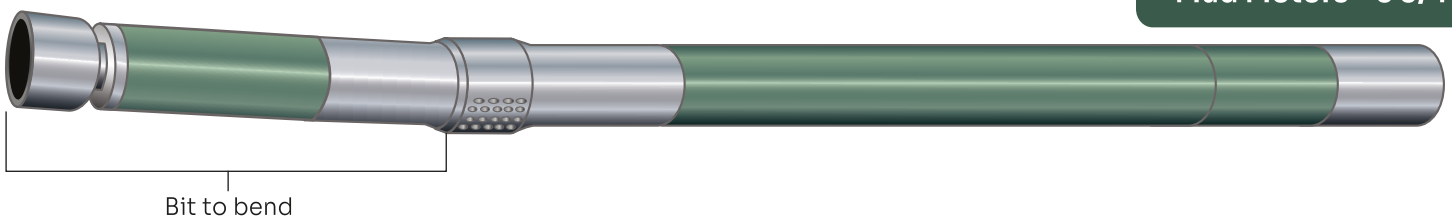
4/5 lobe – (Medium speed motor increase rate of penetration while maximizing the bit life, primarily in long interval drilling.)

Lobe configurations in stock

- 3 1/8" - 5/6 lobe 3.0 stage
- 3 3/4" - 5/6 lobe 3.0 stage
- 3 3/4" - 5/6 lobe 3.8 stage
- 3 3/4" - 9/10 lobe 3.0 stage
- 3 3/4" - 9/10 lobe 4.0 stage
- 4 3/4" - 4/5 lobe 3.5 stage
- 4 3/4" - 5/6 lobe 3.0 stage
- 4 3/4" - 9/10 lobe 4.0 stage
- 6 3/4" - 4/5 lobe 4.8 stage
- 6 3/4" - 9/10 lobe 4.0 stage
- 7 3/4" - 9/10 lobe 4.0 stage
- 8" - 6/7 lobe 4.0 stage
- 8" - 9/10 lobe 4.0 stage

* For other configurations and sizes, please contact our DownHole representative.

Mud Motors – 3 3/4"



Drilling motors – Technical data

3 3/4"	5/6 lobe 3.0 stage		5/6 lobe 3.8 stage	
Motor specifications	**(PH-375-560-30)**		**(PH-375-560-38)**	
	Imperial	Metric	Imperial	Metric
Tool OD	3 3/4"	95 mm	3 3/4"	95 mm
Weight	348 lbs	125 kg	276 lbs	125 kg
Length	12.4 ft	3.8 m	12.5 ft	3.8 m
Lobe configuration	5/6 lobe		5/6 lobe	
Number of stages	3.0 stage		3.8 stage	
Bit speed	100 - 260 rpm		90 - 360 rpm	
Flow rate	80 - 190 gpm	303 - 719 lpm	40 - 160 gpm	150 - 600 lpm
Maximum torque	627 ft-lbs	850 Nm	574 ft-lbs	780 Nm
Maximum power	32 hp	24 kW	37 hp	28 kW
Bit to bend	46"	1,168 mm	45"	1,147 mm
Max rec. diff. pressure	450 psi	31 bar	460 psi	32 bar
Maximum WOB	12,000 lbs	5,443 kg	11,000 lbs	5,000 kg
Max pull to re-run motor	70,000 lbs	31,751 kg	55,000 lbs	25,000 kg
Top connection (box)	2 7/8" reg.		2 7/8" reg.	
Bit connection (box)	2 7/8" reg.		2 7/8" reg.	

3 3/4"	9/10 lobe 3.0 stage		9/10 lobe 4.0 stage	
Motor specifications	**(PH-375-910-30)**		**(PH-375-910-40)**	
	Imperial	Metric	Imperial	Metric
Tool OD	3 3/4"	95 mm	3 3/4"	95 mm
Weight	264 lbs	120 kg	379 lbs	172 kg
Length	10.5 ft	3.2 m	12.4 ft	3.79 m
Lobe configuration	9/10 lobe		9/10 lobe	
Number of stages	3.0 stage		4.0 stage	
Bit speed	125 - 317 rpm		50 - 150 rpm	
Flow rate	60 - 120 gpm	227 - 454 lpm	60 - 140 gpm	227 - 530 lpm
Maximum torque	457 ft-lbs	644 Nm	1,069 ft-lbs	1,450 Nm
Maximum power	18.6 hp	14 kW	63 hp	47 kW
Bit to bend	39"	965 mm	46"	1,168 mm
Max rec. diff. pressure	642 psi	44 bar	600 psi	41 bar
Maximum WOB	12,000 lbs	5,443 kg	12,000 lbs	5,443 kg
Max pull to re-run motor	67,500 lbs	30,617 kg	70,000 lbs	31,751 kg
Top connection (box)	2 3/8" reg.		2 7/8" reg.	
Bit connection (box)	2 3 /8" reg.		2 7/8" reg.	

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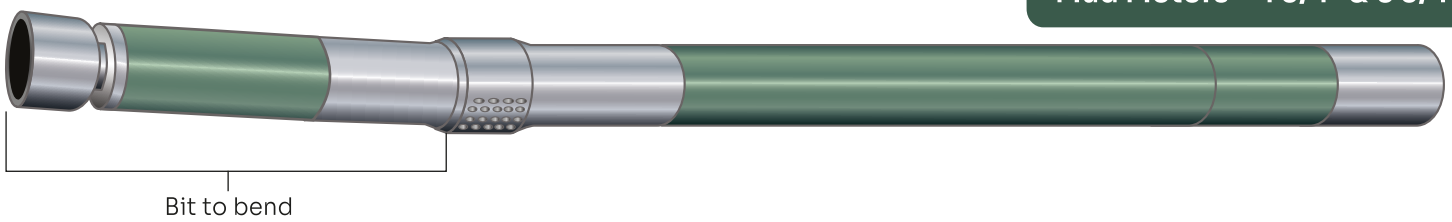
Mud Motors – 4 3/4" & 6 3/4"



Drilling motors – Technical data

4 3/4" — **5/6 lobe 3.0 stage** — **9/10 lobe 4.0 stage**

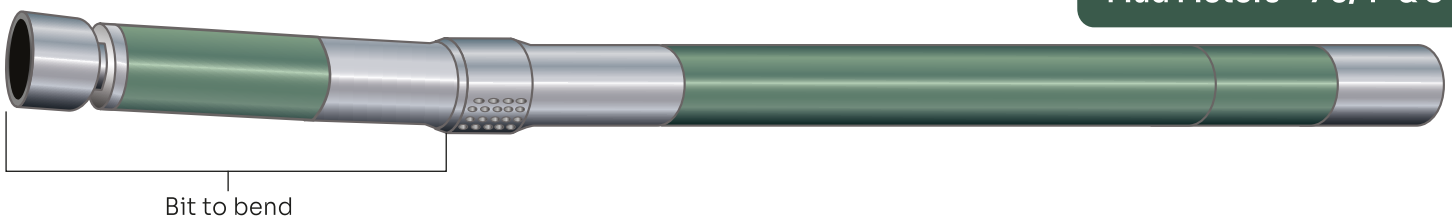
Motor specifications	(PH-475-560-30)		(PH-475-910-40)	
	Imperial	Metric	Imperial	Metric
Tool OD	4.75"	120 mm	4.75"	120 mm
Weight	873lbs	396 kg	1,100 lbs	499 kg
Length	16.7 ft	508 cm	22.3 ft	680 cm
Lobe configuration	5/6 lobe		9/10 lobe	
Number of stages	3.0 stage		4.0 stage	
Bit speed	70 - 175 rpm		70 - 175 rpm	
Flow rate	100 - 250 gpm	379 - 946 l/min	100 - 250 gpm	379 - 946 l/min
Maximum torque	1,586 ft-lbs	2,150 Nm	1,881 ft-lbs	2,550 Nm
Maximum power	76 hp	57 kW	103 hp	77 kW
Bit to bend	46"	1,168 mm	46"	1,168 mm
Max rec. diff. pressure	1,500 psi	103 bar	1,500 psi	103 bar
Maximum WOB	25,000 lbs	11,340 kg	25,000 lbs	11,340 kg
Max pull to re-run motor	100,000 lbs	45,359 kg	100,000 lbs	45,359 kg
Top connection (box)	3 1/2" IF 3 1/2" reg.		3 1/2" IF 3 1/2" reg.	
Bit connection (box)	3 1/2" reg.		3 1/2" reg.	

6 3/4" — **4/5 lobe 4.8 stage** — **9/10 lobe 4.0 stage**

Motor specifications	(PH-675-450-48)		(PH-675-910-40)	
	Imperial	Metric	Imperial	Metric
Tool OD	6 3/4"	172 mm	6.75"	172 mm
Weight	1,940 lbs	880 kg	2,135 lbs	968 kg
Length	22.7 ft	692 cm	22.9 ft	700 cm
Lobe configuration	4/5 lobe		9/10 lobe	
Number of stages	4.8 stage		4.0 stage	
Bit speed	150 - 300 rpm		50 - 180 rpm	
Flow rate	303 - 600 gpm	1,150 - 2,270 l/min	250 - 600 gpm	946 - 2271 l/min
Maximum torque	3,355 ft-lbs	4,550 Nm	3,950 ft-lbs	5,355 Nm
Maximum power	162 hp	121 kW	105 hp	78 kW
Bit to bend	77.5"	1,969 mm	76"	1,930 mm
Max rec. diff. pressure	580 psi	40 bar	600 psi	41 bar
Maximum WOB	66,000 lbs	30,000 kg	75,000 lbs	34,019 kg
Max pull to re-run motor	198,000 lbs	90,000 kg	225,000 lbs	102,058 kg
Top connection (box)	4 1/2" IF		4 1/2" IF 4 1/2" reg.	
Bit connection (box)	4 1/2" reg.		4 1/2" reg.	

