

# THE GYROFLEX NAVIGATOR

The Gyroflex™ Navigator instrument provides the ultimate in 'gyro-flexibility'. This state of the art field proven Northseeking rate gyro instrument has a modular construction, to provide flexibility of operation enabling it to be used for many different gyro service applications including:

- Orientation / Kick Off
- Cased / open hole surveying with real time readout
- Gyro single / multishot memory service on slick line
- Drill Pipe Memory Drop Gyro to save rig time
- Continuous High speed All-Angle surveys



## Technology

Field proven in our service operations for many years, the Gyroflex™ instrument is small and rugged and incorporates the latest rate gyro and accelerometer technologies. This combined with advanced electronics and calibration software provides high accuracy performance.

## System

The system consists of a Gyroflex™ instrument which can run on either an electric wireline connected to a surface power supply and PC or in memory mode on slick / braided line or in drop mode. An optional remote rig floor readout is available for display of survey and drilling information as required. Under normal circumstances, the gyroflex tool would be run in a 1.75" pressure case / thermal shield to maintain temperature stability.

## Gyroflex™ Applications and Benefits

- Field proven to be highly reliable in our own service operations for over 8 years.
- Smallest Northseeking rate gyro (gyrocompass alignment) available.
- High accuracy in a small size unlike most other gyros of this type (1.75" inside the combined pressure case / thermal shield)
- Application flexibility through its modular design:
  - Wireline Mode : Orientation/ Survey mode with real time surface readout
  - Memory Mode : Battery powered single and multishot surveys
  - Continuous Mode: Wireline Powered continuous surveys to horizontal
- Advanced software calibration techniques mean no onsite calibration required.
- Easy to use Drillog™ application software interface

**The Gyroflex<sup>1M</sup> system provides for a range of operating modes, dependant upon the application requirements. Typical applications are summarised below:**

**Gyroflex<sup>1M</sup> Operational Modes**

- |                                |   |
|--------------------------------|---|
| <b>Orientation (Real time)</b> | <b><i>Instrument is stopped at a survey station for 10 secs to perform a gyrocompass alignment (medium accuracy)</i></b>  |
| <b>Survey (Real time)</b>      | <b><i>Instrument is stopped at a survey station for 60 secs to perform gyrocompass (High Accuracy). The instrument also performs an in hole calibration check at this time ensure accuracy.</i></b>   |
| <b>Multishot (Memory)</b>      | <b><i>A memory module is added to the standard instrument to enable the tool to be run on slick or braided line using a battery pack. The system survey parameters can be programmed to suit the application and the tool can be remotely armed by the user.</i></b>  |
| <b>Drop (Memory)</b>           | <b><i>The instrument is dropped within the drillpipe before tripping to save rig time and cost. The instrument can be programmed as in multishot mode, with surveys taken during tripping. The gyro freefall decent is controlled using proprietary mechanical decelerators added to the instrument.</i></b>  |
| <b>Continuous (Real time)</b>  | <b><i>This new mode allows the instrument to run continuously in the borehole at high speeds and enables the system to provide high accuracy surveys from vertical to horizontal (and beyond). Depth measurement is automatic using a proprietary DMS digital depth tracking system and survey increments can be set by the operator down to 1cm.</i></b> |

**Gyroflex<sup>1M</sup> Running Gear**

- |                       |   |
|-----------------------|---|
| <b>Thermal Shield</b> | <b><i>The Gyroflex<sup>1M</sup> instrument is run in a proprietary pressure case / thermal shield configuration having an outside diameter of 1.75" and a pressure rating of 20,000 psi at 400F. The instrument can be run in this heatshield for upto 8 hours, dependant upon external temperature. A 1.9" OD shield is available for extended survey times to 16 hours.</i></b> |
| <b>Battery Pack</b>   | <b><i>The Gyroflex<sup>1M</sup> is operated from a 'C' Cell Alkaline battery pack. A separate thermal shield is used to protect the batteries in high temperature applications.</i></b>   |
| <b>Other</b>          | <b><i>A variety of proprietary running gear has been developed to address specific operational scenarios frequently encountered.</i></b>  |



## Gyroflex™ Navigator Typical Performance Summary

### Instrument Performance

Inclination : +/- 0.1° (vertical to horizontal)  
Azimuth Survey Mode : +/- 0.25° (Lat <60°)  
Azimuth Orientation Mode : +/- 1° (Lat <60°)  
Toolface : +/- 2°  
Positional Uncertainty : 0.3% of MD

### Operating Features

Instrument OD : 1.3"  
Instrument Length : 33"  
Pressure Cased OD : 1.5" (without thermal shield)  
: 1.75" (with thermal shield)  
Pressure case length : 40" min  
Pressure Rating : 20,000psi

Operating modes : Wireline or battery. User defined based upon service requirements  
(Orientation, survey, memory multishot, drop)  
: Continuous survey readout at wireline speeds up to 300 ft/ min.  
Memory Capacity : 3000 shots in multishot / Drop mode  
Battery Life : Upto 40 hours (programmable hold off, shot interval)  
Drop Mode : Controlled decent and landing  
Wireline Telemetry : Digital, Mono or multi conductor to 30,000 ft  
Depth Measurement : Auto continuous depth measurement available

### Electrical Power

Wireline Supply : 250mA Constants current @ 30v  
Max Power Consumption : 6 Watts

### Sensors

State of the art twin axis gyroscope  
High accuracy tri-axial accelerometers.

### Environmental

Temperature : 32-400°F with thermal shield for upto 8 hours (other options available)  
: 40-200°F (without thermal shield)  
Shock : 100g, 1/2 sine 1mS  
Vibration : 10g rms, 20-1000Hz random

### Surface Equipment

Wireline Power supply : 110 / 240 v AC in , 200w Out with protection  
Rig Floor Display : 256 x 128 Transflective LCD with backlight  
: Sealed to IP65  
Software : Windows (98, XP, Vista) based Drillog™ service software