

GE Energy

MWD System

Smart Drilling Solutions for
Directional Drilling...a retrievable
and reinsertable MWD system
for short-radius drilling



imagination at work



Commitment to Quality, Backed by Experience

Since 1971, GE Energy has been providing precision directional drilling instruments to its customers in the oil and gas and river-crossing industries. With an established reputation in the industry, GE provides high quality, reliable down hole systems for directional surveying and navigation.

Efficient

The GE Energy MWD system is designed for easy and efficient transportation to the jobsite. The system's modular design provides MWD services in a single, flexible system with a variety of collar diameters, from 3.5" to 9.5", and in flow ranges from 75 to 1200 gpm. Additionally, GE Energy's MWD solution is fully retrievable and reinsertable, minimizing rig downtime and financial risk.

Economical

The rugged retrievable and reinsertable design reduces financial risk associated with "lost in hole" conditions. GE Energy's training and customer support programs get your experienced personnel up to speed quickly with customized training and maintenance courses.

Retrievable and Reinsertable

GE Energy's MWD probe can be retrieved and reinserted, maximizing down hole time effectiveness and enabling efficient probe upgrades and replacements. In the event that the pipe gets stuck in the hole, this feature minimizes the rig time lost for probe retrieval. Two people can transport the probe to the rig floor, eliminating the need for overhead cranes.

Modular Design

GE's modular MWD System is easily transported and assembled in the field, enabling easy addition of formation evaluation systems such as GE Energy's

gamma ray and Centerfire resistivity solutions. The component structure of the system enables flexible sensor position and placement close to the drill head, optimizing sensor performance. Replacement of individual sensors in the field is another added benefit, eliminating the need to replace the entire MWD system.

Short Radius Applications

The unique design of the MWD systems results in significant system flexibility, allowing the down hole probe to operate in short-radius drilling operations. The system has been utilized in radii as short as 80 degrees per 100 feet.

Positive Pulse

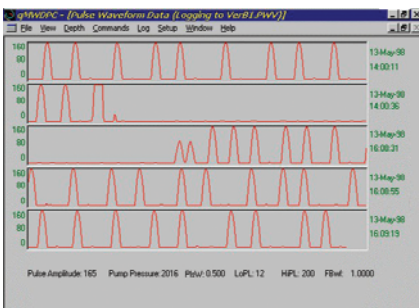
Through positive pulses, down hole life and servicing is simplified through the production of and minimal moving parts. Maintenance is also streamlined – the tool can receive routine service by an experienced technician in less than one day.

Standard Non-Magnetic Drill Collars

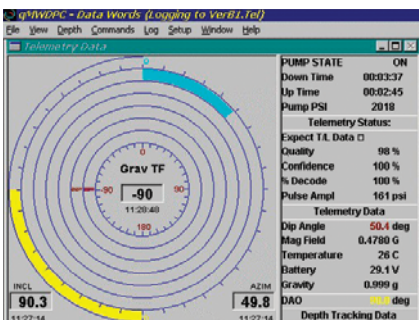
GE Energy's MWD System operates in standard non-magnetic drill collars with a choice of finned or bowspring centralizers

Power Conservation

Energy efficient hardware and software, such as low power components, on demand sensors, down linking capability and operational setup options, integrated into the MWD system minimize power consumption and maximize useful battery life. An electronic flow switch powers down the system when flow ceases, powers up when flow starts and converts into alternate operating modes for optimal battery use. An option to run a second battery can be configured to electronically switch from an exhausted battery to a fresh one, ensuring the user of ample power.



Pulse Waveform Data



qMWDPC-Data Words

Efficient Encoding/Decoding

The heart of the surface system is an extremely reliable, efficient receiver and decoding system, eliminating the need for “hand decoding”. Both surface and down hole systems are easily programmed to meet the needs of drilling conditions while transmitting necessary information to the surface.

Safe Area System

The color graphics LCD screen of the newly updated Rig Floor Display is easily viewed in normal rig operating conditions. Depth tracking options are available, in addition to several screens for numeric and graphic analysis. Intended for use in hazardous areas, communications between rig mounted transducers, safe area laptop computers and the display is distributed through a Safe Area Interface. The interface, located in a non-hazardous area, contains the necessary barriers and protection circuitry to safely operate the system.

Software Supported by Windows-Based Operating System

GE Energy's MWD system runs user-friendly software on the Microsoft® Windows® 2000 operating system. Field engineers also have the options to configure the screen to deliver a variety of operating functions and data.

Value-Added Options Available

The system includes options to allow for the easy addition of GE Energy's Centerfire resistivity and gamma ray system, down hole memory and hardcopy logs.

Performance Benefits

- Reliable
- Long downhole life, low maintenance
- Positive-pulse
- Collar sizes 3.5 inches O.D. and up
- Operates downhole to 175°C and 20,000 psi

- Retrievable and rein-sertable design decreases financial risk
- Proven software/firmware communication system adds operational flexibility
- Easy to configure monitoring screen
- Downlinking capability for selecting tool operating mode without tripping
- Adaptable tool configuration and programming flexibility
- Long battery life, low power consumption
- Simple transport and assemble due to modular design
- Efficient receiver and decoding system prevents “hand decoding”

Surface Equipment

- Rig Floor Display
- Safe Area Interface
- Standpipe Pressure Transducer
- Depth Tracking System (optional)
- Connection cables

Down Hole Assembly

- Wireline retrievable and reinsertable
- Operational at downhole temperatures to +150°C and +175°C

MWD Probe

- Directional Sensors/Electronics
- Battery Pack
- Pulsar/Driver
- Optional Gamma Detector
- Bowspring or Finned Centralizers
- Diameter
 - 1.88 in
- Length
 - 25 ft. standard directional only
 - 32 ft. with gamma or second battery pack
 - 39 ft. with gamma and second battery pack



Directional/
Control Module



Battery Module



Pulsar Unit



Gamma Detector
Module



Bowspring Stabilizer



Rubber Fin Stabilizer

Operating Specifications



Flow Ranges	75-165 gpm, 3.5 in. O.D. collar 100-300 gpm, 4.75 in. O.D. collar 150-600 gpm, 6.5 in. O.D. collar 400-1200 gpm, 8.25 in. O.D. collar
Pressure Drop	100 psi @ 400 gpm
Data Transmission	Positive-pulse
Electrical Power/Operating Time	Lithium battery operates to +150°C or +175°C. Will operate for 175 to 200 hours per battery pack
Operational Modes	Operator-selectable sequences and downlinking options. Highly flexible operating software. Selectable resolution – all parameters
Maximum Lateral Displacement Error	2.6 ft./1000 ft. or a conical uncertainty of $\pm 0.15^\circ$ maximum
Inclination Accuracy	$\pm 0.1^\circ$
Toolface Accuracy	$\pm 0.5^\circ$
Dip Angle Accuracy	$\pm 0.1^\circ$
Maximum Lost-circulation Material	40-50 ppb concentration, any size, pre-mixed



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