PRIMEHORIZONTAL

Mud Motors – 7 3/4" & 8"



Drilling motors – Technical data

7 3/4" **9/10 lobe 4.0 stage**

Motor specifications	(PH-775-910-40)	
	Imperial	Metric
Tool OD	7.75"	197 mm
Weight	2,668 lbs	1,210 kg
Length	23.6 ft	720 cm
Lobe configuration	9/10 lobe	
Number of stages	4.0 stage	
Bit speed	80 - 180 rpm	
Flow rate	300 - 900 gpm	1,135 - 3,407 l/min
Maximum torque	14,800 ft-lbs	20,000 Nm
Maximum power	383 hp	286 kW
Bit to bend	86"	2,179 mm
Max rec. diff. pressure	800 psi	55 bar
Maximum WOB	80,000 lbs	36,287 kg
Max pull to re-run motor	275,000 lbs	124,737 kg
Top connection (box)	6 5/8" reg.	
Bit connection (box)	6 5/8" reg.	

8" **6/7 lobe 4.0 stage**

Motor specifications	(PH-800-670-40)	
	Imperial	Metric
Tool OD	8"	203 mm
Weight	3,196 lbs	1,450 kg
Length	23.3 ft	710 cm
Lobe configuration	6/7 lobe	
Number of stages	4.0 stage	
Bit speed	80 - 240 rpm	
Flow rate	290 - 900 gpm	1,100 - 3,400 l/min
Maximum torque	4,905 ft-lbs	6,650 Nm
Maximum power	208 hp	153 kW
Bit to bend	90"	2,305 mm
Max rec. diff. pressure	478 psi	33 bar
Maximum WOB	80,000 lbs	36,287 kg
Max pull to re-run motor	275,000 lbs	124,737 kg
Top connection (box)	6 5/8" reg.	
Bit connection (box)	6 5/8" reg.	

Drill Bits

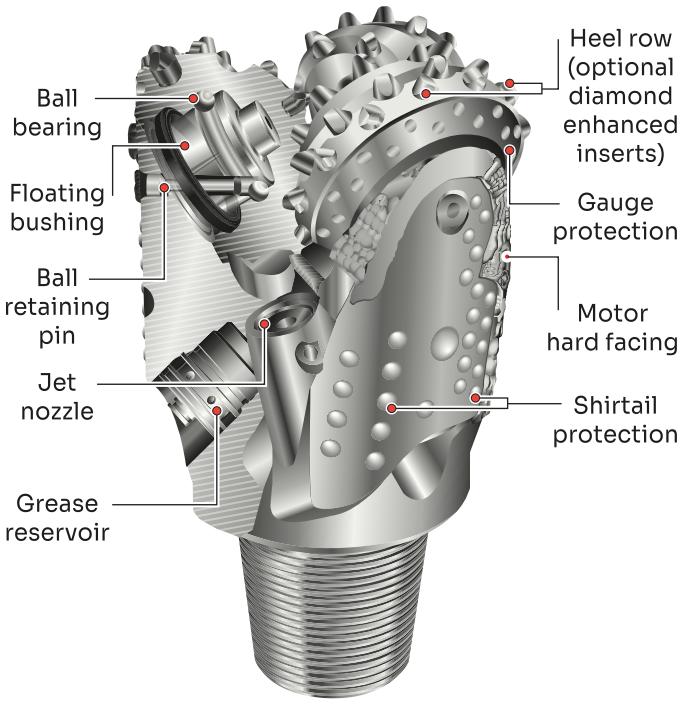
Since the early 1900's when the first roller cone tri-cone rock bits were patented, these tools have proven to provide the best all-around cutters for drilling rock, from soft formations all the way to extremely hard formations. While most cutting technologies have been attempted, their uses have proven too limited to specific rock formations, and the tri-cone roller cone rock bit remains the bit of choice for the wide range of applications encountered in HDD horizontal drilling projects.

All the major bit manufacturing companies have developed bits for specialized applications during the past 20 years, but these developments generally have focused on vertical drilling applications rather than horizontal drilling applications.

Prime Horizontal has chosen to work with a small group of bit suppliers who consistently provide bits tailored to the wear characteristics of horizontal drilling. Prime Horizontal sells bits with extra heavy gauge protection and the bit suppliers add these options to the bits they sell. In certain circumstances additional options are asked for, such as diamond impregnated coatings on the shirt-tails to extended jet nozzles for softer formation jet bits.

It is important to understand the type of formation intended to be drilled so an accurate recommendation can be made as to which type of bit would be best for a specific project. For example, there are 8 different grades of roller cones, denoting softer formations all the way to the hardest. Within each grade, there are another four different sub-grades of each. And finally, within each of the sub-grades, there are many additional options from changing up the type of bearing in use based on formation expectations.

Clients are asked to supply the compressive strengths of the formations and the type of formations to be drilled so Prime Horizontal can make appropriate recommendations on which drill bits to use.



IADC coding

First digit	1, 2 and 3 designate Steel tooth bits with 1 for soft, 2 for medium and 3 for hard formations.
	4, 5, 6, 7 and 8 designate Tungsten carbide insert bits for varying formation hardness with 4 the softest and 8 the hardest.
Second digit	1, 2, 3 and 4 are a further breakdown of formation with 1 the softest and 4 the hardest.
Third digit	This digit will classify the bit according to bearing/seal type and special gauge wear protection as follows:
	1. Standard open bearing roller bit
	2. Standard open bearing roller bit for air drilling only
	3. Standard open bearing roller bit with gauge protection which is defined as carbide inserts in the heel of the cone
	4. Ball & roller sealed bearing bit
	5. Roller sealed bearing bit with carbide inserts in the heel of the cone
	6. Journal sealed bearing bit.
	7. Journal sealed bearing bit with carbide inserts in the heel of the cone.

PRIMEHORIZONTAL

PGT (Pressure Gravity Tool)

The Pressure Gravity Tool is a stand-alone probe for use in reaming operations. In conjunction with the separate Pressure Module (PM) and a drill string Pressure Sub, the PGT monitors pipe and annular pressure, as well as instantaneous reamer rotation at a much higher sample rate than is provided by typical survey tools.

With pressure and rotation plotted in RivCross software the driller receives immediate feedback of downhole reaming performance, reducing the occurance of costly twist-offs and frack-outs.

All pressure and rotational data is logged to the permanent RivCross job database for verification that project tolerances have been met.

Compatible with standard pressure components and straightforward to deploy, the PGT provides an immediate ROI through improved productivity while providing accountability for the most challenging reaming jobs.

Benefits

Features

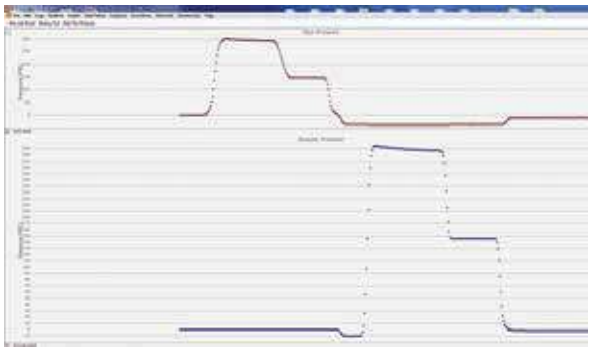
- Real-time monitoring of annular and pipe pressure
- Digital accelerometer system provides instantaneous RPM feedback at the reamer

Benefits

- No footage fees
- Reduces frequency of costly twist-offs and frack-outs

Applications

- Reaming in hard rock or environmentally sensitive areas
- Projects requiring pressure verification



Pipe and annular pressure while drilling

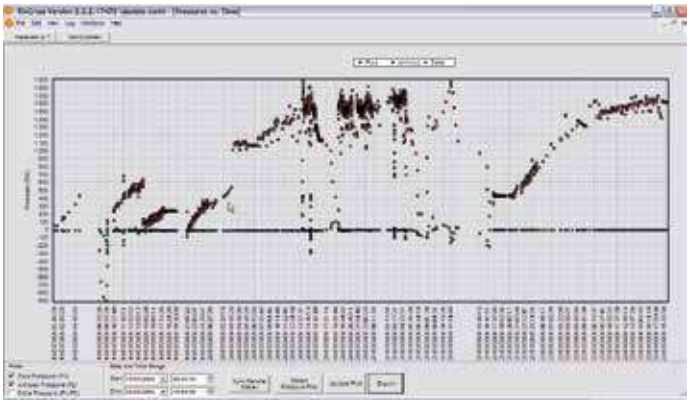
Specifications

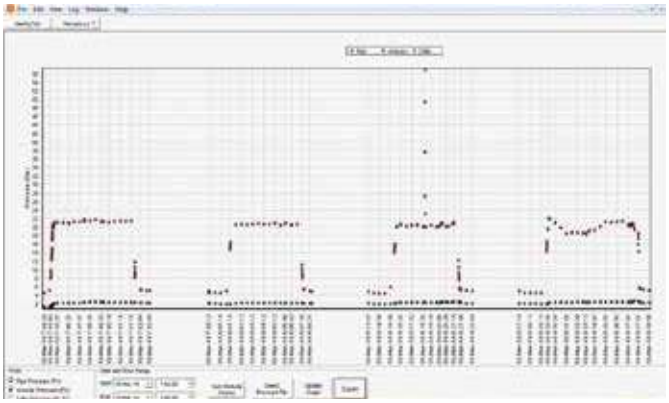
Outside Diameter: 1.75”
Length: Head to foot - 30.125”
Electrical Connection: 1-3/16”, 12 tpi (standard wet connect)
Internal Operating Temperature: 0-85C
Pressure Rating: 10,000 psi (survival)
Pressure Connection at Foot: Requires Pressure Module

