

# SCM4000

SCM4000  
Dynamic And Fatigue Materials Testing Software  
Control and Acquisition Software  
V.20



2012



## SCM4000 SOFTWARE

### Introduction

**SCM4000** is a user-friendly software for all controller set up functions: configuration, direct machine control, test and methods configuration, acquisition, graphical display, user access, reports configuration, etc.

SCM4000 is intended for controlling the machine and mainly conducting different type of tests: simple static test tension compression, flexural testing; high cycle and low cycle fatigue testing; fracture toughness, fatigue crack growth and run user defined waveform.

The program is compatible with Windows XP, SP3 or Windows 7 operating systems.

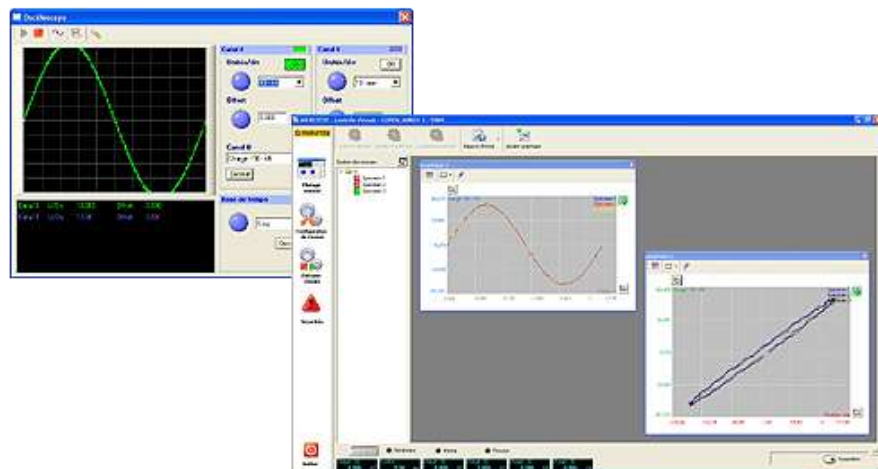
The software is a Microsoft Windows based package for testing of uni-axially loaded materials, in accordance with a wide range of different standards. Waveforms generally employed are constant amplitude sine, triangular and trapezoidal. There is the option to generate any other user-defined wave form, e.g single ramp for tensile test. It is possible to conduct incremental step tests using blocks of cycles with increasing and/or decreasing cyclic amplitude. Hold time experiments are possible with hold in peak tension and/or compression strain for strain controlled creep-fatigue test but for the sequential loading conditions in one cycle such as strain cycling in fatigue region and hold time introduction at a constant stress level (stress control) are also possible to simulate the real LCF and creep interaction. Provision exists for termination of a test upon specimen breakage or fall in the peak tensile stress below a value that can be specified during the progress of a test. There is provision for saving the test formats and user-defined test screens in a test configuration file for future use. The software is supported by an extensive HTML help with on-line documentation of the various features of the system.

### Application Software SCM4000

The system is computer controlled and programmed by means of the adapted MICROTTEST SCM4000 software to MOOG PTC system, including standard manual control, elongation rate control, position rate control, load rate control and strain rate control. It's a very reliable and adaptable system. The SCM4000 package includes suitable tools for machine control, data acquisition, report generation and facility for dynamic exchange of data to Microsoft excel.

The SCM4000 software is designed to run static and cyclic tests with selectable waveform: sine, square, triangle, ramp, hold, profile and custom waveform.

All database and controlled parameters is managed using a computer (included) with the MICROTTEST SCM4000 (latest version, English version).





The flexibility of **SCM4000 software** allows the user the full automation of the tests by means of a powerful Method Editor. It is user-friendly dynamic testing software to run **user defined test protocols**.

Ability to create test templates, Data export to ASCII and Report generation while the test is running.

Included controller software for dynamic control, Low Cycle Fatigue (LCF3), Static tests, Dynamic Tests, Fracture Mechanics, Random loading, etc. These types of tests are user configurable.

SCM4000 software includes a powerful Method Editor to define the test sequence, test parameters and user-selectable calculations in order to automatize the whole test process.

The users can generate their own methods (test templates) or modify the existing ones by means of a friendly **Method Editor**; test sequences, test parameters, calculations, configurations, graphic display, test reports templates, etc.

Test parameters are user defined and can be saved and restored to and from disk. The Methods Editor allows this definition, including different type of parameters: numerical values, formula, time format variables, text, etc.

