

# RUMUL Software

for applications  
on dynamic  
testing systems

**Controller dynamic load**

Mode: Load-Amplitude

F2: 20.00 kN

S=f(F/D) Set: 20.00 kN

**Controller static load**

Mode: Load-static (mean)

F3: 30.00 kN

Set: 30.00 kN

**Display measured Values**

Channel Cycles: 1316 \*100

Channel Frequency: 190.00 Hz

Channel Load / R-Ratio: 0.20

Channel Remaining time: 8.58 h

**Monitoring**

<input type="checkbox"/>	active		Cycles	=>	6000000
<input type="checkbox"/>	active		Frequency-Tripping	=>	1.38 Hz
<input type="checkbox"/>	active		Frequency-Tripping	=>	0.10 Hz
<input type="checkbox"/>	active		Load upper value	<=>	49.00 kN to 51.00 kN

Buttons: Specimen, Monitoring, Drive, Crosshead, Null, Compen., Save, Reset, STOP F12

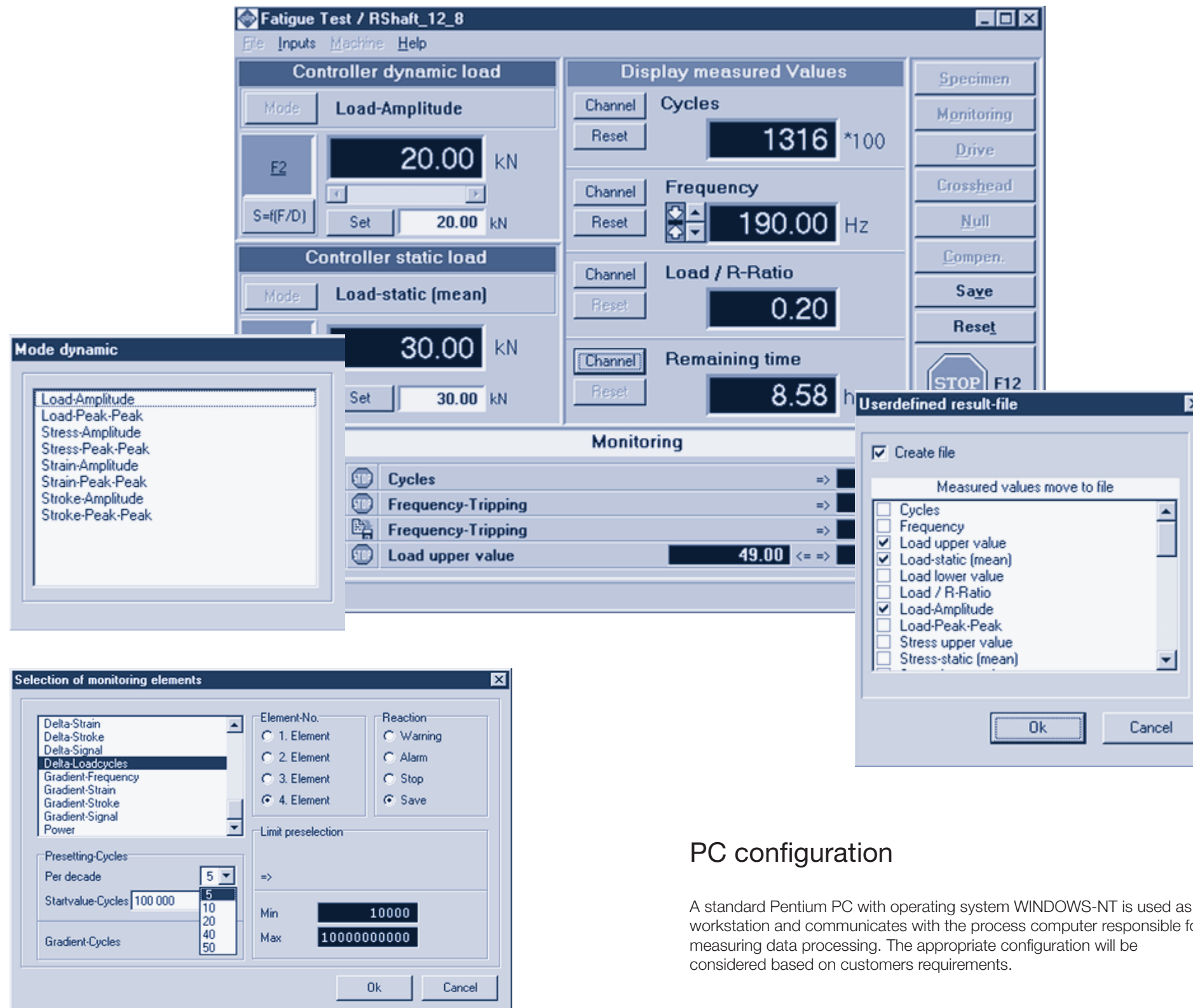


RUSSENBGER PRÜFMASCHINEN AG

# RUMUL Software

## Special features in the RUMUL Software with graphic display

- clearly arranged display structure
- operating system WINDOWS-NT
- different procedures in displaying, controlling and storing the relevant data
- extensive On-line help system
- integration into network with mailing functions available
- scope function for enhanced monitoring facilities
- user friendly and safe operation of the testing machine via the graphic display and mouse
- automatic setting of the resonant testing machine via program
- automatic compensation of the mass forces generated by oscillating gripping heads
- qualified remote control of the machine in set-up mode
- easy self-installation of program modules
- various evaluation methods for different tests are available
- customized or adapted software on request



# RUMUL Software

## Structure of the Software

The software provides an easy to use and easy to understand operating surface and guides the user in a dialog through the single program procedures. The user has a number of different possibilities in order to choose and to display the test parameters, to monitor the machine as well as the ongoing test and to define different program reactions.

An extensive On-line help system supports the easy use of the program.