PRIMEHORIZONTAL

Pressure Module

A Pressure Module is used to measure downhole pressure. It gives real-time measurements of mud pressure both inside the drill pipe and in the annulus just behind the drill bit. Pressure measurements are taken behind the bit when jetting. When using a mud motor the pressure is measured directly behind the mud motor.

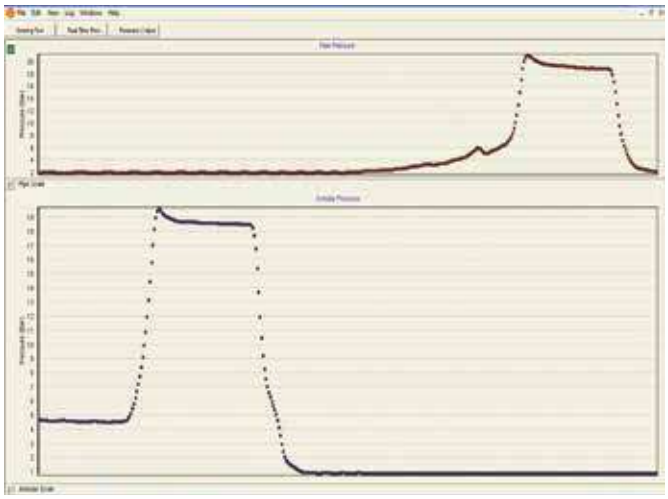




Examples of a post-job PWD drilling charts

The pressure data is monitored and stored by the standard RivCross software used with the ParaTrack-2 system. The pressure can be viewed in real time. It is also stored for later use. The software allows easy graphical representations of pressure variations with time, an example of which is shown (above left). Alarms can also be set in the software and will trigger if pressure limits are exceeded during drilling.

Because it is capable of giving a rapid indication of an increase in downhole pressure, the measurement of pressure while drilling is an effective technique to reduce the risk of bentonite (drilling mud) breakout during the drilling process. It can also help ensure that a drilled hole is kept clean and free of blockages, thus reducing operational risks.



Specifications*

Outside Diameter: 1.75”*
Length: 35.5” (902mm)
Borehole Annulus Gauge: 0-1,000 psi Full Scale, 3,000 psi survival, 5,000 psi burst
Drillpipe Gauge: 0-3,300 psi Full Scale, 10,000 psi survival, 10,000 psi burst
Non-linearity: +/- 0.1 % FS
Hysteresis: +/-0.015% FS

* Centralizers available in custom sizing
** (Pressure Module only – requires separate Pressure Gravity or Steering tool and pressure orienting sub)

PRIMEHORIZONTAL

Pressure While Drilling

In conjunction with a Pressure Module and a Pressure While Drilling (PWD) Orienting Sub, the ParaTrack-2 system tool is used to measure downhole pressure. It gives real-time measurements of mud pressure both inside the drill pipe and in the annulus just behind the drill bit. Pressure measurements are taken behind the bit when jetting. When using a mud motor the pressure is measured directly behind the mud motor.

Pressure Module

The Paratrack-2 tool must be the PWD enhanced version to allow the connection of the Pressure Module as shown here.

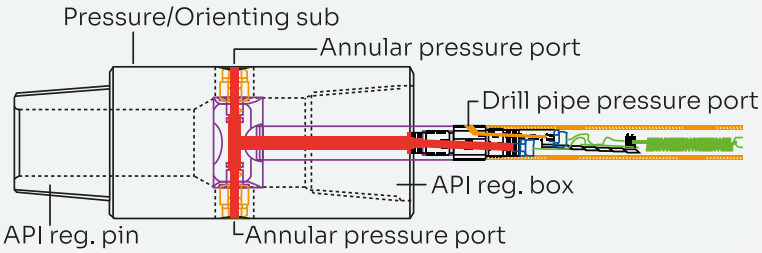
The Pressure Module

Specifications

Length	600mm
Drillpipe annulus gauge	350 bar full scale
Pilot hole annulus gauge	35 bar full scale

Pressure While Drilling (PWD) / orienting sub

The pressure module has a grease-filled access port in its side for measurement of the pipe pressure and another grease-filled access port at the bottom which allows transport of pressure from the specialized Pressure While Drilling (PWD) / orienting sub as shown in Figure 2. The PWD sub uses a grease-filled access port to transport pressure measured from the outside of the PWD sub to the Pressure Module. The Pressure Module then sends the pressure data up the wire line to the interface box and computer located at the top of the hole.

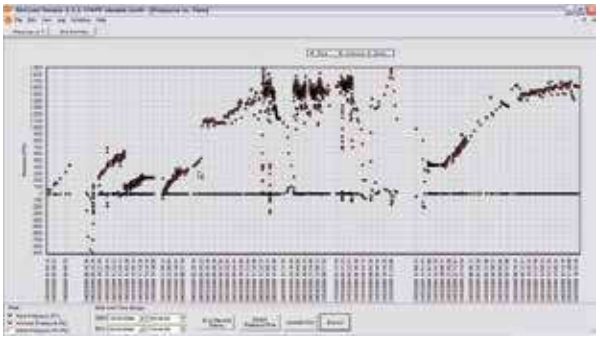


The Pressure While Drilling (PWD) /
Orienting Sub showing the attached Pressure Module.

The pressure data is monitored and stored by the standard RivCross software used with the Paratrack-2 system. The pressure can be viewed in real time. It is also stored for later use. The software allows easy graphical representations of pressure variations with time, an example of which is shown right. Alarms can also be set in the software and will trigger if pressure limits are exceeded during drilling.

Because it is capable of giving a rapid indication of an increase in downhole pressure, the measurement of pressure while drilling is an effective technique to reduce the risk of bentonite (drilling mud) breakout during the drilling process.

It can also help ensure that a drilled hole is kept clean and free of blockages, thus reducing operational risks.



An example of a post-job PWD drilling chart

PRIMEHORIZONTAL

Shock Tool

The Prime Horizontal Shock Tool is a simple drilling enhancement tool designed to reduce bit bounce and impact forces. Reducing bit bounce will increase formation contact and therefore increase the rate of penetration. Reducing impact forces will increase drilling motor and bit life.

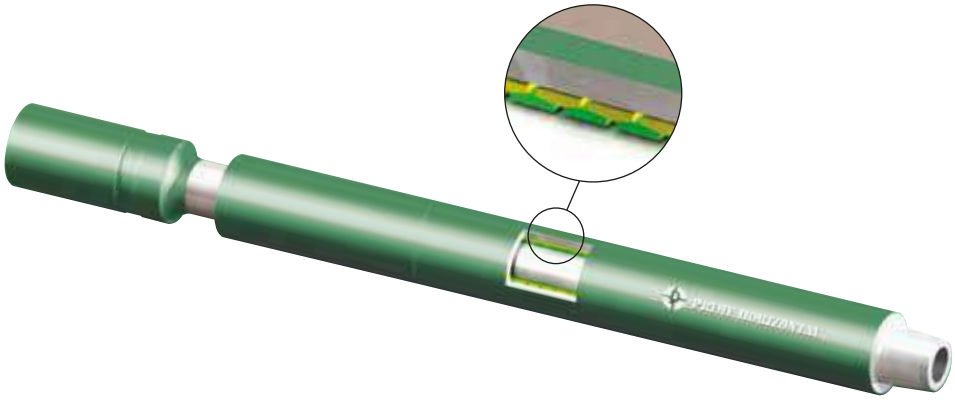
The Prime Horizontal Shock Tool has a relatively soft spring rate and linear travel that will function effectively in a wide range of weight on bits. Because the Prime Horizontal Shock Tool does not rely on internal hydraulic fluid and valves it operates consistently in a wide range of temperatures.

As the name implies the tool is a linear shock absorber that uses unique load dampening steel springs to reduce impact forces and bit bounce. The drilling torque is transmitted through a heavy duty spline. The Prime Horizontal Shock Tool is the ultimate in mechanical simplicity for reliable performance in a wide range of drilling conditions.

Benefits

The use of Prime Horizontal's Shock Tooling will increase your bit life and protect your drill string.