The **Sequence Editor** included in the Methods Editor in SCM4000 allows carry out test with user defined procedures and protocols by graphical programming. Each sequence can be associated to a defined configuration file and it includes the definition of test parameters, calculations, reports, acquisition mode, etc.

#### **Fracture Mechanics (example)**

The **Method Editor software** includes methods different standardized tests according to the customers requirements. For example:

- Configured software Methods to perform K<sub>IC</sub> tests in accordance with **ASTM E 399-09e2**, CTOD tests according to **ASTM E 1290-08e1**. The property K<sub>IC</sub> determined by **ASTM E 399-09e2** characterizes the resistance of a material to fracture in a neutral environment in the presence of a sharp crack under essentially linear-elastic stress and severe tensile constraint, such that (1) the state of stress near the crack front approaches triaxial plane strain, and (2) the crack-tip plastic zone is small compared to the crack size, specimen thickness, and ligament ahead of the crack.

The **ASTM E1290-08e1** method characterizes the fracture toughness of materials through the determination of crack-tip opening displacement (CTOD) at one of three events: (a) onset of unstable crack extension without significant prior stable crack extension, or (b) onset of unstable crack extension with significant prior stable crack extension, or (c) the end-of-test after significant slow stable crack extension. This test method may also be used to characterize the toughness of materials for which the properties and thickness of interest preclude the determination of K<sub>IC</sub> fracture toughness in accordance with Test Method E399.

- Included (method) compliance software to perform JIC tests as per **ASTM E 813-89**. This test method covers the determination of J<sub>IC</sub>, which can be used as an engineering estimate of fracture toughness near the initiation of slow stable crack growth for metallic materials. It applies specifically to geometries that contain notches and flaws and that are sharpened with fatigue cracks. The recommended specimens are generally bend type that contain deep initial cracks. The loading rate is slow and environmentally assisted cracking is assumed to be negligible.

- A standard package of methods having the feature for conducting **tensile tests** will also be supplied.

These software methods are used during training and acceptance tests and can be readapted in situ to more specific user requirements.

Waveforms generally employed are constant amplitude sine, triangular and trapezoidal. There is an option to generate any other user-defined wave form, e.g single ramp for tensile test. It is possible to conduct incremental step tests using blocks of cycles with increasing and/or decreasing cyclic amplitude. Hold time experiments are possible with hold in peak tension and/or compression strain for strain controlled creep-fatigue test but for the sequential loading conditions in one cycle such as strain cycling in fatigue region and hold time introduction at a constant stress level (stress control) are also possible to simulate the real LCF and creep interaction.

The termination of a test upon specimen breakage or fall in the peak tensile stress below a value that can be specified during the progress of a test can be specified in the Method according to the test parameters.

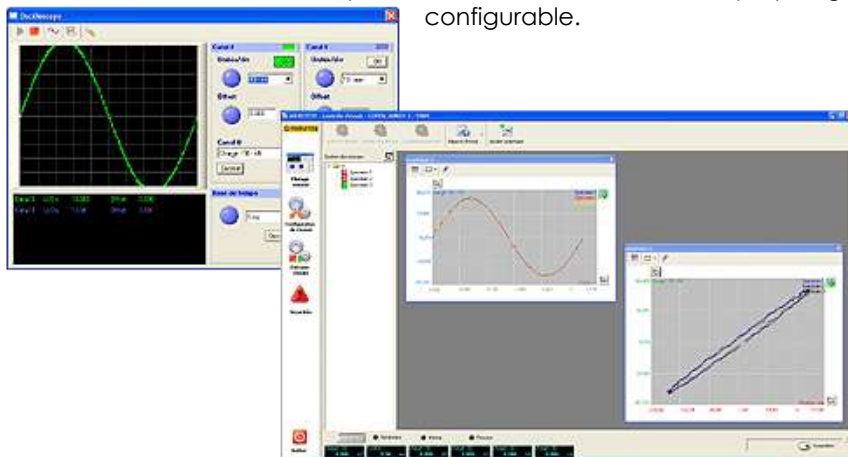
In the **Control Panel Module**, the test formats and user-defined test screens can be saved in a test configuration file for future use, including, if necessary auto-scaling of graphics.

System status can be display, showing current control mode, alarms, limits, waveform type, frequency, cycle number, channel complete configuration parameters and calibration, status of hydraulic power unit, current values, digital I/O definition, etc.

The PID parameters can be modified from SCM4000 software. An automatic setup is performed under SCM4000 user command.

SCM4000 can show multiple digital displays of any configured channel: transducer values, calculated channels, external channels, cycle counters, test time. The number and position of displayed channels is user configurable. All these channels and parameters can be rearranged by means of the Configuration Panel Module and stored/recalled from computer hard disk.

