GEOTEST *Express*

floXlab

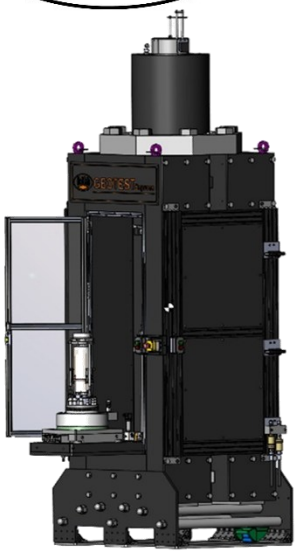
- Triaxial testing of rock samples as per ASTM & ISRM specifications
- Capable of performing complete triaxial test cycle – from initialization to completion – including multi-stage testing procedures quickly and effortless
- Doubles the number of tests achievable per day
- Significantly shortens preparation time between the tests
- Axial load up to 2,000 kN
- Up to 210 MPa cell pressure capacity

OVERVIEW

The GEOTEST EXPRESS Rock Triaxial Testing Systems, is engineered to deliver unmatched precision, reliability and efficiency in rock mechanic's research. Built upon decades of technical refinement, the system embodies a highly mature design that has evolved though successive engineering iterations to achieve optimal structural and operational performance. Combined with streamlined manufacturing processes, the GEOTEST EXPRESS stands as a benchmark for engineering excellence, testing efficiency, and cost-effective performance in the field of rock characterization.

The FLOXLAB GEOTEST EXPRESS is a closed-loop, digitally servo-controlled triaxial testing apparatus designed for high-precision execution of triaxial compression tests on rock specimens. The system enables accurate control of stress and strain parameters, ensuring repeatable and reliable results under various loading conditions. In addition to conventional triaxial applications, it is engineered to perform permeability evaluation, hydraulic fracturing, acoustic velocity, acoustic emission and electrical resistivity measurements, and other advanced rock mechanics investigations requiring precise load, pressure, and deformation control

Triaxial cell



Sample Mounted

Cell Base Inserted into Load Frame

Cell Wall Lowered Ready for Testing

An automatic hydraulic lift and sliding base are integrated into the GEOTEST EXPRESS system to provide rapid and effortless specimen setup—far more efficient than traditional triaxial configurations. The triaxial cell can be fully assembled or disassembled at the push of a single button, eliminating the need for bolts or nuts and significantly reducing preparation time, allowing operators to focus on testing rather than setup.

Constructed from high-grade stainless steel, the triaxial cell is designed to accommodate cylindrical specimens up to 55 mm in diameter, with an available upgrade for larger specimens up to 100 mm. The standard unit features a rigid loading piston combined with a low-friction graphite seal, ensuring smooth and stable operation.

The self-contained cell wall design allows the wall to be automatically lowered and securely locked once the specimen is prepared, simplifying handling and improving safety. The configuration includes an internal load cell, embedded instrumentation, and reinforced frame assemblies for enhanced precision in deformation modulus and post-failure behavior measurements.

The standard GEOTEST EXPRESS configuration incorporates a servo-valve-controlled confining pressure intensifier to control confining pressures. The intensifier is housed within a robust metal cabinet equipped with casters, a 20-liter fluid reservoir, ensuring mobility and operational convenience. Pressure gauge provides real-time verification of confining pressures, while quick-connect fittings simplify fluid line connections and reservoir maintenance. The pressure intensifier integrates a pressure transducer and LVDT, enabling servo control based on pressure, fluid volume, or any other user-defined parameter. This setup allows execution of complex testing protocols such as stress/strain path analysis, rock compressibility determination, permeability testing, and hydraulic fracturing

The GEOTEST EXPRESS operates through FLOXLAB's integrated digital signal conditioner and controller, combined with the advanced GEOTEST's software. Triaxial testing is streamlined through direct programmable control of test parameters—stress, strain, and others—automatically adjusted to specimen geometry.

