Stress path triaxial and uniaxial automatic test system
Advantest Rock: advanced testing system designed for rock testing

ADVANTEST

- ➧ Advanced testing system suitable for extremely variable materials, from soft sandstone to high-strength marbles
- ➧ Determination of Elastic modulus, Poisson's ratio and strength characteristics of rock specimens under uniaxial and triaxial conditions
- ➧ Automatic performance of triaxial tests with combined control of axial load and confining pressure
- ➧ Multiple failure stages triaxial test (stress – path mode) carried out automatically, the entire failure path is derived from a single specimen including post-peak softening phase
- ➧ Also suitable for load, stress, displacement and strain-controlled testing on concrete, fibre-reinforced and shotcrete specimens (with the relevant options and accessories)
- ➧ Fully programmable test procedures including axial load and confining pressure levels and combinations
- ➧ Integrated data acquisition and results elaboration including failure envelope plotting
- ➧ Extremely flexible system ideal for research purposes

Standards ASTM D7012 | ASTM D2664 | ASTM D2938 | ASTM D3148 | ASTM D5407 | EN 14580 | EN 1926 | ISRM

CONTROLS Stress path triaxial and uniaxial automatic test system is designed to test various materials, from soft sandstone to high strength marbles.
The test system comprehends:

ADVANTEST ROCK
- servo-hydraulic control console for axial load application in conformity with the relevant Standards. Includes a dedicated software for triaxial testing which also controls the SERCOMP ROCK and automatically determines the sample failure envelope.
- The ADVANTEST ROCK performs loading-unloading ramps and can also be used for load/stress/displacement/strain controlled testing on concrete, fiber reinforced concrete, shotcrete, etc. (with the suitable options and accessories)

SERCOMP ROCK
- servo-hydraulic control console for confining pressure control into the Hoek cell (triaxial test only). It runs as a remotely controlled unit, fully operated by the Advantest Rock software.
- Includes 4 additional channels for strain / displacement transducers.

ADVANCED SOFTWARE
- ADVANTEST ROCK and SERCOMP ROCK are linked to a single PC for data acquisition and results elaboration.
- The overall test information and readings are always available on the PC screen:
- Axial load and sample strength
- Hoek cell confining pressure
- Sample deformation measured by strain gauges and external displacement transducers

Plus any additional load/strain/displacement readings from external transducers that may be useful for research purposes.

HIGH STIFFNESS COMPRESSION FRAME
- to be selected from the wide CONTROLS product range, conforming to the size of the sample and the expected strength.
- Due to the typical high strength and fragility of rocks we recommend high capacity test frame (4000kN or 5000kN capacity).

HOEK CELL
various models for different sample size are available: from EX type with dia. 21.46 mm up to HQ type for core with dia. 63.5 mm.

Triaxial test is carried out automatically with multiple failure stages: from a single specimen it is possible to plot the entire failure envelope.

Test procedure

- Axial and horizontal stresses are increased hysotropically up to a defined level
- Cell pressure is maintained constant and axial stress is increased
- When the sample approximates maximum strength, the cell pressure is automatically increased up to a defined level
- Cell pressure is again maintained constant and axial stress is increased
- When the sample again approximates maximum strength, the cell pressure is further increased
- The above procedure is automatically repeated several times
- Maximum peak strength is reached and, in case of displacement control, the test is continued (softening phase)
- Cell pressure is reduced in steps and, for each step, the residual strength is measured
- All the maximum peak loads are plotted against corresponding values of cell pressure building the complete failure path.
- For a typical configuration of an Automatic triaxial test system see Additional information.

