

## AutoLab 1000

**AutoLab 1000 is a hydrostatic servo-hydraulic system for measurements of compressional and shear wave velocities, permeability, electrical resistivity, pore volume compressibility and linear compressibility on rock specimens up to 50 mm (2.0 in) in diameter at *in situ* overburden pressure, pore pressure and temperature.**

AutoLab 1000 是一套伺服水静压测试系统，这套系统用来测试综合波传播速度，渗透率，电阻率，孔隙的体积可压缩性和线性压缩测试。该系统可对直径50 毫米内（用户根据需要指定一直径尺寸）的岩心进行原位的覆压，孔压和温度条件下进行测试。

The high-pressure system consists of a pressure vessel and servo-hydraulic intensifiers for confining and pore pressure. Coreholders for velocity, permeability and resistivity are mounted on cloverleaf closures, which insert in the pressure vessel and lock with a 60° rotation. This design is convenient for routine measurements at reservoir pressures up to 100 MPa (15,000 psi) and temperature. An external furnace heats the vessel.

AutoLab 1000的高压系统是由一个压力仓以及可提供围压和孔压的伺服压力倍增器组成。声波、渗透率、电性的岩心夹持器采用蝶式封包技术，这样可以将其放置在压力仓中通过旋转60° 进行锁死。这种设计非常便于设备在模拟油藏条件压力（压力高达100MPa）和温度条件下进行测试。压力仓外置加热炉可用于加热。



**Key Features 主要特点**

Servo-hydraulic control of confining pressure, pore pressure and flow rate

伺服液压控制器控制围压、孔压以及流速

Control of pressures and temperature at reservoir conditions

在油藏条件下对温度和压力进行控制

Integrated electronics console for servo amplifiers and signal conditioning

伺服放大器和信号调理集成在电子机柜中

AutoLab software for system control and data acquisition

AutoLab 软件完成系统控制与数据采集

**Coreholders 岩心夹持器**

PS2 ultrasonic transducers for compressional and shear wave velocities

PS<sup>2</sup>超声波传感器用于测量纵波和横波速度

Permeability (with water or brine) assemblies spanning a range of 0.05 millidarcies to 500 millidarcies

渗透率（水或盐水）探头装置测量渗透率范围0.05md-500 md

Low Permeability (0.01 microdarcies to 50 microdarcies)

超低渗透率探头（0.01 u d-50d）

## Coreholders for the System

### 系统的岩心夹持器

• **PS<sup>2</sup> Ultrasonic Transducer** These coreholders measure one compressional and two orthogonally polarized shear waves and waveforms at confining pressures, pore pressures and temperatures appropriate for each system. Each transducer operates at a center frequency of 500 to 700 kHz. The transducers operate at reservoir pressures and temperatures.

**PS<sup>2</sup> 超声波** 这些岩心夹持器可以在围压条件下测量一个纵波和两个正交横波的波速与波形。每个探头操作中心频率 500-700kHz。探头可在油藏的温度压力条件下操作。

• **Permeability** A new measurement technique to measure fluid permeability at *in situ* conditions has been developed at NER. The method involves the control of a complex transient in pore pressure at the upstream side of the sample while monitoring the pore pressure response at the downstream end. Permeability is computed by fitting the response to analytical solutions. The standard configuration is suitable for permeabilities between 0.05 millidarcies and 500 millidarcies. The significant advantages to this technique are its short duration (10 seconds), small pore pressure perturbation (0.4 MPa or 50 psi) and complete automation for acquisition and processing. This option also supports pulse decay, sinusoidal oscillation and steady state methods.

**渗透率** NER 公司现已开发了一种新的在油藏原位条件下测试流体渗透率的方法。这种方法涉及控制岩样上游的孔隙压力，采用符合瞬态法测试，同时监测岩样下端孔隙压力响应。通过对响应压力进行拟合分析、计算得到渗透率。标配渗透率探头的测试范围 0.05md 到 500md。这种测试方法的优点是测试等待时间短（10 秒），小的孔隙压力干扰（0.4MPa 或 50psi）以及数据全自动化采集和处理。此探头还支持脉冲衰减法，正弦震荡法和稳态法测试。

• **Low Permeability** Utilizing a special coreholders with a small dead volume and integral pressure transducer, AutoLab 1500 can be configured for low permeability materials of 0.01 microdarcies to 50 microdarcies. This option utilizes NER's complex transient method for permeability analysis, allowing use of customizable pressure transients as well as more traditional sinusoidal oscillation and pulse decay.

**超低渗透率** 采用一个小的死体积和集成压力传感器的特制岩心传感器，AutoLab 1500 配置了可以测量 0.01 u d-50 u d 的超低渗材质。此选项采用 NER 的复合瞬态法进行渗透率分析，此选项支持采用自定义的瞬态法和传统的正弦震荡法和脉冲衰减法。

• **Complex Electrical Impedance (Formation Factor)** Resistivity is measured as a function of frequency, stress and temperature for both two and true four electrode techniques. NER's ZMeter impedance analysis is used to perform true four electrode measurements

at frequencies between 0.02 Hz and 100 kHz. Two electrode measurements, especially at high frequencies, employ an HP Impedance Analyzer.

复电阻率（地层因子）作为频率、压力和温度等参数的相关函数，电阻率测量采用两极法和真正的四极法测量。NER ZMeter 电阻分析是用于执行真正的四电极测量，测量时频率在 0.02Hz 和 100Hz 之间。两极法的测量,尤其是在高频段,采用一个 HP 电阻分析仪

## Coreholders for the System

### *PS<sup>2</sup> Ultrasonic Transducer*

Two Velocity Coreholders with flow through capability  
Signal Conditioning with Data Acquisition Electronics  
One Compressional and Two Shear Waves per Coreholder  
Operating Conditions:  
Maximum Temperature (120°C)  
Specify one diameter from range 25 to 50 mm

**PS<sup>2</sup> 声波传感器** 两个具有孔压加载功能的声波岩心夹持器,带有数据采集原器件的信号调节器,可同时测一个纵波两个横波的岩心夹持器。

操作条件: 最大温度 (120°C)  
岩心范围: 25-50mm指定一个直径尺寸



PS<sup>2</sup> Ultrasonic Transducer



### **Permeability**

Transient and Steady State

0.05 to 500 millidarcy

Maximum Pore Pressure for Transient Methods 1,500 psi

Specify diameters from range 25 to 50 mm

#### **渗透率探头**

瞬态法和稳态法

0.05-500md 瞬态法测量时最大孔压

1500 psi 岩心范围 25-50mm 指定一个直径尺寸

### **Low Permeability**

Low permeability transducer for transient measurements

50 microdarcy to 10 nanodarcy

Maximum Pore Pressure 10,000 psi

Specify one diameter between 25 and 50 mm

#### **超低渗探头**

采用瞬态法测量的超低渗探头

渗透率测试范围: 50 $\mu$ d-10nd

测量时最大孔压: 10,000 psi

岩心范围: 25-50mm 指定一个直径尺寸

### **Complex Electrical Impedance**

Four Electrode Technique

Maximum Differential Load 25 MPa

Specify 2 diameters from range 25 to 50 mm

四极法测试

最大轴向载荷: 25MPa

岩心范围: 25-50mm 指定一个直径尺寸



Permeability Transducer



Complex Electrical Impedance

**The English Language Version Shall Prevail**

中文仅供参考，请以英文为准