SCM4000 can also show multiple real time graphs from any configured channel: transducer values, calculated channels, external channels, cycle counters, test time. At least 4 graphs can be display at the same time and showing at least values from 4 different channels. The number, position, scales, colors, etc. of displayed graphics is user configurable.



All the defined channels, including direct values from transducers, calculated channels, external channels, time, can be recorded by means of the data acquisition software included. Different acquisition modes, sample rate, start/stop conditions, storage addressing, etc are available in SCM4000.

Data export to ASCII or Excel files and report generation are possible with the Graphic Editor Module. Reports can also be delivered while the test is running.

The flexibility of SCM4000 software allows the user the full automation of the tests.

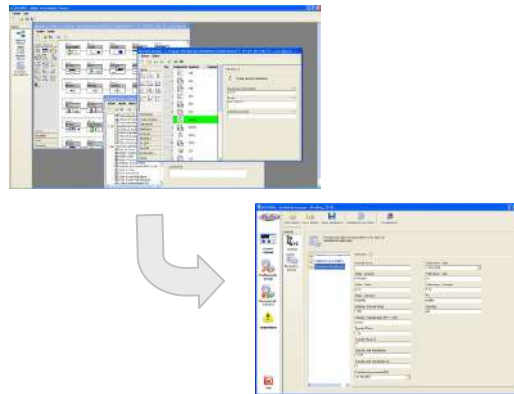
The software allows the recording and **graphical representation** for all defined test parameters. The SCM4000 software has scope for display of real time graph showing the output of at least four transducers and basic data capturing facilities.



New methods can be defined by the user by means of this Test Methods Editor. The SCM4000 software is compatible with Windows XP, SP3 or Windows 7 operating systems. Extensive HTML help with on-line documentation

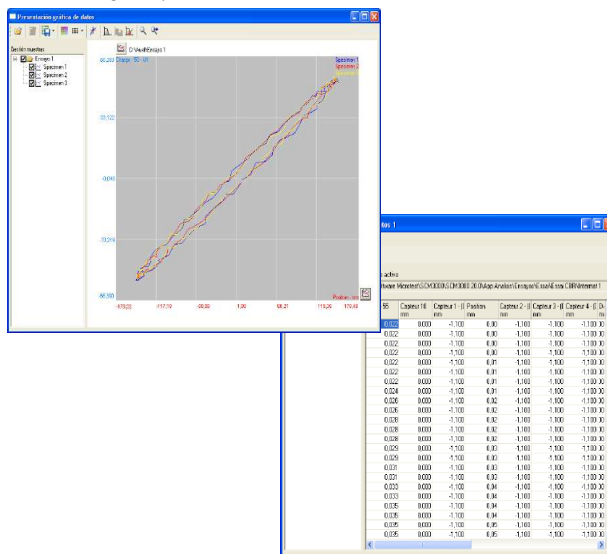
### Data logging

Real-time display of the cycle number, the total stress range, the mean stress, the elastic, plastic and total strain ranges, the raising and falling moduli and the hysteresis loop area for each captured loop is incorporated into the software package. Cyclic data capture intervals are user-definable prior to starting the test and provision exists for recording additional data when a test is in progress. The number of points/cycle in data capture (cyclic) is large enough to capture all the data points during stress relaxation in the strain controlled creep-fatigue interaction tests even for longer hold period 90 min. The data acquisition speed is >5 kHz (it depends on the hardware). Provision to save the data capture format for future use exists. Graphical display of cycles vs. peak stress or strain, the stress-strain hysteresis loop, and any other user-defined parameters are possible.



The SCM4000 Control Panel Module is also used to display in real time the quantities involved in the test and the results from the recorded data: cycle number, the total stress range, the mean stress, the elastic, plastic and total strain ranges, the raising and falling moduli and the hysteresis loop area for each captured loop is incorporated into the software package.

The acquisition interval and acquisition mode are user definable prior the beginning of the test (defined also in the Method). The data acquisition speed can be higher than 5kHz.



The number of points/cycle in data capture (cyclic) is large enough to capture all the data points during stress relaxation in the strain controlled creep-fatigue interaction tests even for longer hold period 90 min.

The Method Editor includes the Results Module with the definition of formula to be used with the recorded data. These calculations are used during the test to show the results defined according to the standard.

Graphical display of cycles vs. peak stress or strain, the stress-strain hysteresis loop, and any other user-defined parameters are possible.



## Description of the different SCM4000 modules Control and Acquisition Software

The SCM4000 software is designed for control and data acquisition in dynamic and fatigue testing machines.