The data which have been produced are convertible (ASCII-code) and therefore available to work with in customary programs such as EXCEL or WINWORD.

The program is structured to calculate and classify the appropriate set values automatically. Function and use of every single program is described in detail on the next following pages of this brochure.

The programs offer a wide range of flexibility on the basis of our vast experience in running tests in fatigue and fracture mechanics.

In addition, we have incorporated into the basic software a mailing function which allows to connect the system to a network and thus to check the status of the current test from his office.

## PC configuration

A standard Pentium PC with operating system WINDOWS-NT is used as workstation and communicates with the process computer responsible for measuring data processing. The appropriate configuration will be considered based on customers requirements.



# RUMUL Software

## Extended fatigue test

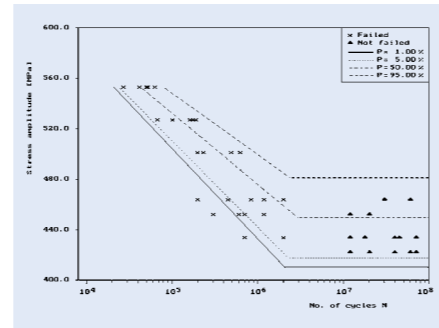
The tests are carried out in either load or stress control mode on specimens as well as on components. In case of crack or failure the program acknowledges a number of measuring values, e.g. the frequency drop on a resonant testing machine is a very good indication of a growing crack in the test piece. The permissible increment is chosen by the user to adapt the sensitivity to the test specific requirements. In addition four free choosable measuring channels or calculated parameters can be displayed.

The program provides a feature to store intermediate results prior to the final crack. These data consist of information concerning the damage process during the test and allow to analyse the deterioration. To allow the user most universal test conditions a data file with fixed data structure is generated to be used in combination with the RUMUL evaluation software for further data processing as well as a free choosable data structure to run quite customized tests.

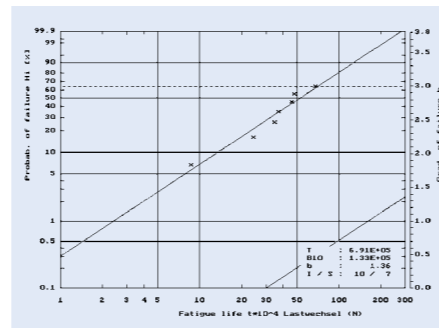
## Evaluation software

With the editing function already existing measuring data can be integrated into the evaluation.