- Vibration Dampening Device should limit damage to down-hole electronic tooling
- Spring Stack compensates for fluctuation in bit weight requirements
- Absorbs both natural and induced vibrations
- Longer bit life by eliminating unusual vibration wear patterns on bit
- Self-lubricated for prolonged life
- Double sealed thread joints and pistons



Steel springs to reduce impact forces and bit bounce.

Specifications

	Model Number	Outside Diameter	Internal Diameter	Tool Length	Torque Capability	Tensile Yield Load	Spring Rate	Max – Min Working Compression Load	Tool Weight
Metric	ST 475	127 mm	50.8 mm	320 cm	51,521 nm	181,437 kg	321.44 kg/mm	22,679 – 2,721 kg	240 kg
	ST 650	165 mm	50.8 mm	198 cm	88,128 nm	290,299 kg	392.87 kg/mm	18,143 – 3,628 kg	254 kg
	ST 800	203 mm	71.1 mm	219 cm	176,256 nm	351,534 kg	607.17 kg/mm	31,751 – 4,535 kg	415 kg
Imperial	ST 475	5.0 in	2.00 in	10.5 ft	38,000 ft-lbs	400,000 lbs	18,000 lbs/in	50,0000 – 6,000 lbs	530 lbs
	ST 650	6.5 in	2.00 in	6.5 ft	65,000 ft-lbs	640,000 lbs	22,000 lbs/in	40,000 – 8,000 lbs	560 lbs
	ST 800	8.0 in	2.80 in	7.2 ft	130,000 ft-lbs	775,000 lbs	34,000 lbs/in	70,000 – 10,000 lbs	915 lbs

PRIMEHORIZONTAL

Rock Reamer

Metric sizes

Specifications

Body				Cutters			
Body	Min pilot hole (mm)	Connections	No of cutters	Opening range (mm)			
RR4	114	2 7/8" IF B x B	3	216	254	305	-
				AA	BB	CC	DD
RR6	159	3 1/2" IF B x B	3	305	356	406	457

Body				Cutters					
				Opening range (mm)					
Body	Min pilot hole (mm)	Connections	No of cutters	A	B	C	D	E	F
RR8	216	4 1/2" IF B x B	3	406	457	508	559	610	660
RR17	445	7 5/8" Reg. B x B	3, 4	609	660	711	762	813	864
RR26	660	7 5/8" Reg. B x B	3, 5	813	864	914	965	102	1067
RR36	914	7 5/8" Reg. B x B	3, 4, 5	1067	1118	1168	1219	1270	1321
RR42	1067	7 5/8" Reg. B x B	4, 5, 7	1219	1270	1321	1372	1422	1473
RR48	1220	7 5/8" Reg. B x B	4, 5, 7	1372	1422	1473	1524	1575	1626

* Thread connections mentioned are in standard sizes. Other connections are available upon request.

Cutter specifications

Milled Tooth

Alluvial formations, clays, soft rock.
3–21 Mpa (500–3,000 PSI) compressive strength formations.

Formation types: Sandstone, shale, mudstone, clays, gravels and conglomerate.

Teeth are milled directly from the hard cone steel and tungsten hardfacing applied on the trailing edge to maintain sharpness of the blade. TCI gage row MT cutters available on special order.

TCI Chisel

Medium rock
21–103 Mpa (3,000–15,000 PSI) compressive strength rock.

Formation types: Limestone, sandstone and shale.

TCI teeth are aggressive conical shaped for aggressive penetration rates in medium type rock.

TYPE 5 (IADC)

Medium – hard rock
83–172 Mpa (12,000 - 25,000 PSI) compressive strength rock

Formation Types: Granite, marble, and dolomite.
TCI teeth have moderate extensions.
Gage area has all dome type cutters to maximize cutter gage life.

TCI Type 7

Hard rock
172–310 Mpa (25,000 - 45,000 PSI) compressive strength rock

Formation Types: Quartz, basalt, and quartzite.
TCI teeth are all hemispherical shape, providing a longer cutter life in extremely hard rock.

Body, cutter and arm weights – in kg

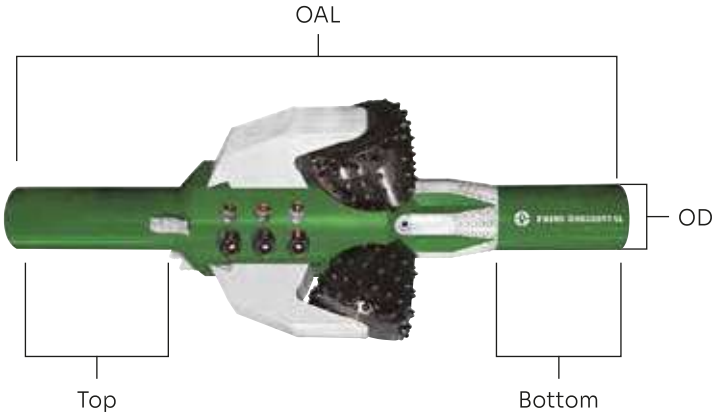
Body | **RR4** – 61 | **RR6** – 157 | **RR8** – 331 | **RR17** – 869 | **RR26** – 1210 | **RR36** – 1770 | **RR42** – 2150 | **RR48**

Body	R4-8.5	R4-10	R4-12	R6-12	R6-14	R6-16	R6-18	R6-20	A	B	C	D	E	F
MT	1.8	3.6	5.4	6.8	10.4	14.0	18.6	25.4	14.4	21.2	28.8	36.0	45.9	57.6
TCI	2.7	4.5	7.2	9.5	13.5	18.9	24.9	33.1	18.5	27.5	35.6	45.0	56.7	69.8
FRA	2.3	3.2	4.1	9.0	10.8	12.6	15.9	16.8	22.5	24.8	30.6	33.8	39.6	45.5

* Weight in kg per cutter

PRIMEHORIZONTAL

Rock Reamer



Operating specifications– Metric si zes

					Mill Tooth		TCI					
Tool series	Pilot hole (mm)	Thread B x B	No. of cutters	Opening size (mm)	WOB (000's kg)	RPM's	WOB (000's kg)	RPM's	Body OD (mm)	OAL* (mm)	Top* (mm)	Bottom* (mm)
RR4	114	2 7/8" IF	3	216 – 305	3.5 – 4.5	50 – 80	3.5 – 5.5	40 – 80	89	1054	381	305
RR6	159	3 1/2" IF	3	305 – 457	4.5 – 7.0	40 – 100	7.0 – 9.0	35 – 80	120	1320	305	381
RR8	216	4 1/2" IF	3	406 – 660	7.0 – 9.0	40 – 80	7.0– 18.0	35 – 70	165	1549	318	406
RR17	445	7 5/8" Reg.	3	609 – 864	7.0 – 11.5	40 – 65	9.0 – 18.0	40 – 65	241	1638	305	356
RR26	660	7 5/8" Reg.	3	813 – 1067	7.0 – 13.5	35 – 60	9.0 – 22.5	35 – 55	241	1638	305	305
RR36	914	7 5/8" Reg.	4	1067 – 1321	7.0 – 13.5	35 – 55	9.0 – 22.5	35 – 50	241	1638	305	305
RR42	1067	7 5/8" Reg.	4	1219 – 1473	7.0 – 13.5	35 – 50	9.0 – 22.5	30 – 45	241	1638	305	305
RR48	1220	7 5/8" Reg.	5	1372 – 1626	7.0 – 16.0	35 – 45	9.0 – 27.0	25 – 40	241	1638	305	305

▪ Lengths apply for new bodies only.

The suggested weights and RPM's are only a recommended guide.Weights and RPM's should be adjusted to maximum penetration rates modified by expected cutter life.
They will vary with formation and rig power. Recommended weights assume minimum pilot hole sizes. As the cutting shoulder is reduced, less weight is needed.

Tips:

- Softer formations will normally respond to lighter weights and higher RPM's. Harder formations require more weight and slower RPM's
- Adjust weight and RPM to achieve optimum torque. Avoid uneven rotation of hole opener.
- Use sufficient fluid volume to obtain optimum hole cleaning.
- Proper centralisation will enhance tool performance and increase downhole life.

PRIMEHORIZONTAL

Lo Torque Hole Opener

Metric sizes

LT hole opener specifications

Body				Cutters			
Body	Min pilot hole	Connections	No of cutters	Opening range			
LT2	6.4	2" IF P x B	3	15.2			
LT4	11.4	2 7/8" IF P x B	3	20.3	25.4		30.5
LT6	16.5	3 1/2" IF P x B	3	30.5	35.6		40.6
				A	B	C	D
LT8	21.6	4 1/2" IF P x B	3	40.6	45.7	50.8	55.9
LT16	40.6	7 5/8" Reg. P x B	3	61.0	66.0	71.1	76.2
LT24	61.0	7 5/8" Reg. P x B	4	81.3	86.4	91.4	96.5
LT32	81.3	7 5/8" Reg. P x B	4	106.7	111.8	116.8	121.9
LT40	101.6	7 5/8" Reg. P x B	4	121.9	127.0	132.1	137.2
LT48	121.9	7 5/8" Reg. P x B	5	137.2	142.2	147.3	152.4

* Thread connections mentioned are in standard sizes. Other connections are available upon request.

Cutter specifications

Milled Tooth

Alluvial formations, clays, soft rock.
3–21 Mpa (500–3,000 PSI) compressive strength formations.