Software is designed to adapt to the needs of the users for the standard accomplishment of tests or personalize special applications.

The system allows the user to work manually with the test equipment, like a classic Control Panel; or in automatic mode, executing predefined automatic test methods that minimize the possibility of errors in the execution of the test.

The different modules of SCM4000 software allow the personalization of the system for different types of test equipment: load ranges, number and type of measurement sensors, resolution and physical units of measurement, etc.

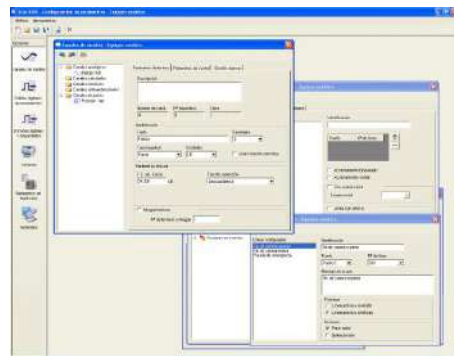
### Configuration

The configuration module, allows the user to adapt the system to the needs of each testing equipment: number of measurement channels, types of sensors, etc.

The system allows the creation of user channels, whose value is obtained from the evaluation of a mathematical expression.

Automatic detection capabilities of the connected sensor.

Possibility to apply different configurations to the testing equipment, based on user needs



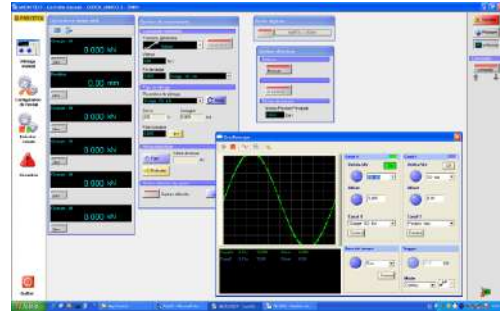


## Test control

### Direct control of testing equipment

The Control Panel gives to the user the direct access to all functions of the machine, the possibility to make data acquisitions, execute automatic test methods, etc.

Possibility of connect and manage third-party devices such as: temperature controllers, measurement devices, etc.



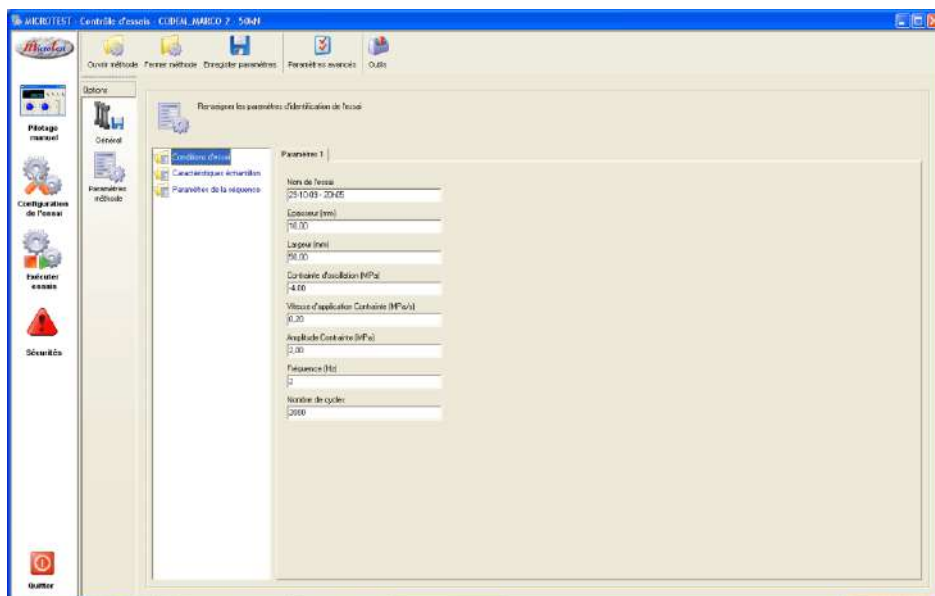
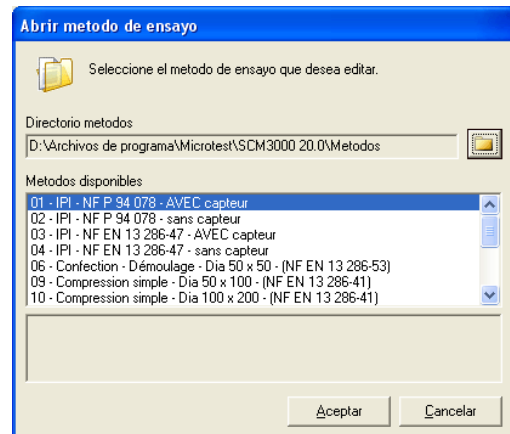
### Test configuration

With only two clicks the user can have the SCM4000 ready to run a test with direct output of results.

