

# AutoLab 2000

# Laboratory System

**AutoLab 2000 is a versatile triaxial apparatus for petrophysical and mechanical rock properties measurements at *in situ* conditions on specimens from 0.75 to 4.0 inches in diameter. Based on experimental requirements, the apparatus can be designed to operate at confining pressures to 30,000 psi (200 MPa) and pore pressures to 15,000 psi (100 MPa) with a pressure vessel bore diameter as large 7.50 inches.**



AutoLab 2000 is a complete laboratory system, which performs standard rock mechanics tests and facilitates the measurement of coupled processes. Velocity, permeability, and resistivity transducers are designed to accommodate strain instrumentation. Measure strain, and compressional and shear wave velocities to compare static and dynamic elastic moduli; relate changes in permeability to stress induced anisotropy; or correlate electrical resistivity with pore volume compression. AutoLab software acquires these data while simultaneously controlling the loading paths. Rapid data reduction and informative reports speed up analysis.

## Key Features

- deformation experiments for conventional and specialized loading paths,
- pore volume compressibility
- servo-hydraulic control of strain rate, force, confining pressure, pore pressure, and flow rate,
- two pore pressure intensifiers to facilitate fluid exchange
- strain measurement with either LVDTs or strain gages,
- temperatures to 250°F (121°C),
- integrated electronics console for servo- amplifiers and signal conditioning,
- AutoLab software for system control and data acquisition.

## Optional Coreholders

- PS<sup>2</sup> ultrasonic transducers for compressional and shear wave velocities,
- permeability (with water or brine) assemblies spanning a range of 10 nanodarcies to 500 millidarcies,
- electrical resistivity (formation factor).

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The versatility of the AutoLab 2000 supports a comprehensive suite of experimental conditions. The following applications have been incorporated into previous systems:

- velocities parallel and normal to the core axis,
- location and number of acoustic emissions associated with specimen damage,
- permeability parallel and normal to the core axis,
- two phase fluid flow at high flow rates to evaluate sanding potential,
- true triaxial loading on prismatic specimens,
- effect of fluid substitution on the strength of shales

The apparatus is compact and convenient. Many systems generate force parallel to the core axis with a large hydraulic cylinders operating at 3,000 psi. This necessitates a large load frame. NER adopted a different approach. A piston divides the pressure vessel into two chambers. The overburden pressure on the rock is developed in the lower chamber. When the pressure in the top chamber is greater, a differential stress is exerted on the specimen. The pressure in each chamber is controlled with high pressure, servo hydraulic intensifiers. The axial loading operates in force or displacement control. High pressure translates to reduced size for a high capacity unit.

The pressure vessel is a tube with no threaded closures for greater safety at high pressures. The vessel is lowered onto the base pedestal and secured by moving a yoke between the top plate of the loading frame and the top of the pressure vessel. The differential stress, confining pressure, and pore pressure are generated with three servo- controlled hydraulic intensifiers housed in a separate safety enclosure.

**AutoLab 2000****Specifications****Triaxial Vessel**

Bore Diameter, inches	4.00
Effective Bore Length, inches	10.50
Pressure Rating, psi	30,000
Electrical Feedthrus (minimum)	32

**Axial Force**

Maximum Axial Force, lbs	300,000
Force Cell Capacity, pounds	150,000
Stroke, inches	2

**Confining Pressure Intensifier**

Maximum Output Pressure, psi	20,000
Output Volume, cubic inches	11.9
Pressure Transducer Accuracy	+/- 0.5% F.S.

**Pore Pressure Intensifier**

Maximum Output Pressure, psi	10,000
Output Volume, cubic inches	1.23
Pressure Transducer Accuracy	+/- 0.5% F.S.