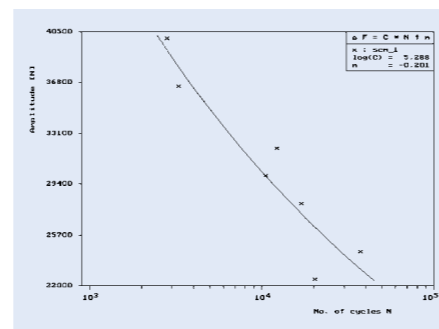
- protocol with project and specimen data
- results in tabulated or graphical form
- data printing
- evaluation based on the arc sin  $\sqrt{p}$ -Transformation with different limits of crack probability
- evaluation based on Weibull with informations upon the statistical values
- evaluation in using a regression parabola of higher degree
- stair case method in transition range; evaluation of Log-Gaussian distribution in fatigue strength range
- display of probability nets
- graphics can be copied into WINDOWS office-software



Evaluation based on arc sin  $\sqrt{p}$ -Transformation



Evaluation based on Weibull



Evaluation based on a regression parabola

# RUMUL Software

## Fatigue crack growth based on ASTM E 647

The tests are based on a cyclic stressintensity  $\Delta K$  control. The program calculates the static and dynamic load based on the current crack length and the required stressintensity. Following methods to measure the crack length are supported by the SOFTWARE:

- crack length measuring system FRACTOMAT and RUMUL KRAK GAGES
- any analog signal (0 up to +10 V) with a free eligible calibration function
- compliance (displaying crack closure at  $F_{op}$ )
- manually via keyboard

The value of the stressintensity is automatically given based on a eligible function which is depending on the fatigue crack growth value (default: exponential function)

- descending  $\Delta K$  at a constant R-ratio
- descending  $\Delta K$  at a constant  $K_{max}$
- descending  $\Delta K$  at a constant  $K_{mean}$
- ascending  $\Delta K$  as above
- constant  $\Delta K$
- constant load F

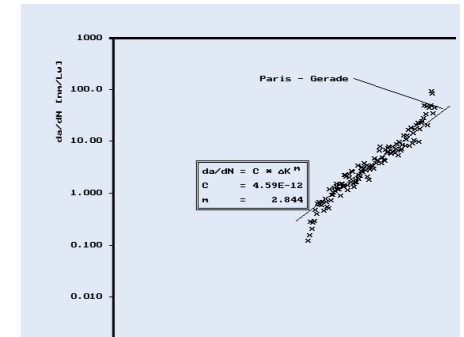
A test based on descending  $\Delta K$  allows "Threshold"-procedures. An appropriate selection of the gradient which reduces  $\Delta K$  exponentially prevents a premature crack arrest due to the plastic zone. The option  $K_{max} = \text{constant}$  excludes a possible crack closure effect.

The SOFTWARE supports six types of specimens:

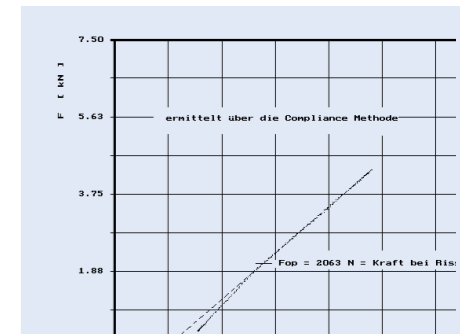
- Compact Tension specimen (CT)
- Three Point Bending specimen (3PB)
- Round Compact Tension specimen (RCT)
- Center Crack Tension specimen (CCT)
- free defined tension specimen
- free defined compression specimen

For the first two types of specimens the geometry functions of ASTM are applicable.

All functions to each type of specimen are free to change. In particular the free defined specimens allow a customer specific use of the geometry function.