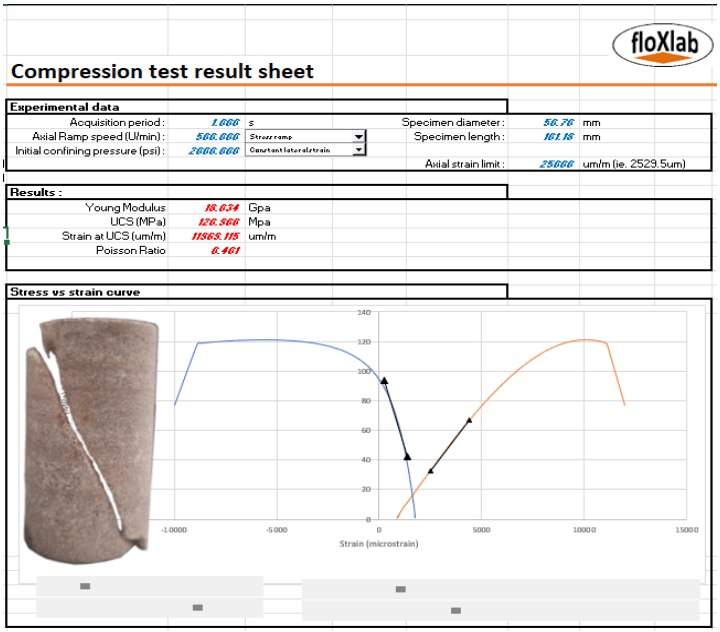
All test parameters are continuously computed and instantly available for display, graphing, or closed-loop control. The software also supports custom user-defined variables and multi-sensor averaging, offering extensive flexibility for advanced experimental configurations and ensuring accurate, consistent test results.

The system design eliminates the need for complex and time-consuming pre-calculations when configuring test programs, allowing operators to focus entirely on the material's mechanical response rather than on hardware setup or signal management.

FLOXLAB's network-ready architecture enables seamless data monitoring, sharing, and control with the flexibility to display or export test parameters in any preferred unit system, even when combining mixed measurement units. At the core of the GEOTEST EXPRESS lies an embedded microprocessor that ensures uninterrupted test execution, maintaining full operational capability even in the event of a host computer failure.

The controller features automatic dynamic control mode switching between connected transducers and computed parameters, enabling smooth, bump-less transitions during testing. It also performs signal conditioning for all connected transducers, applying real-time linearization through high-order polynomial calibration. The digital control loop delivers the responsiveness required for precise load regulation in brittle materials.

Test example



Compression test result sheet

Experimental data

Acquisition period :	1.666	s	Specimen diameter :	50.76	mm
Axial Ramp speed (U/min) :	500.666	Stress ramp	Specimen length :	101.16	mm
Initial confining pressure (psi) :	2666.666	Constant lateral strain			
			Axial strain limit :	25000	um/m (ie. 2529.5um)

Results :

Young Modulus	18.634	Gpa
UCS (MPa)	126.566	Mpa
Strain at UCS (um/m)	11565.115	um/m
Poisson Ratio	0.461	

Stress vs strain curve

The GEOTEST EXPRESS system enables multi-stage triaxial testing with precision and operational simplicity. The following example illustrates a multistage triaxial test performed to determine the residual strength of a rock specimen under varying confining pressures.

The test was conducted on a single Berea Sandstone sample with a diameter of 50 mm and a height of 100 mm, instrumented with one axial deformation sensor and one diametral sensor to capture detailed strain measurements.

Three confining pressure levels were applied sequentially: 20 MPa, 50 MPa, and 100 MPa. Each stage was automatically terminated by the software once the Poisson's ratio reached a threshold of 0.5, indicating the onset of significant lateral deformation.