**Electronics Console**

○ Servo-amplifiers; NER AutoLab	3
○ Fail Safe / Emergency Shutdown	1
○ Signal Conditioning LVDTs,	3
○ Pressure Transducers	3
○ Force Cell	1
○ Strain gages	3
○ Thermocouple	1
○ Pulser-Receiver, NER-PR-03	1
○ NER Z meter	1



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# Specifications

## Computer Control and Data Acquisition with AutoLab Software

### Control

- Force or Axial Displacement
- Confining Pressure
- Pore Pressure or flow rate

### Data Acquisition

- A/D 32 channels@12 bits
- Compressional and Shear Wave Velocities,
- Resistivity,
- Permeability

### Data Reduction

- P and S Wave Velocity
- Permeability
- Resistivity
- Stress strain, pressure, etc.

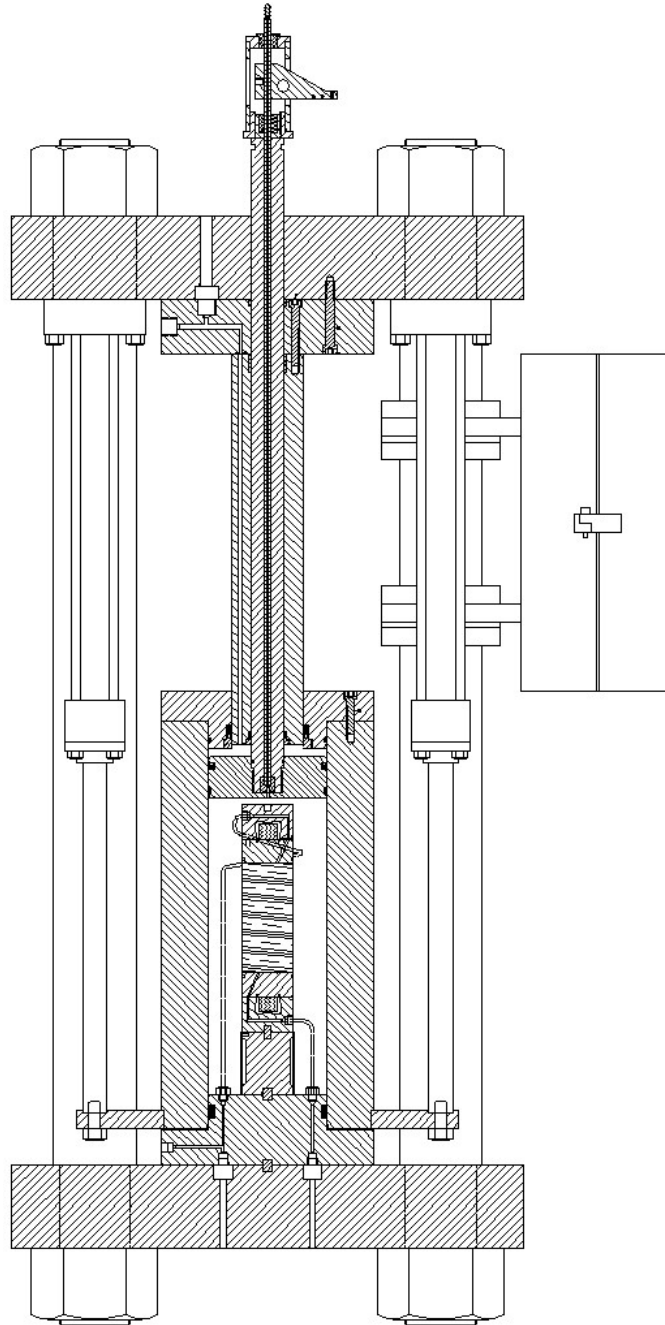
## Hydraulic Power Supply (Axial Piston Pump)

Maximum Operating Pressure, 3,000 psi  
Reservoir Capacity, 20 gallons

\* These specifications are based on a 1.50 inch diameter specimen supporting velocity, permeability, resistivity, and strain measurements. The specifications will vary depending on applications and sample requirements.

# AutoLab 2000

# Schematic



Schematic of AutoLab 2000