Evaluation of the Paris-Line



Evaluation of  $F_{op}$  (opening)

## Evaluation

- protocols with project and specimen data
- tabulated results
- graphical interpretation with dynamic scaling
- generating measuring results, smoothing of graphs
- determination of the Paris-line in a eligible window
- editor to edit diagrams
- printer/plotter configuration



# RUMUL Software

## Block test

The block test is basically a fatigue test with different load horizons within the test. A sequence of a maximum of 100 load horizons (Blocks) is automatically repeated. A block is defined by amplitude, meanload and number of cycles or a hold time.

### Inputs

- specimen informations
- generating blocks
- criteria of interrupt

### Display

- headings such as date, test or specimen numbers
- current load (static and dynamic)
- current block
- operating frequency
- number of sequences

### Evaluation

- protocol with headings
- tabulated print-out

## Precracking of fracture mechanic specimens

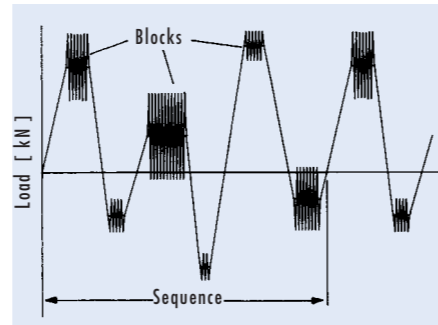
The operating frequency on a resonant pulsator depends very strongly on the stiffness of the specimen to be tested. The stiffness changes with the propagation of the crack, therefore the frequency change is a value of the crack length. In order to follow the known standards the test is being done in a number of load steps which correspond to the different crack lengths. The single load steps are automatically processed. Running a first precracking test on a specific type of specimen the crack length corresponding frequency drop is being determined. The data will be stored and are again available for later tests.

### Input

- test or project number
- specimen dimensions
- data on load steps and crack length

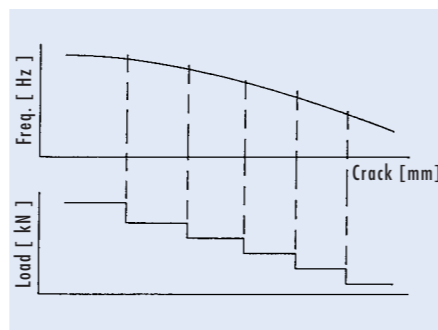
### Display

- headings such as date, test and specimen numbers etc.
- current load (static as well as dynamic)
- current load step
- operating frequency
- frequency steps (difference)



Blocks

No	Meanload kN	Dynamic load kN	Cycles *100	Holding t sec
>1	13.00	0.00	0	15
2	16.00	16.00	1000	0
3	20.00	9.00	20	0
4	0.00	0.00	0	0
5	0.00	0.00	0	0
6	0.00	0.00	0	0



Frequency drop/load

Step	Type	Load-Peak-Peak kN	R-Rat	Frequency Hz
>1	N	18.00	0.10	-1.20
2	N	16.00	0.10	-0.90
3	N	14.00	0.10	-0.80
4	N	12.00	0.10	-0.70
5	N	10.50	0.10	-0.70
6				

# RUMUL Software

## Communication interface OPTOTRON

The fiberoptical communication interface OPTOTRON is designed to switch electrical loads up to 3kVA directly likewise to trigger digital in/outputs.

To control such a variety of different devices, an assortment of application-boxes is available.

Due to the potentialfree galvanic isolation and the noise-free transmission any interferences or transients interfering the system or the connected external devices are avoided.

### Advantages of the optical fiber are:

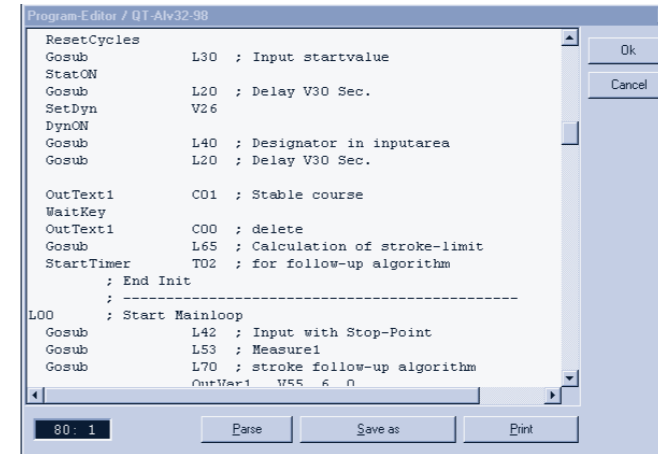
- no transmission of noise or interference signals
- galvanical potential separation
- electrical isolation
- no danger of electrical short cuts
- flexibility and universal use.