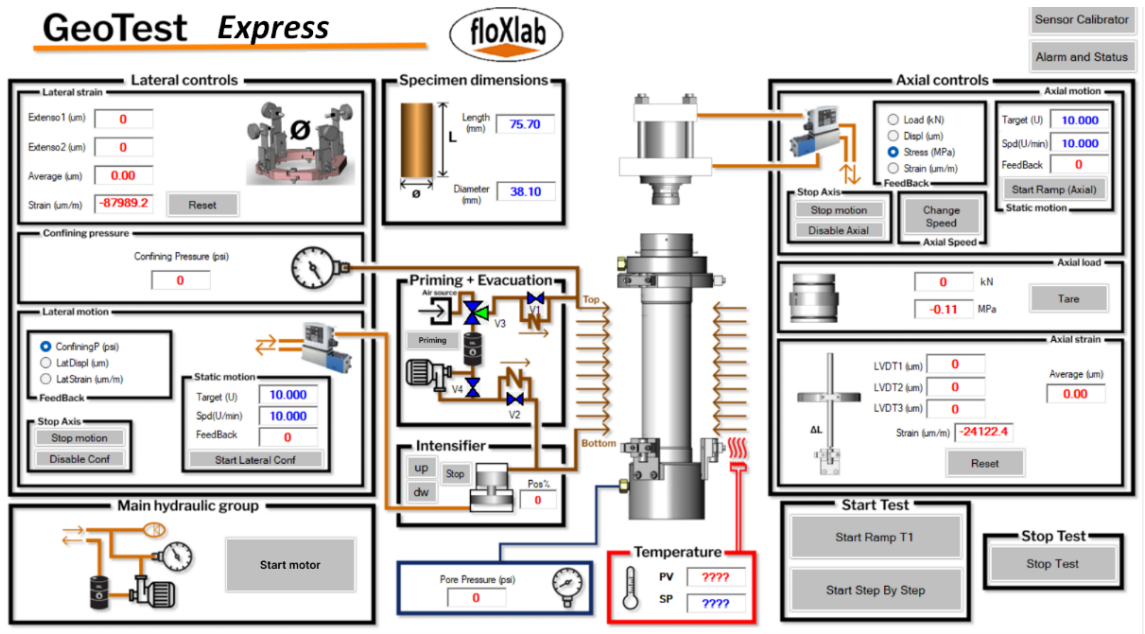
During the final stage, the confining pressure of 100MPa was maintained constant while control was switched to radial strain mode to induce large post-peak deformations while preventing specimen rupture. A high-stiffness loading frame was employed to ensure system stability and accurate post-failure response measurement.

When the deviator stress dropped by more than 25% of the peak value, the system automatically transitioned to frame displacement control, stabilizing the test and maintaining sensor alignment.

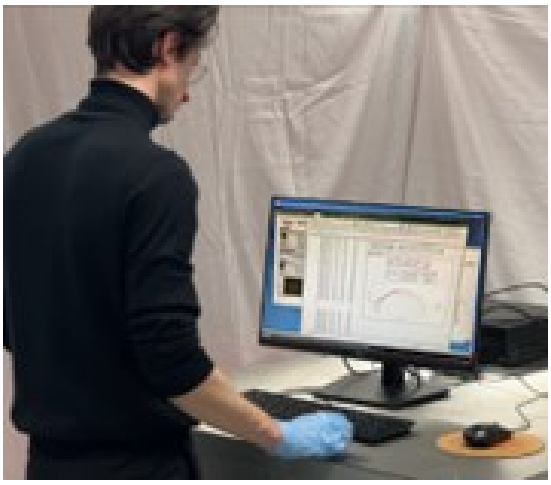
The specimen was then strained at 1 mm/min for 0.25 minutes, and the corresponding deviator stress was recorded as the residual strength for that confining pressure. The confining pressure was subsequently reduced to 50 MPa, and the same procedure was repeated, followed by testing at 20 MPa.

This example demonstrates the robust control precision and automation capabilities of the GEOTEST EXPRESS, allowing complex multistage triaxial tests to be executed efficiently with consistent, repeatable, and high-resolution data acquisition across all loading conditions.