ADVANTEST ROCK control console 50-C9842/RCK and 86-D2999 Pc cabinet

Technical specification

ADVANTEST 9 ROCK

Hydraulic group

Max. working pressure: 700 bar
Max. oil delivery: 2 lpm at low pressure, 0.7 lpm at high pressure
4 hydraulic ports for connection of test frames
Flow control via servo-controlled proportional valve
Oil cooling system with forced ventilation
4 ON/OFF valves with electronic control

Hardware and on board software

Maximum resolution: 1/524,000 divisions
8 input channels:
- 4 for load sensors (load cells or pressure transducers)
- 4 for displacement transducers (potentiometric, LVDT amplified or analogical) and for deformation transducers (clip gauge, strain gauge).
- Electrical characteristics of the conditioners:
- VEXC: from 0.5 to 10 V DC selected via software
- Single/dual ended input
- Input signal from -2.5 to +2.5 V DC
- Zero and gain adjustable via software
Data acquisition synchronized on all channels
8 analogical outputs corresponding to each channel for possible use of an external data acquisition system
Test execution with control of:
- Load/specific load
- Displacement
- Strain

Auto-diagnostic system including oil level and oil filter obstructed
320x240 pixel display
Storage of multiple calibration curves for immediate connection of different sensors.
Low frequency Dynamic tests: max. frequency 0.1 Hz (depending on the wave amplitude)

Phisical specifications

Power rating 750 W
Voltage: 230V, 50Hz, 1ph or 230V, 60Hz, ph or 110V, 60Hz, 1ph
Dimensions (lxwxh): 470x410x1000 mm
Weight approx.: 120 kg, excluding PC and printer

SERCOMP 7 ROCK

Max. working pressure: 700 bar
Max oil delivery: 0.7 l/min
Flow control via servo-controlled proportional valve
4 additional channels for strain / displacement transducers
Power rating: 750 W
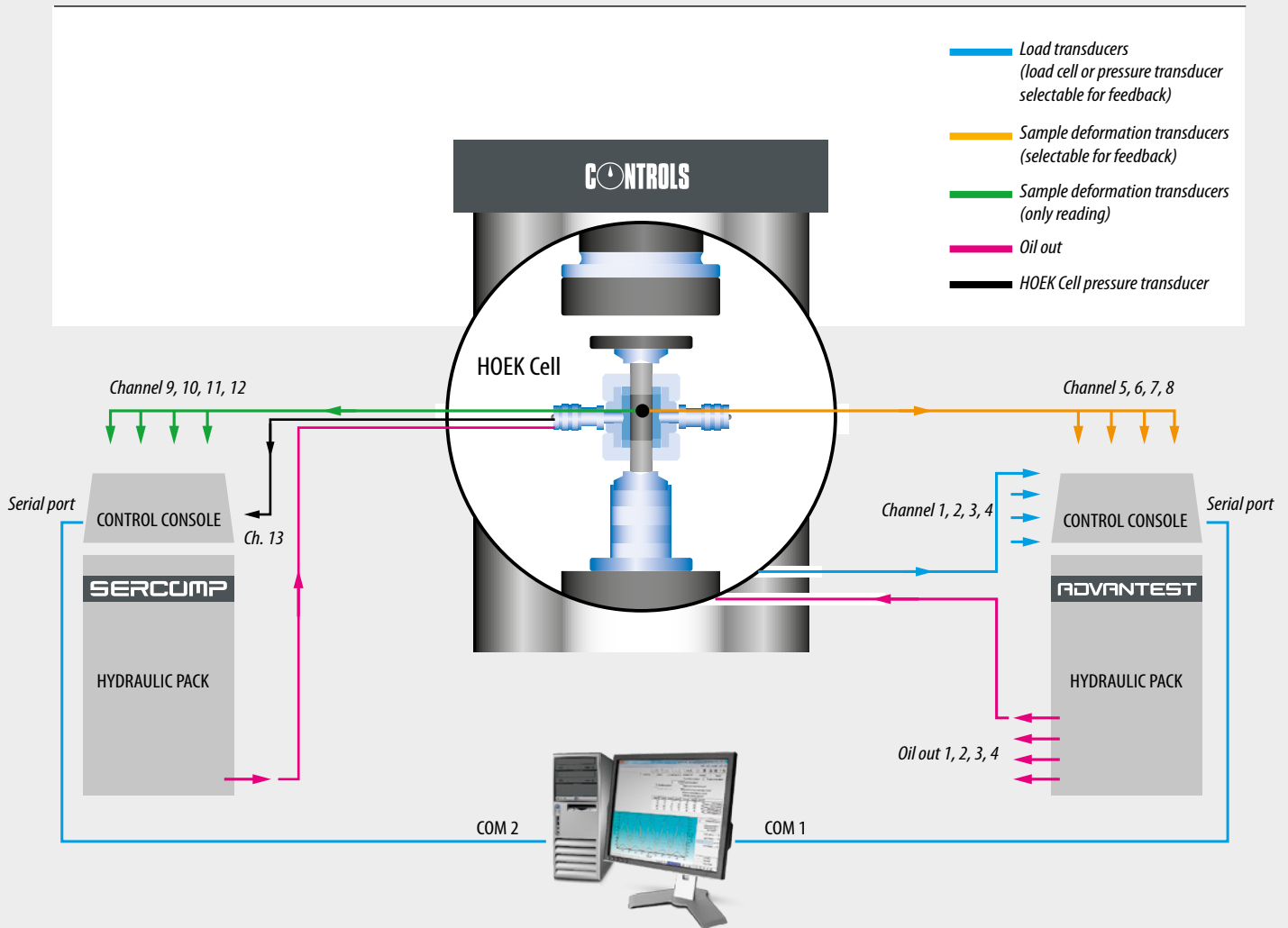Dimensions (LxWxH): 470x410x1000 mm
Weight approx.: 120 kg