Formation types: Sandstone, shale, mudstone, clays, gravels and conglomerate.

Teeth are milled directly from the hard cone steel and tungsten hardfacing applied on the trailing edge to maintain sharpness of the blade. TCI gage row MT cutters available on special order.

TYPE 5 (IADC)

Medium rock
41–103 Mpa (6,000 - 15,000 PSI) compressive strength rock

Formation types: Limestone, sandstone, and shale.

TCI teeth are aggressive conical shaped for aggressive penetration rates in medium type rock.

TYPE 7 (IADC)

Medium – hard rock
83–172 Mpa (12,000 - 25,000 PSI) compressive strength rock

Formation Types: Granite, marble, and dolomite.

TCI teeth have moderate extensions.

Gage area has all dome type cutters to maximize cutter gage life.

TYPE 8 (IADC)

Hard rock
172–310 Mpa (25,000 - 45,000 PSI) compressive strength rock

Formation Types: Quartz, basalt, and quartzite.

TCI teeth are all hemispherical shape, providing a longer cutter life in extremely hard rock.

Lo-Torque Hole Opener Cutters to match the formation hardness of your bore.
The Lo-Torque Tungsten Carbide Cutter types now range from medium to extremely hard rock formations. Close attention to insert material composition of gage, inner row and base areas of the cutters optimizes their performance in the wide range of rock conditions encountered in horizontal drilling.

Body and cutter weights – in kg

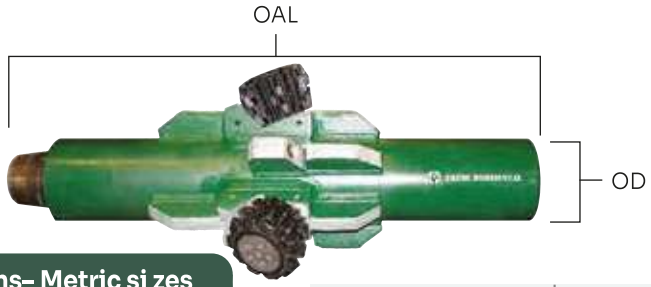
Body	**LT2** – 15	**LT4** – 51	**LT6** – 121	**LT8** – 218	**LT16** – 539	**LT24** – 885	**LT32**– 1230	**LT40** – 1451	**LT48** – 1545

Body	LT2	LT4			LT6			LT8				LT16				LT24				LT32				LT40				LT48			
	2"	8"	10"	12"	12"	14"	16"	16"	18"	20"	22"	24"	26"	28"	30"	32"	34"	36"	38"	40"	42"	44"	46"	48"	50"	52"	54"	56"	58"	60"	62"
MT	1.3	1.8	3.6	5.4	6.8	10.4	14.0	14.5	21.3	29.0	38.2	14.5	21.3	29.0	38.2	14.5	21.3	29.0	38.2	14.5	21.3	29.0	38.2	14.5	21.3	29.0	38.2	14.5	21.3	29.0	38.2
TCI	1.3	2.7	4.5	7.3	9.5	13.6	19.0	18.6	27.6	35.7	45.3	18.6	27.6	35.7	45.3	18.6	27.6	35.7	45.3	18.6	27.6	35.7	45.3	18.6	27.6	35.7	45.3	18.6	27.6	35.7	45.3

* Weight in kg per cutter

PRIMEHORIZONTAL

Lo Torque Hole Opener



Operating specifications– Metric si zes

						Mill Tooth		TCI			
Body type	Pilot hole	Body thread P x B	No. of cutters	cutter series	Opening size (cm)	WOB (000's kg)	RPM's	WOB (000's kg)	RPM's	Body OD (cm)	OAL*
LT2	6.4	2" IF	3		15.2	1.4 – 3.2	50 – 80	1.4 – 3.2	30 – 60	6.35	60.96
LT4	11.4	2 7/8" IF	3		20.3 – 30.5	3,6 – 4.5	50 – 90	4.5 – 5.4	40 – 80	8.89	95.25
LT6	16.5	3 1/2" IF	3		30.5 – 40.6	4.5 – 6.8	40 – 100	6.8 – 9.1	35 – 90	11.43	111.76
LT8	21.6	4 1/2" IF	3	A	40.5	6.8 – 9.1	40 – 100	9.1 – 18.1	35 – 90	16.51	123.19
				B	45.7	6.8 – 9.1	40 – 90	9.1 – 18.1	35 – 80		
				C	50.8	6.8 – 9.1	40 – 80	9.1 – 18.1	35 – 80		
				D	55.9	6.8 – 9.1	40 – 75	9.1 – 18.1	35 – 70		
LT16	40.6	7 5/8" Reg.	3	A	61.0	6.8 – 11.3	40 – 75	9.1 – 18.1	35 – 70	24.13	135.89
				B	66.0	6.8 – 11.3	40 – 75	9.1 – 18.1	35 – 70		
				C	71.2	6.8 – 11.3	40 – 75	9.1 – 18.1	35 – 70		
				D	76.2	6.8 – 11.3	40 – 65	9.1 – 18.1	35 – 60		
LT24	61.0	7 5/8" Reg.	4	A	81.3	6.8 – 13.6	35 – 60	9.1 – 22.7	35 – 55	24.13	148.59
				B	86.4	6.8 – 13.6	35 – 60	9.1 – 22.7	35 – 55		
				C	91.4	6.8 – 13.6	35 – 60	9.1 – 22.7	35 – 55		
				D	96.5	6.8 – 13.6	35 – 60	9.1 – 22.7	35 – 55		
LT32	81.3	7 5/8" Reg.	4	A	101.6	6.8 – 13.6	35 – 55	9.1 – 22.7	35 – 50	24.13	148.59
				B	106.7	6.8 – 13.6	35 – 55	9.1 – 22.7	35 – 50		
				C	111.8	6.8 – 13.6	35 – 55	9.1 – 22.7	35 – 50		
				D	116.8	6.8 – 13.6	35 – 55	9.1 – 22.7	35 – 50		
LT40	101.6	7 5/8" Reg.	4	A	121.9	6.8 – 13.6	35 – 50	9.1 – 22.7	30 – 45	24.13	148.59
				B	127.0	6.8 – 13.6	35 – 50	9.1 – 22.7	30 – 45		
				C	132.1	6.8 – 13.6	35 – 50	9.1 – 22.7	30 – 45		
				D	137.2	6.8 – 13.6	35 – 50	9.1 – 22.7	30 – 45		
LT48	121.9	7 5/8" Reg.	5	A	142.2	6.8 – 15.9	35 – 45	9.1 – 27.2	25 – 40	24.13	148.59
				B	147.3	6.8 – 15.9	35 – 45	9.1 – 27.2	25 – 40		
				C	152.4	6.8 – 15.9	35 – 45	9.1 – 27.2	25 – 40		
				D	157.5	6.8 – 15.9	35 – 45	9.1 – 27.2	25 – 40		

Tips:

- Softer formations will normally respond to lighter weights and higher RPM's.
  Harder formations require more weight and slower RPM's
- Adjust weight and RPM to achieve optimum torque. Avoid uneven rotation of hole opener.
- Use sufficient fluid volume to obtain optimum hole cleaning.
- Proper centralisation will enhance tool performance and increase downhole life.

- Lengths apply for new bodies only.
- The suggested weights and RPM's are only a recommended guide.
- Weights and RPM's should be adjusted to maximum penetration rates.
- They will vary with formation and rig power. Recommended weights assume minimum pilot hole sizes. As the cutting shoulder is reduced, less weight is needed.

PRIMEHORIZONTAL

GyroTrack

Pipeline survey services

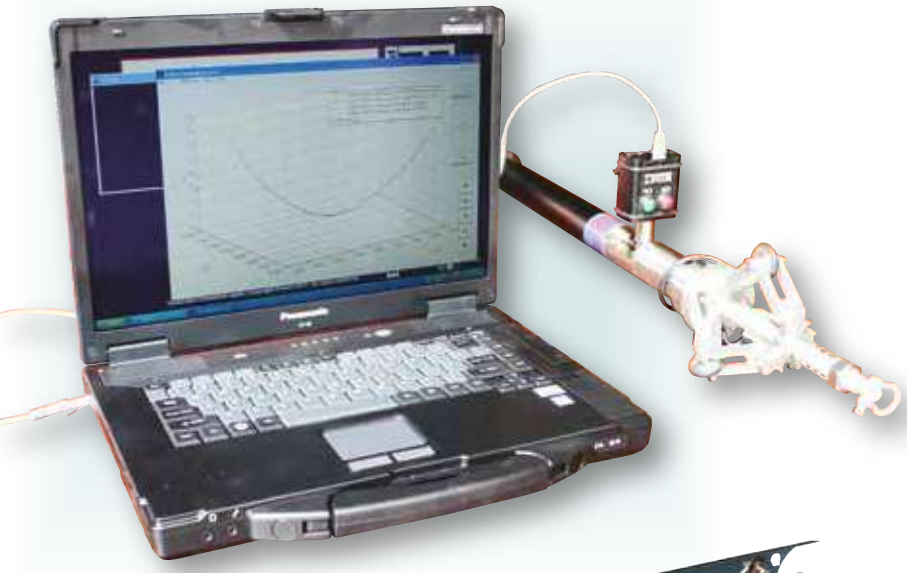
Taking advantage of more than 10 years experience as a leading field service company to the HDD market, Prime Horizontal offers post installation pipeline surveying using gyroscope technology.

