Directive™ Micro Processor Unit (MPU)

fact sheet

The Directive MPU is part of GE's upgraded Tensor MWD that dramatically improves performance and reliability. Our patent-pending Directive MPU is responsible for all functionality of the MWD and LWD systems. It is retro-compatible with GE's Tensor. As part of the Directive MWD System, it is designed to work with the Safe Area Interface and qMWD software package to provide reliable downhole information.

Features and Benefits

The Directive MPU is programmed on the surface, according to job specific requirements. The various features of the Directive MPU help optimize data transmission, data processing, data storage and extend battery life.

Memory

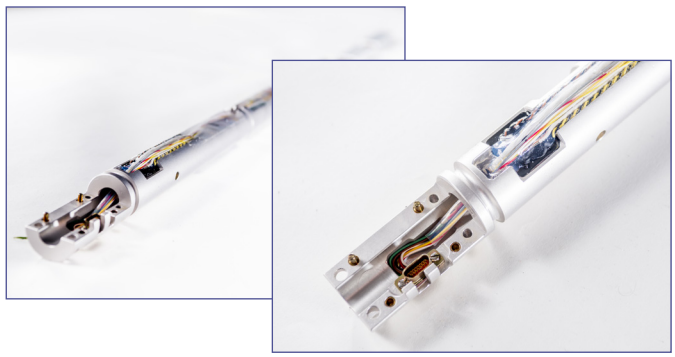
The MPU's efficiency has been increased by a factor of 4, and reliability has been rigorously verified with more than 10,000 field test hours of benchmarking at temperatures up to and beyond 175ºC, more than 1,000 hours drilling and more than 50,000 feet drilled in various formations in North America with EM and mud pulse telemetry. The memory functionality can be customized using Memory I/O.

Battery Switch Capability

The MPU can be programmed to switch from a primary to auxiliary battery once a specified voltage is reached in order to extend battery life.

Rotation Sensing

The MPU can use either accelerometers or magnetometers to measure drill string rotation. The tool can be programmed to transmit different data parameters based on the measured rotation. This enables the tool to transmit data that is relevant to the current drilling operation.



Flow Sensing

This determines flow on/off state to control the behaviour of the MWD tool and acquire static surveys.

Re Sync Capability

This allows the tool to automatically recover telemetry signals when the tool signal is lost, without having to stop the drilling process to regain signal.

Downlink Capability

Downlink capability allows the user to change the operating behavior of the tools while downhole. This allows for increased drilling efficiency and fewer trips out-of-hole to reconfigure the MWD system.

Shock Evaluation

This ability will allow the user to monitor lateral, transverse, and total shocks as seen by the MPU. A real-time evaluation of shocks while drilling will be displayed, and recorded data will enable better maintenance scheduling for the MWD string.

Tensor LWD System Capability

The Directive MPU is compatible with Scinturion* Gamma and Centerfire* resistivity tools.

Specifications

Parameter	Specification
Pressure Limit	20,000 psi [1,380 bar, 138 MPa]
Temperature Limit	175°C
Shock Limit	1,000 g/0.5 millisecond
Vibration Limit	20 g RMS

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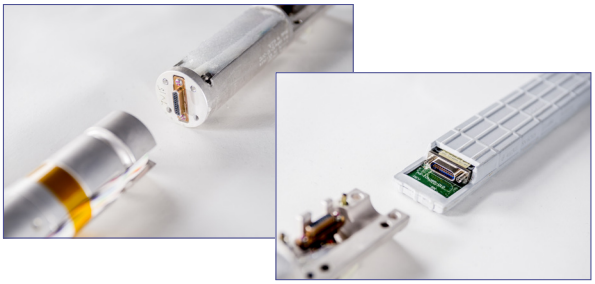

HALT and Laboratory Testing

The MPU has undergone HALT testing over a temperature range of -76°F to 428°F [-60°C to 220°C] under vibration levels of up to 80 g RMS.

Extensive (>10,000 hours) laboratory testing has been performed to verify the functional capability of the tool, including:

- Low-level vibration longevity testing
- Shock evaluation testing
- Complete LWD integration testing

Industry Wide Compatibility†

The MPU has been tested with a variety of industry standard surface receiver systems and is compatible with Tensor v1.6x compliant surface receiver systems.

†GE recommends that customers perform independent testing to ensure that their specific receiver systems are fully compatible.

Shock and Vibration Measurements‡

- 8-Level shock discrimination (lifetime)
- 5-Level temperature discrimination (lifetime)
- 10 Maximum shocks (lifetime)
- Improves tool aging and fleet management capability

‡Enhanced memory and shock evaluation available from firmware v3.02 onward

Directive Triple Power Supply

The Directive Triple Power Supply is a modular switching power supply assembly designed for use in downhole drilling applications. The Triple Power Supply converts the battery voltage to the DM into +5 and ±13 V supplies. Both durable and reliable, the tool provides an efficient instrument for downhole power needs.

Power on Demand

Functional Design

Adjustable from external control, the power supply unit provides three outputs: +5 Vdc, +13 Vdc, and -13 Vdc.

Protected from Shock and Vibration

The unit is encased in silicone rubber for protection against extreme conditions and control of thermal properties.

Performance Benefits

- Power-efficient switching supply, especially in battery applications
- Application over a wide supply voltage range
- Easy to operate with functional design
- Reliable in extreme temperatures
- Able to withstand server shock and vibration

Electrical Specifications

Input Voltages:	19 to 32 Vdc
Output Voltages:	+5 Vdc ± 100 mV @ 100 mA ±13 Vdc ± 0.5 Vdc @ 150 mA

Mechanical Specifications

Overall Length:	10.00" [254 mm]
Overall Width:	1.10" [27.94 mm]
Chassis Profile:	1.36" [34.54 mm]
Molded Length:	10.30" [261.6 mm]
Connector:	15-pin MDM to mate with onboard MDM-15SCBRP

Dynamic Specification

Vibration:	5–20 Hz, 1 in. double amplitude, 20–200 Hz, 30 g, all axes
Shock:	1,000 g, 0.5 msec, 1/2 sine all axes

Temperature Specifications

Operating Temperature:	-25°C to +175°C
Max Thermal Gradient:	3°C/minute

www.geoilandgas.com/drillingmeasurements

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