Supervision station



The GEOTEST EXPRESS represents an optimal solution for triaxial testing in both research and commercial rock mechanics laboratories, combining precision, safety, and efficiency in a single integrated platform. Its automated locking triaxial cell, along with automatic cell filling and drainage, minimizes test preparation time while ensuring a secure and streamlined setup process.
Designed for flexibility, the FLOXLAB GEOTEST EXPRESS can accommodate specimens up to 100 mm (4 inches) in diameter, making it suitable for a broad range of geological materials and testing conditions.



Key features include:

- Direct measurement of axial and lateral strain directly on the specimen for high-accuracy deformation data
- LVDT-based instrumentation for reliable, user-friendly operation
- Simplified test preparation and execution, allowing effortless setup and consistent performance stress.

GEOTEST *Express*

A - Axial Load:

1,000 kN
2,000 kN
Other upon request

B – Frame Stiffness:

1,000kN: 3 GN/mm
2,000kN: 4.5 GN/mm

C – Confining pressure:

70 MPa
140 MPa
210 MPa

D – Specimen size:

Up to: 55 mm
Up to: 100 mm

E – Pore pressure:

70 MPa
140 MPa
210 MPa

F – Regime:

Static
Dynamic

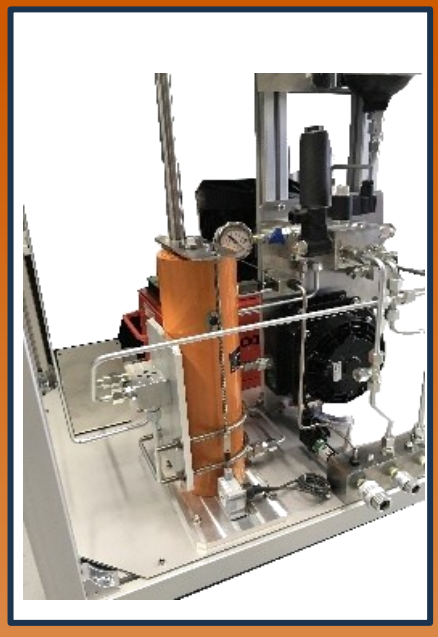
GEOTEST *Express - components*

TRIAXIAL CELL

The triaxial cell is a high-pressure vessel designed for precise confinement and axial loading under static and dynamic testing conditions. It features an automated locking system with an integrated hydraulic lift, enabling fast, bolt-free specimen installation and ensuring accurate, repeatable test setup.

Key features include:

- Pressure ratings of 70, 140 or 210 MPa
- Two cell sizes for specimens up to 55mm or 100mm
- Wetted parts in stainless steel or Inconel



CONFINING PRESSURE INTENSIFIER

The confining pressure intensifier is a high-precision, servo-controlled pressure system designed to apply and maintain stable confining pressure during triaxial testing.

It provides rapid pressure ramping, accurate closed-loop control, and excellent pressure stability for both static and dynamic test conditions.

Key features:

- Servo-valve-controlled operation in pressure or displacement mode
- Confining pressure ratings of 70, 140, 210MPa.
- Wetted parts in stainless steel

GEOTEST *Express - components*

PORE PRESSURE PUMP

The GEOTEST EXPRESS pore pressure pump is a high-precision, electro-mechanical unit designed to apply and regulate pore pressure with high accuracy during triaxial testing. It enables stable pressure control, rapid response, and precise measurement for reliable drained and undrained test conditions.

Available configurations:

- Operate in pressure or flow-rate control mode
- Working pressure up to 70 MPa,140 MPa, 210 MPa
- Flow rate up to 60 cc/min
- Wetted parts stainless steel, Hastelloy

ACOUSTIC VELOCITY FIXTURE

The ultrasonic velocity system is an integrated measurement module designed to determine P- and S-wave velocities in rock specimens during triaxial testing.

It provides high-resolution, synchronized ultrasonic acquisition under load and pressure, enabling continuous monitoring of dynamic elasticity parameters.