With unrivalled customer service, fast reaction times, a flexible approach to client requirements and offices on four continents, Prime Horizontal offers this service worldwide using the field proven GyroTrack platform.

GyroTrack is a versatile and unique multi-purpose pipeline mapping system. With a proven track record on virtually every continent, this multi-diameter system provides the most accurate results on pipeline location.

A unique system of exchangeable centralizing wheel units gives the GyroTrack an operational range of ID80mm (3.15") to ID1200 (48"). Whether the pipeline is made of steel, concrete, HDPE or PVC, this mapping system will improve any HDD implementation procedure.

The GyroTrack tool with centralization, may be pulled either by a hand operated wireline or a mechanical winch. In certain cases, the tool may be pumped through the product line.



GyroTrack positioned in pipe

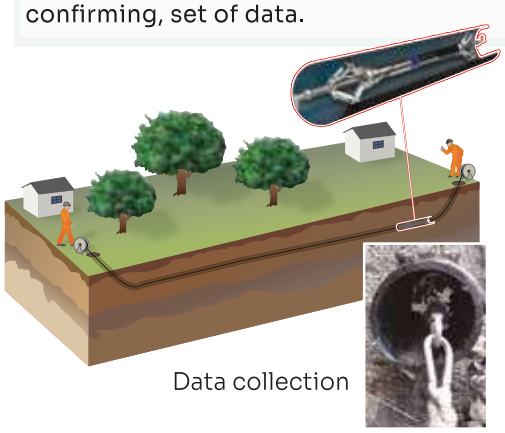
PRIMEHORIZONTAL

GyroTrack

Data collection

GyroTrack operation is enabled after insertion into the end of the product line. Once physical location measurements are made, GyroTrack is pulled through the line at a predetermined rate, usually 1 to 1.5 m/sec.

After GyroTrack arrives at the other end of the product line, it is reversed and pulled back obtaining a second, confirming, set of data.

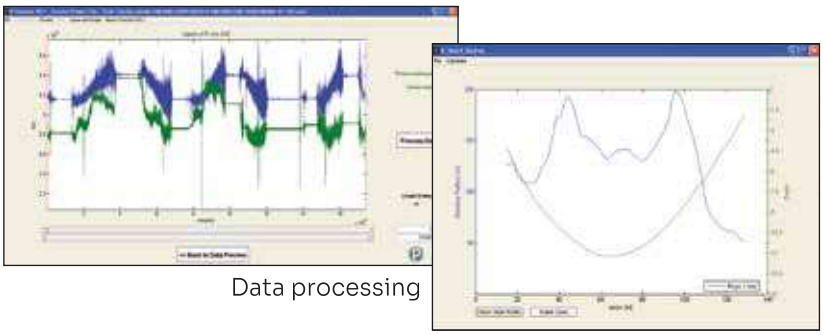


Data collection

Data processing

Captured data is immediately checked on site to ensure data collection limits and quality control targets have been met. After confirmation, the data can be uploaded to the office through GPRS.
An immediate on site Survey Report can be provided at this time. The report would include the following attributes.

- 3D pipeline profile
- Bend radius report per customer defined intervals
- Inclination analysis
- Job specification
- Job locations



Data processing

Data transfer to GIS

Output data can be exported to open platform formats for seamless integration in common GIS platforms such as:

- AutoCAD
- Excel
- MicroStation
- Text

A final report will be produced after office quality control of the survey.

Specifications

Diameter	3.15"/80 mm to 32"/800 mm	36"/900 mm	48"/1200 mm
Operational ID range	Fully variable in range	36"/900 mm	48"/1200 mm
System length	44"/1000 mm to 67"/1700 mm	47"/1200 mm	40"/1000 mm
Min. bending radius	180"/4500 mm to 26"/660 mm	2D	2D
System weight	3 kg to 8 kg	22kg	25kg
Logging rate	800hz		
Calibrated Accuracy	15cm in XYZ over a 500m distance between Way Points**		
Battery autonomy	> 3 hours		

** Accuracies subject to many environmental factors and are more closely defined within each Post Job Report.
Specifications may change without prior notice.

PRIMEHORIZONTAL

Small Diameter GyroTrack Tool
OD range: 1.5 – 3" (40 – 75 mm)

Benefits

- Maps small diameter ducts
- Unaffected by magnetic influences
- Water resistant up to 5 bar/75psi
- Ideal for small radius utility pipes

The small GyroTrack is a gyroscope based mapping tool specifically developed for generating accurate As-Built maps of short duct segments, has an outside diameter of just 36mm and is suitable for a pipe ID of 40mm (1.5”). Optionally, a spacer set is available to scale the unit incrementally up to pipes and ducts with an ID of maximum 75mm (3.0”).

The small GyroTrack is robust and easy to operate. Typically, an As-Built profile of a pipe segment can be generated in 30 minutes. Data processing requires mere minutes and output can be instantly viewed in most common GIS platforms.

1 Data collection

GyroTrack operation is enabled after insertion into the end of the product line. Once physical location measurements are made, GyroTrack is pulled through the line at a predetermined rate, usually 1 to 1.5 m/sec.

After GyroTrack arrives at the other end of the product line, it is reversed and pulled back obtaining a second, confirming, set of data.

2 Data processing

Captured data is immediately checked on site to ensure data collection limits and quality control targets have been met.

After confirmation, the data can be uploaded to the office through GPRS.

An on site Survey Report can be provided at this time. The report would include the following attributes.

- 3D pipeline profile
- Bend radius report per customer defined intervals
- Inclination analysis
- Job specification
- Job locations

3 Data transfer to GIS

Output data can be exported to open platform formats for seamless integration in common GIS platforms such as:

- AutoCAD
- Excel
- MicroStation
- Text

A final GIS treport will be produced after office quality control of the survey.

Specifications

Diameter	1.4"/36 mm
Operational ID range	**1.5"/40 mm** to **3"/75 mm**
System length	30"/770 mm
System weight	5 lb/2 kg
Inclination rate	+45˚ to -45˚
Maximum pulling force	150 lb/75 kg
Maximum travelling speed	1 m(3')/sec
Logging rate	100hz
Battery autonomy	> 3 hours
Minimum bend Radius in:	DN50/SDR11 duct (ID40.8 mm) : **800 mm**
	DN63/SDR11 duct (ID51.5 mm): **600 mm**
	DN90/SDR11 duct (ID73.6 mm): **300 mm**

An example final GIS report

PRIMEHORIZONTAL

ABIA Bit Sub

The At Bit Inclination Assembly (ABIA) Sub is the newest addition to Prime Horitzontal's line of HDD tools. By using the ABIA bit sub, inclination at the bit can now be monitored in real-time - a first for the HDD industry.

Benefits

- The ABIA technology is in the bit box in a sub
- Is interchangeable between any suitable mud motor
- Is placed between the drill bit and the motor
- Inclination is measured at the bit
- Monitors inclination in real-time
- Improves inclination control, accomodating tighter tolerances

Absolute inclination is transmitted from the bit-box via EM to the ParaTrack 2 probe positioned in its normal position in the non-magnetic drill collar behind the motor. Drill-string inclination is monitored in RivCross software, where inclination at the bit can be compared to inclination at the probe, greatly assisting the surveyor in conditions with mixed substrates or when tight tolerances on inclination are required.

Prime Horizontal's unique bit sub design means that the ABIA can be used with any suitably sized motor. This gives the possibility of using the ABIA with customer owned motors.

ABIA Bit Sub & kit

Specifications

Length: 70 cm (28")
Diameter: 20 cm (8")
Weight (total sub + kit): 250 kg (550 lbs)
Connection size: 6 5/8 Reg Pin x 6 5/8 Reg Box

The At Bit Inclination Assembly (ABIA) which provides real-time monitoring of at-bit inclination