PC and SOFTWARE

PC and printer of the latest generation
Remotely control the entire system.
Display graphical and numerical data including multi-plot mode, e.g. 3 different deformation curves with respect to a single time axis
Execute tests and sequences of steps/cycles programmable by the user
Print out test reports
Allow the real time modification of the test parameters during the test execution, including active control channel
Language selection: English, French, Spanish, Italian, plus another language which can be created by the user

Hoek cell 45-D0566 supported by holding device model 45-D0556/H

ADVANTEST Rock Triaxial tests. Layout of the system

Legend:
- Load transducers (load cell or pressure transducer selectable for feedback)
- Sample deformation transducers (selectable for feedback)
- Sample deformation transducers (only reading)
- Oil out
- HOEK Cell pressure transducer

HOEK Cell

Channel 9, 10, 11, 12 — Channel 5, 6, 7, 8

Serial port — CONTROL CONSOLE — Ch. 13 — Channel 1, 2, 3, 4 — CONTROL CONSOLE — Serial port

SERCOMP — ADVANTEST

HYDRAULIC PACK — HYDRAULIC PACK

Oil out 1, 2, 3, 4

COM 2 — COM 1

Ordering information

ADVANTEST 9 ROCK

45-C9842/RCK

Advantest 9, Servo-hydraulic unit for controlling up to four test frames for compression, flexure and indirect tensile tests with load, displacement and deformation control.Complete with PC, printer and software, including dedicated software module for rock testing under triaxial conditions (requires also the SERCOMP ROCK unit). 230 V, 50 Hz, 1 ph.

45-C9843/RCK

Advantest 9, Servo-hydraulic unit for controlling up to four test frames for compression, flexure and indirect tensile tests with load, displacement and deformation control.Complete

with PC, printer and software, including dedicated software module for rock testing under triaxial conditions (requires also the SERCOMP ROCK unit). 220 V, 60 Hz, 1 ph.

45-C9844/RCK

Advantest 9, Servo-hydraulic unit for controlling up to four test frames for compression, flexure and indirect tensile tests with load, displacement and deformation control.Complete with PC, printer and software, including dedicated software module for rock testing under triaxial conditions (requires also the SERCOMP ROCK unit). 110 V, 60 Hz, 1 ph.

SERCOMP 7 ROCK

45-C7022/RCK

Sercomp Rock, servo-hydraulic control console for lateral pressure control, it can be used as a remotely controlled pressure unit, managed by the Advantest 9 Rock. 230 V,50 Hz, 1 ph

45-C7023/RCK

Sercomp Rock, servo-hydraulic control console for lateral pressure control, it can be used as a remotely controlled pressure unit, managed by the Advantest 9 Rock. 220 V,60 Hz, 1 ph

45-C7024/RCK

Sercomp Rock, servo-hydraulic control console for lateral pressure control, it can be used as a remotely controlled pressure unit, managed by the Advantest 9 Rock. 110 V,60 Hz, 1 ph