Key features

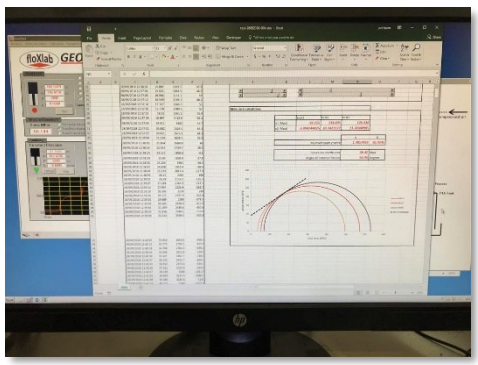
- In-vessel-P- and S1-S2-wave ultrasonic measurement at 1MHz
- Operates up to 120°C under triaxial stress conditions

GEOTEST *Express - components*

HEATING JACKET

The heating jacket is a precision-controlled thermal system designed to uniformly heat rock specimens during triaxial testing.
It ensures stable and homogeneous temperature distribution under pressure, enabling accurate simulation of in-situ thermal conditions.
Key feature includes:

- Operating range up to 150 °C (standard) or 200°C (high-temperature option)



GEOTEST SOFTWARE

The GEOTEST software is an advanced analysis platform designed for automated processing and interpretation of triaxial test data.

It provides precise calculation of mechanical parameters, real-time visualization, and standardized reporting to ensure accurate and repeatable test interpretation.

Key features include:

- Automated analysis of stress-strain, strength, creep and petrophysical properties
- Integrated interpretations of acoustic velocity, acoustic emission and damage evolution

GEOTEST *Express - components*

ACOUSTIC EMISSION

The acoustic emission system is a high-sensitivity monitoring module designed to detect and locate microcracking and fracture events during triaxial testing. It provides real-time, high-frequency data acquisition and advanced signal processing for accurate damage evolution and failure analysis.

Key features include:

- Six lateral AE sensors – full radial coverage
- Signal amplification – 40 dB, 32–1000 kHz filters
- High-resolution acquisition – 16-bit, 10 MHz, 8 channels
- Precise event location – ~2 mm accuracy
- Real-time fracture reconstruction – live morphology mapping

HYDRAULIC FRACTURING

The hydraulic fracturing system is a precision-controlled module designed to initiate and propagate fractures under controlled pressure conditions within rock specimens.

It enables accurate regulation of injection pressure and flow, with synchronized data acquisition for detailed fracture initiation and propagation analysis.

Key features include:

- For specimens 50-100mm in diameter
- Borehole diameter: 6.35-mm
- Wetted parts in stainless steel or Inconel

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ROCK PERMEABILITY

The permeability system is a high-precision module designed to measure fluid flow through rock specimens under controlled stress and pressure conditions.

It provides accurate permeability determination using the Darcy's law method, fully synchronized with triaxial loading and pore pressure control.

Key features:

- Permeability range: 0.01 mD to 10 Darcy
- Pressure: up to 70 MPa

ELECTRICAL RESISTIVITY

The electrical resistivity system is an integrated measurement module designed to evaluate the electrical properties of rock specimens under triaxial stress conditions. It supports both two-point and four-point measurement configurations, providing precise, synchronized resistivity data correlated with mechanical loading and microstructural evolution.

HYDRAULIC POWER UNIT

The hydraulic power unit is a high-efficiency system providing stable, low-noise hydraulic flow for precision servo-controlled testing. Two versions are available: one optimized for static testing and a second designed to support both static and dynamic loading modes with enhanced flow and response capacity.

- Static version:
  Constant pressure, constant flow pump
  Flow: up to 5 lpm
  Reservoir fluid: 20 Liters
- Static & Dynamic version:
  Constant pressure, variable flow pump
  Flow: up to 20 lpm
  Reservoir fluid: 100 Liters
  Frequency up to 10 Hz

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GEOTEST *EXPRESS*

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