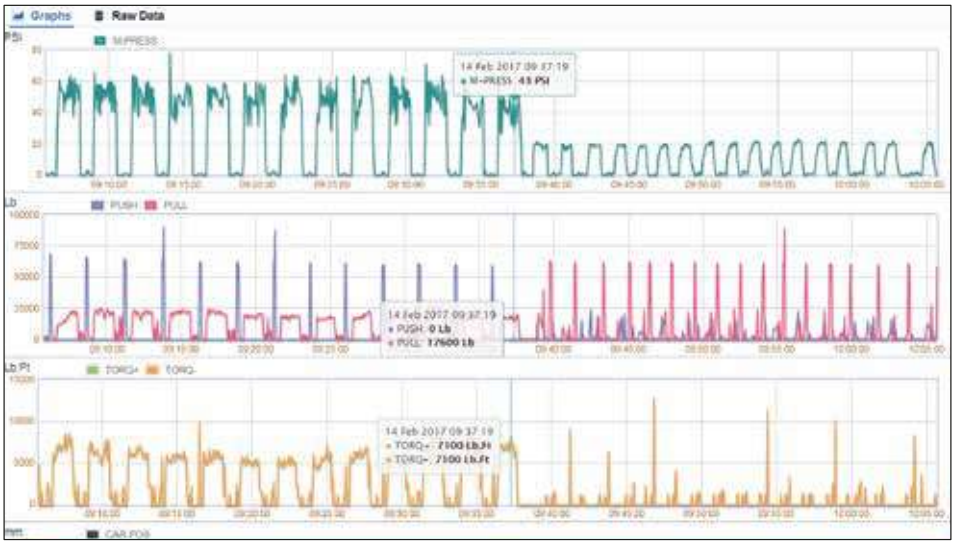
PRIMEHORIZONTAL

ProData

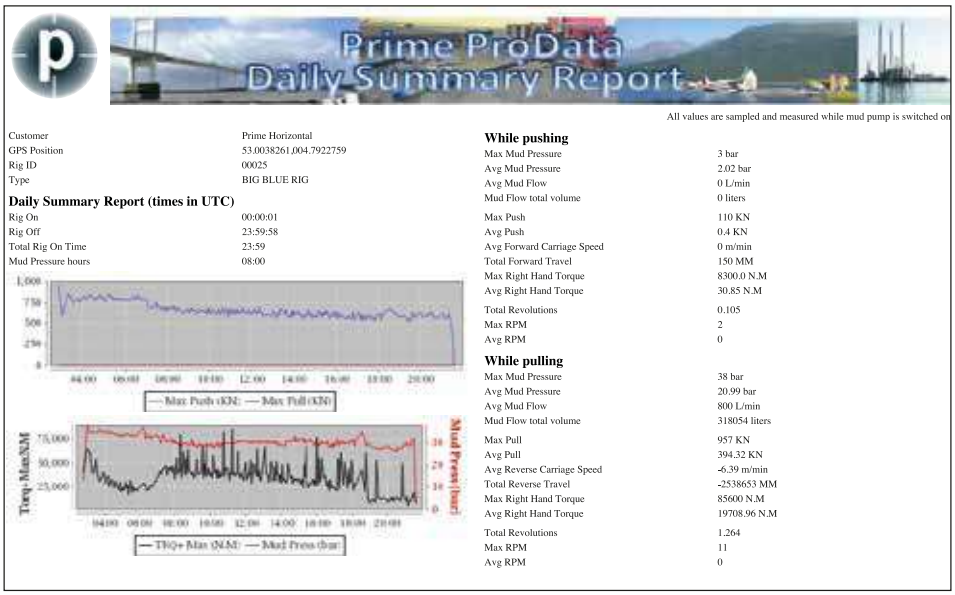
ProData is a system for measuring drilling parameters and displaying them locally at the rig site or in a remote office location via the cell network.

Benefits

- Daily reports give concise overview of drilling activities
- In depth analysis of the drilling operation
- Reduced downtime
- Reduced broken pipe and stuck in hole problems
- High and low pre-set alarms of all measured drilling parameters
- User defineable 3rd party access
- Real time graphical representations of drilling parameters logged every 3 seconds
- Increased tooling life
- Data archive on site and off site
- Multiple operations oversight from one location
- Facilitates decision making
- Savings in supervisory man hours on the drill site



Data Display



Prime ProData
Daily Summary Report

All values are sampled and measured while mud pump is switched on

Customer	Prime Horizontal
GPS Position	53.0038261,004.7922759
Rig ID	00025
Type	BIG BLUE RIG

Daily Summary Report (times in UTC)

Rig On	00:00:01
Rig Off	23:59:58
Total Rig On Time	23:59
Mud Pressure hours	08:00

While pushing

Max Mud Pressure	3 bar
Avg Mud Pressure	2.02 bar
Avg Mud Flow	0 L/min
Mud Flow total volume	0 liters
Max Push	110 KN
Avg Push	0.4 KN
Avg Forward Carriage Speed	0 m/min
Total Forward Travel	150 MM
Max Right Hand Torque	8300.0 N.M
Avg Right Hand Torque	30.85 N.M
Total Revolutions	0.105
Max RPM	2
Avg RPM	0

While pulling

Max Mud Pressure	38 bar
Avg Mud Pressure	20.99 bar
Avg Mud Flow	800 L/min
Mud Flow total volume	318054 liters
Max Pull	957 KN
Avg Pull	394.32 KN
Avg Reverse Carriage Speed	-6.39 m/min
Total Reverse Travel	-2538653 MM
Max Right Hand Torque	85600 N.M
Avg Right Hand Torque	19708.96 N.M
Total Revolutions	1.264
Max RPM	11
Avg RPM	0

Daily Report

PRIMEHORIZONTAL

ProData

Features

- Retrofit existing drill rigs or install on new drill rigs
- Suitable for installation on drill rigs from 12 to 600 tons
- Use of field proven and internationally certified sensors
- Use of modular design for adding new data packages, such as steering data, mud weight & viscosity data or Downhole Pressure & Gravity information
- GPS Position tracking
- Use of wireless technology to avoid using cables at the drill site
- Ruggedized to withstand vibration and ingress to minimum IP67
- Automatic data transfer to local and cloud-based user portal
- Security with password access for each rig and each client
- Capability of multiple users per client with client definable user permissions.
- Viewable on any device, any time, anywhere.

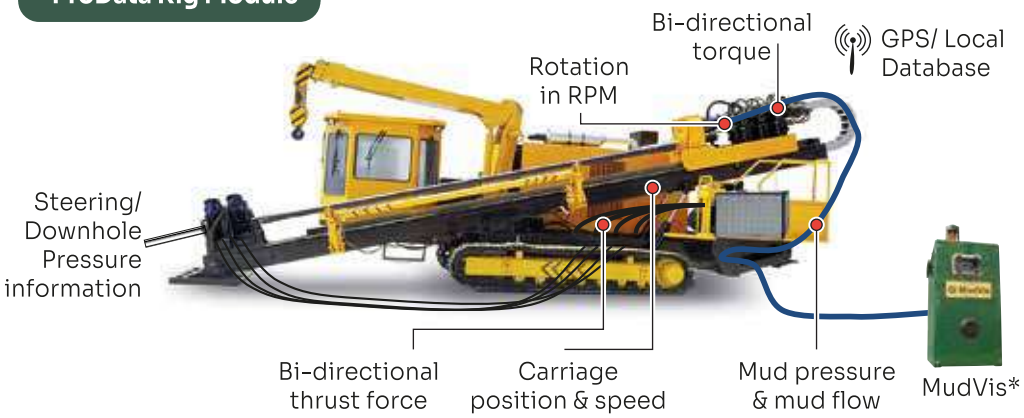
ProData System

The ProData system automatically gathers, stores and transmits it modular suite of HDD rig site data to an on-site database (Local). The data is also transmitted via the cell network to the Prime Horizontal cloud-based database (Remote).

Both remote and local database archives make all logged data available for on-demand access by means of the intuitive and user-friendly client access portals.

Through these portals the customer gains access to either historical or “live” data (near real time) from one of the two Prime web servers.

ProData Rig Module



* Denotes non-standard component

PRIMEHORIZONTAL

Wireless Driller Display Adaptor

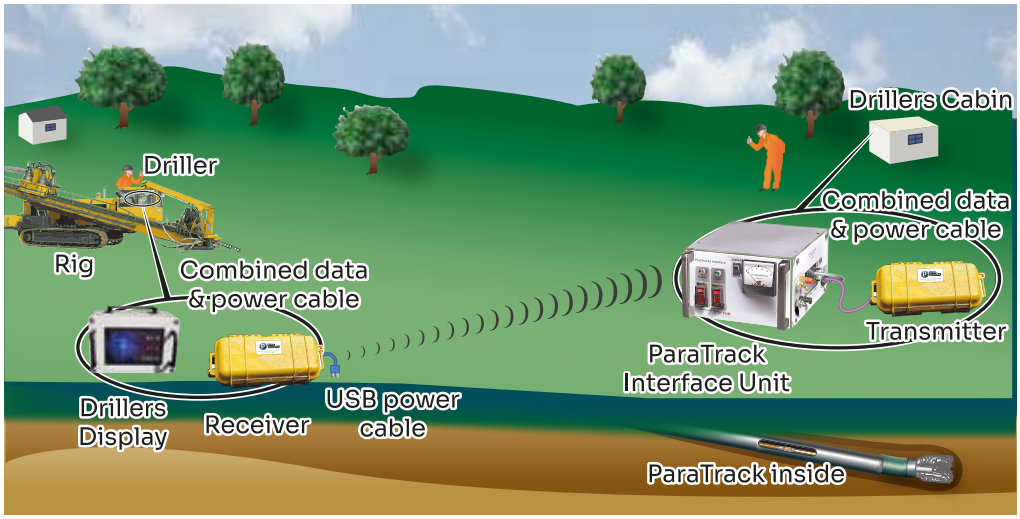
With a range of up to 500m (1,640 feet), Prime Horizontal's new Wireless Driller Display Adaptor for ParaTrack is perfect for any HDD jobsite drilling a pilot hole with ParaTrack.

Easy to setup, and flexible. The transmitter is powered by the standard ParaTrack interface box. The receiver is powered by a standard 2.1A USB power source (e.g. phone charger) and the receiver also provides power to the Driller Display itself. This gives the driller a variety of power options to choose from, 220V, 110V, 12V etc., and an easy "plug and play" setup.