Accessories

Hoek cell and sample extruder

Strain gauges for uniaxial and triaxial tests

Compression device for uniaxial tests

Compression frames to EN 12390-4, EN 772-1

Compression frames to ASTM C39, C140, AASHTO T22

PC cabinet
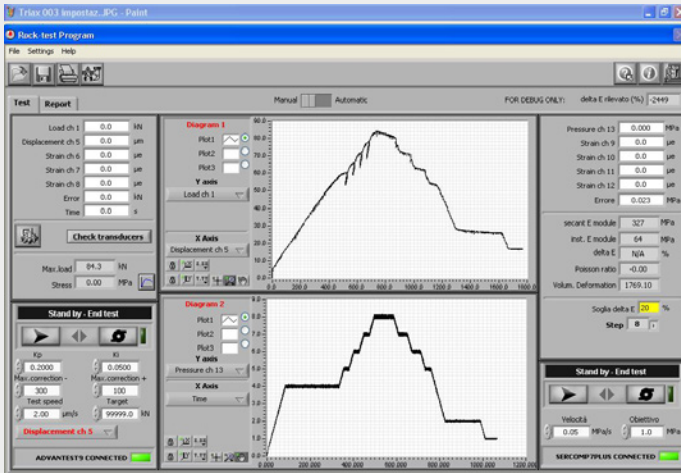
Screenshot of a stress-path triaxial test on rock performed with the ADVANCED system (load vs displacement and cell pressure vs time diagrams)
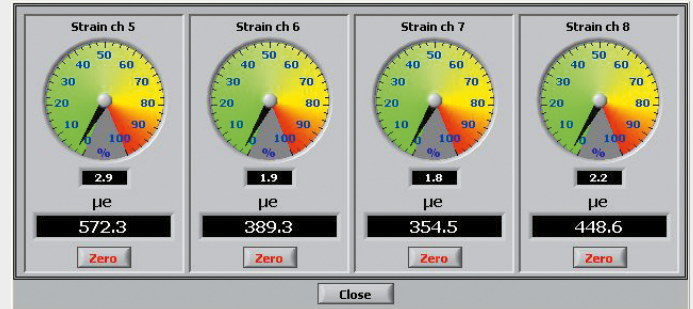
Virtual gauges indicating the actual reading of the sensor in percentage respect the full scale. It's an excellent tool for transducers positioning
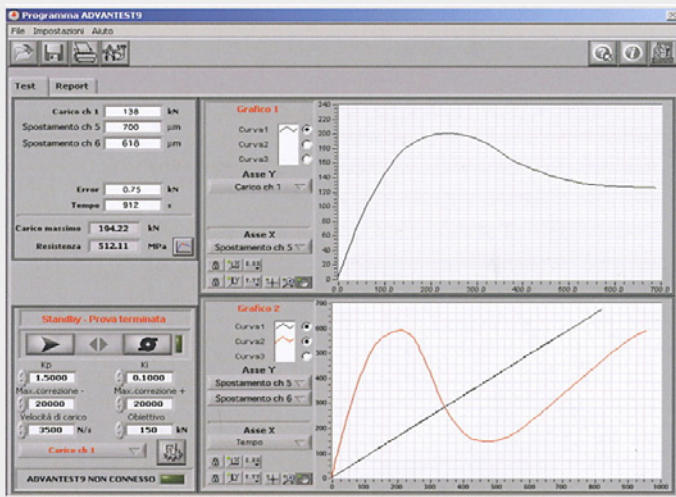
ADVANTEST software, main screen shot of software used for strain displacement controlled tests
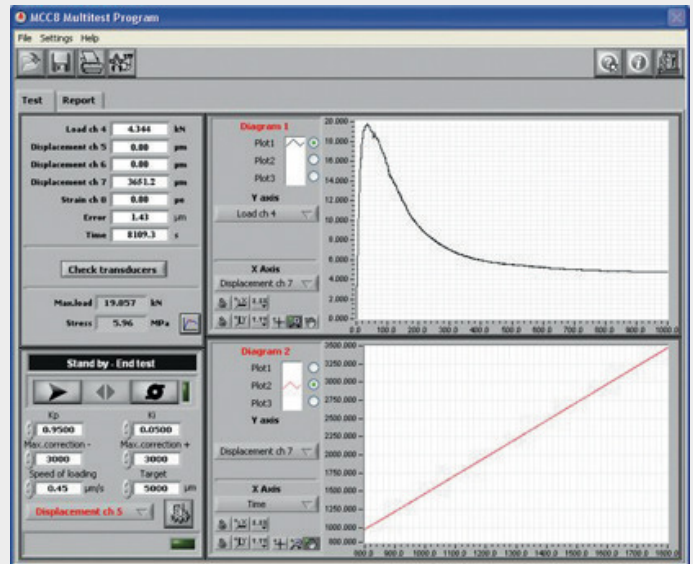
ADVANTEST software. Results of flexure test on a fiber reinforced concrete beam performed under delflection rate control