### Advantages of the new hardware are:

- modular system
- subsequently mountable
- large assortment of application-boxes available
- integrated signal reproduction of the digitized optical signals.

### Applications:

- extended fatigue tests
- corrosion tests
- involving pumps, fans, heaters, etc. into the test process (corrosion tests)
- data exchange with external measuring devices.

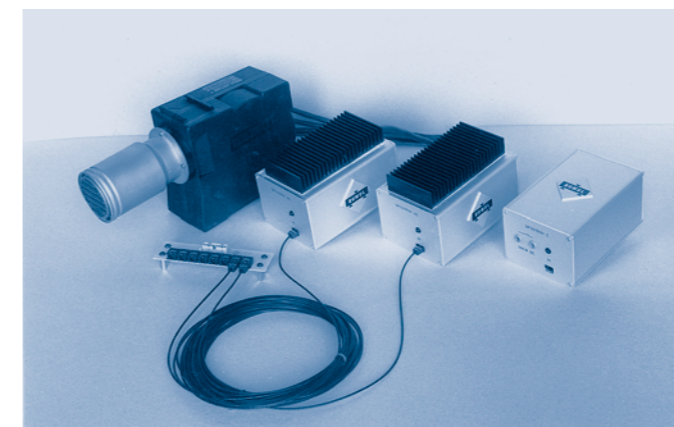


## Universal program ProTest

Free programmable machine program with a reduced and for RUMUL resonant testing machines optimized command set. Easy to use due to self-explaining expressions and the same display structure as the program Extended Fatigue Test.

### The program allows:

- establishing universal test programs
- programmable time and load cycle bases
- support of up to 24 in-/output devices
- triggering external devices over potentialfree fiberoptical interface OPTOTRON
- evaluation of test data by RUMUL evaluation software
- extensive On-line help system



OPTOTRON  
Fiberoptical communication interface to integrate external devices interactively to the test-procedure





# The RUMUL product family



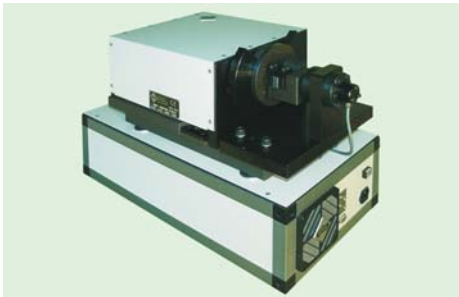
**MIKROTRON 5/20 kN**  
resonant testing machine



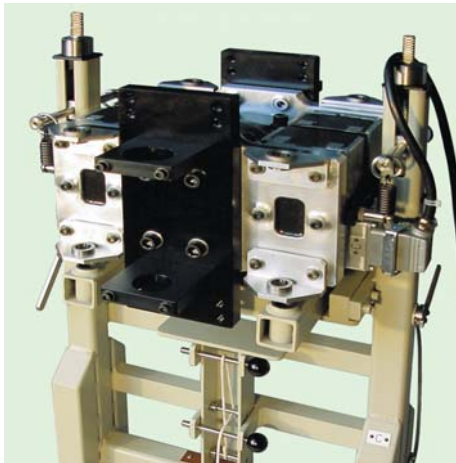
**TESTRONIC 50/250 kN**  
resonant testing machine



**VIBRO-Forte 500 kN**  
resonant testing machine



**CRACKTRONIC**  
bending / torsion pulsator



**SWINGER**  
resonant testing machine



**UPGRADE** of old  
resonant testing machines



**FRACTOMAT**  
crack length measuring system