The Prime Horizontal Wireless Driller Display Adaptor will work with all existing greyscale & colour ParaTrack Driller Displays and interface boxes regardless of age.

Benefits

- No more Driller Display cables
- Range up to 3 km (9,850 ft)
- Plug & Play
- Works with all existing grey scale displays
- Low Baud rate gives high resistance to signal interference
- Crush proof
- No batteries - powered by standard USB power source
- Water resistant up to IP 67



Wireless Driller Display Adaptor with the new touchscreen Wireless Drillers Display

Specifications

Dimensions:	19 x 9.8 x 6.2 cm (7.5 x 3.9 x 2.4")
Weight:	800 g/1.8 lbs (per set)
Range:	500 m (1,640 ft)
Input:	2.1A USB power source
Power supply options:	220/110/12 V
Water resistant:	IP 67
Frequency:	433 MHz
RF power:	50m W/ 17 dBm
Operating temperature:	-25˚C to 65˚C (-13–149 ˚F)

PRIMEHORIZONTAL

Colour Wireless Driller Display

Benefits

- Hi-resolution colour 5” touch screen
- High speed graphics processor
- WiFi capability direct from laptop
- Flexible and easy handling
- Compatible with standard Prime Horizontal cables
- Equipped with a “cigarette lighter” 12V lead and global mains power lead
- Range up to 25m without external dongels or antennae
- Option to extend range up to 3 km with use of the Wireless Driller Display Adaptors

Prime Horizontals 5” Colour Wireless Driller Display is a new generation total sunlight viewable touch screen.

It meets the need for tough, flexible onsite equipment, while offering high performance specifications. Replacing the current grayscale screens in use around the world.

Specifications

Technical

- **Resolution:** 800 x 480 pixels WVGA
- **Range:** 2.4 GHz WiFi up to 25m (line of sight)
- **Legibility:** (1000 NIT cd/m2) Viewable in full strength sunlight
- **Viewable angle:** up to 70˚ from any direction
- **Dimensions:** 180 x 100 x 120 mm (7” x 3.9” x 4.7”)
- **Power supply:** 12-30 V

Environmental

- **Degree of protection:** Meets IP 66 standards
- **Operating Temperature:** -20˚C – 70˚C
- **Storage Temperature:** -40˚C – 80˚C

Photo taken in direct sunlight showcasing the visibility and intensity of colour on the Wireless Driller Display screen.

The New generation colour Wireless Driller Display screen can be used with these optional adaptors.

PRIMEHORIZONTAL

MudVis: Automated Mud Viscosity Logging System

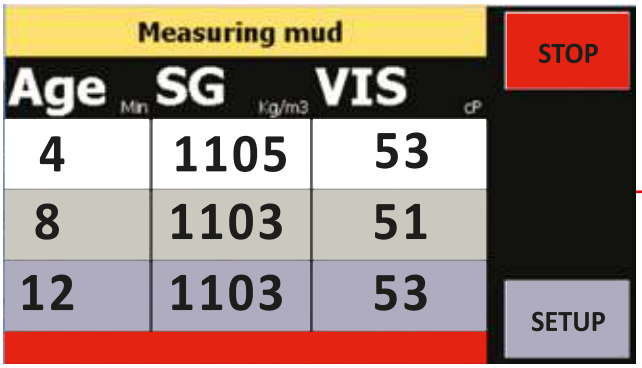
Benefits

- Real-time automated Viscosity measurements assists the Mud Engineer during the mixing process
- Easy tracking of mud weight throughout the drilling & reaming process
- Generates mud mixing data for reports
- Data download via WiFi for logging, reporting and analysis purposes
- Monitoring is accessible via WiFi from around the drill site from laptops, smartphones and tablets
- User friendly self calibrating/ cleaning, low maintenance system
- Exterior mounted alarm system
- Ability to react quickly to changing soil conditions

Designed specifically for the HDD industry, MudVis samples your stock; or mixing tank bentonite at regular preset intervals (varying from 4 to 10 minutes).

The viscosity and specific gravity values are logged in the processing unit, displayed on a sunlight viewable LCD screen, on Wifi enabled laptops, smartphones, and tablets for easy viewing at a glance.

Complements the mud mixing system by providing real time viscosity values during mud mixing.

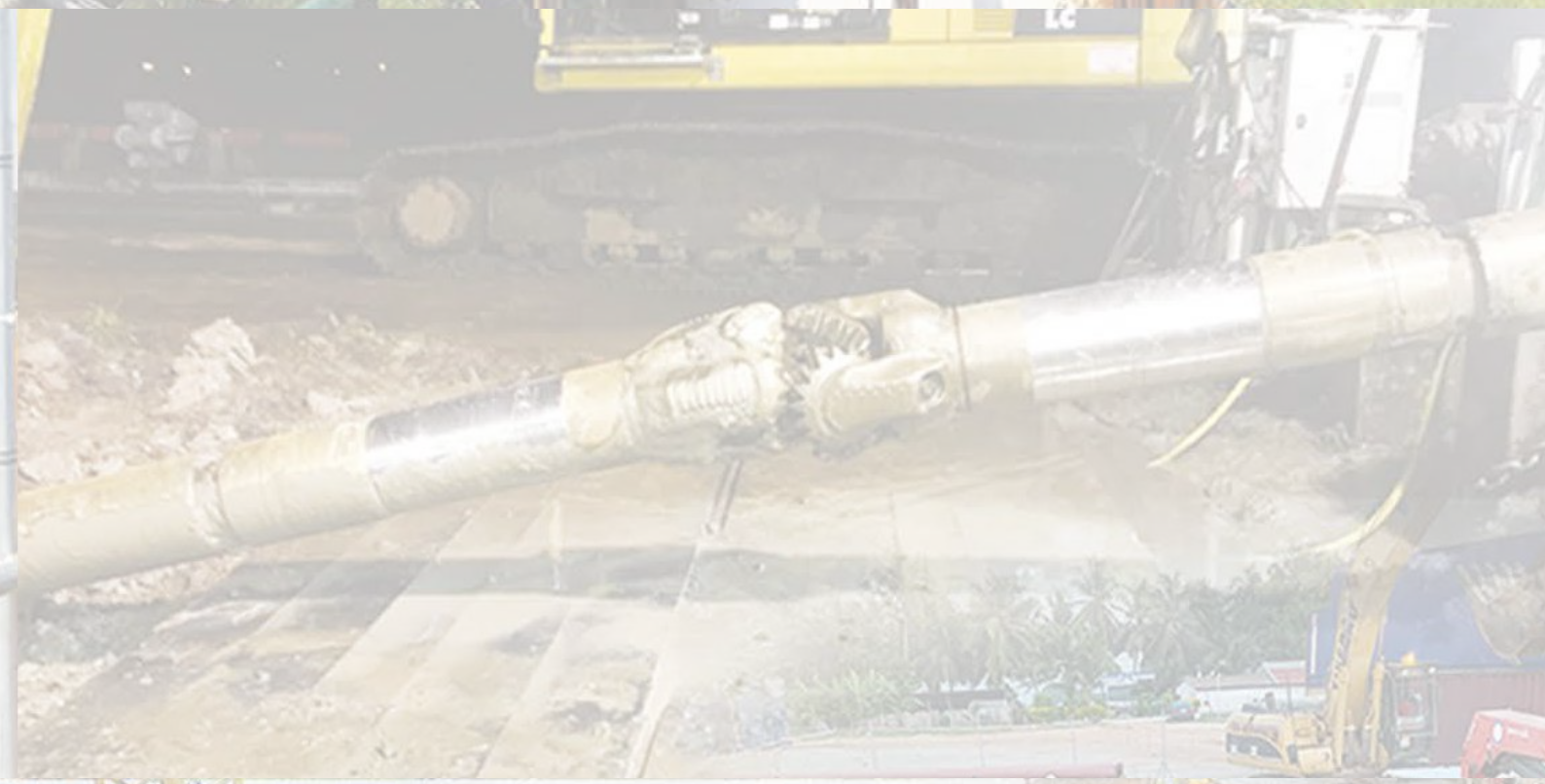


Readout of results on the sunlight viewable display screen displaying:
Timing, Specific Gravity and Viscosity

Data logging snapshot of mud measurement viewed on a mobile device

Specifications

Weight (dry)	30 kg (66 lb)
Power	110/220v mains supply
Mud pump	12 m (40 ft) max, 200 l/min
Viscosity units	MFs or Centipoise
Specific gravity units	kg/m³ (lb/ft³)
Measurement frequency	Reading at preset intervals [from 4 minutes on (adjustable)]
Accuracy SG / VIS	+/- 1.5%
WiFi capability	With app for real time readings
Mud viscosity	Up to 100 MFs
Dimensions of box (lwh)	30 x 46 x 57 cm (12 x 18 x 22 in)



PRIMEHORIZONTAL

Innovation & Experience: Creating Confidence from Entry to Exit

Prime Horizontal's Global offices

Prime Horizontal has been a primary driver of advances in the ParaTrack system of magnetic guidance for many new applications and remains the primary user of ParaTrack. As a result, Prime Horizontal is considered one of the foremost authorities on the use of the ParaTrack system in HDD applications.

We would like to continue to be involved with your upcoming projects, so when we can be of assistance please get in touch.

www.primehorizontal.com

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