Determination of Elastic Modulus using surface-mounted strain gauges

Specimen fitted with 55-C0222/F compressometers

Typical configuration of an advanced automatic system for uniaxial and triaxial tests on rock specimens

Axial load unit

Code	Description	Uniaxial Q.ty	Triaxial Q.ty
45-C9842/RCK	ADVANTEST Rock servo-hydraulic control console	1	1
86-D2999	PC cabinet (optional)	1	1
50-C68Z00	4000 kN cap. EN compression frame	1	1
50-C0050/CAL	Special calibration procedure of load digital unit assuring Class 1 from 1% of full scale	1	1
50-C69/EK	Explosion proof test kit comprehending: safety cables securing the upper platen to the frame, metallic perforated fragment guard and bottom platen anti-fall safety system.	1	1
50-C9080/P*	Distance piece dia. 200x30 mm with threaded centering pin	1	1
50-C9082/P*	Distance piece dia. 200x50 mm with threaded centering pin	1	1

*distance pieces have to be selected according to the sample dimensions

Confining pressure unit

Code	Description	Uniaxial Q.ty	Triaxial Q.ty
45- C7022/RCK	SERCOMP Rock servo-hydraulic pressure control, console	1	1

HOEK CELLS (different models available. We propose NX model)

Code	Description	Uniaxial Q.ty	Triaxial Q.ty
45-D0556	Hoek cell, NX, 54.7 mm dia.	-	1
45-D0556/A	Pair of load spreader	-	1
45-D0556/B	Distance pad	-	1
45-D0556/1	Spare rubber membrane	-	5
45-D0577/A	Rock sample extruder	-	1
45-D0577/4	Extruder adapter set for NX specimens	-	1
45-D0556/H	Holding device for Hoek cell	-	1

Uniaxial component

Code	Description	Uniaxial Q.ty	Triaxial Q.ty
45-D9035	Compression device for samples up to 55mm diameter x 110 mm height	1	-

Typical configuration of an advanced automatic system for uniaxial and triaxial tests on rock specimens

Strain reading and control (select the suitable strain gauges within the models listed below)

Code	Description	Uniaxial Q.ty	Tiaxial Q.ty
82-P0398	Electric device to complete and compensate up to four Wheatstone bridges with ¼ or ½ bridge set up	1	1
82-P0399/B	Strain gauge application kit	1	1
82-P0399/1	Connecting terminals. 50 pairs sheet	1	1
82-P0390	Strain gauge, grid width 4.53x9.53 mm. Pack of 10	1	1
82-P0391	Strain gauge, grid width 3x20 mm. Pack of 10	1	1
82-P0392	Strain gauge, grid width 2x30 mm. Pack of 10	1	1
82-P0393	Strain gauge, grid width 1x60 mm. Pack of 10	1	-
82-P0340/10	High precision displacement transducer LDT type, 10mm travel	-	3*
82-P0340/A	Electric mean device for 2 or 3 transducers P0340/x	-	1*
82-D1260	Magnetic transducer holder	-	3*
82-P0070/3	MS EXCEL Template for stress/strain analysis, Elastic Modulus and Poisson's ratio processing in uniaxial and triaxial tests (single stage)	1	-
82-P0070/4	MS EXCEL Template for stress/strain analysis, Elastic Modulus and Poisson's ratio processing in triaxial tests (single and multi-stage)	-	1

* the items listed as optional are REQUIRED for displacement controlled testing under triaxial condition to perform automatic failure path test (Multi - stage) and to evaluate post-peak behaviour of the specimen.