The selected method is previously tailored if necessary through the pre-configured parameters, according to the test procedure, by means of the Method Editor.

The user can add any desired parameter to completely identify the test procedure to be performed.

- Test management data.
- Identification data for the test sample.



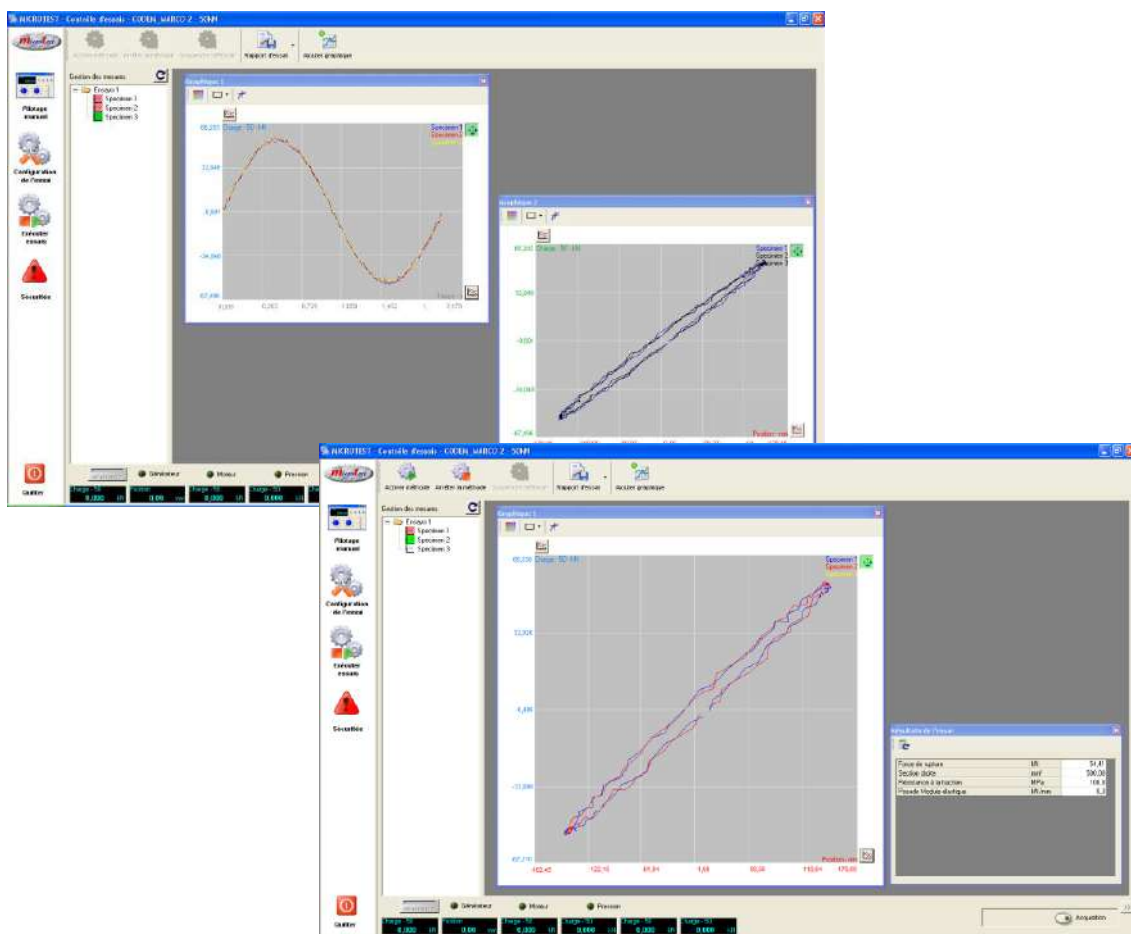


## Running a test

Only one click is all the user needs to run a test. The test method, comprising the sequence, calculations and recording, automatically will perform all the necessary operations in the testing machine and will guide the user during this process.

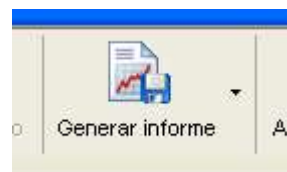


The test execution mode allows the user to configure the different displays and graphs to be shown during the test.

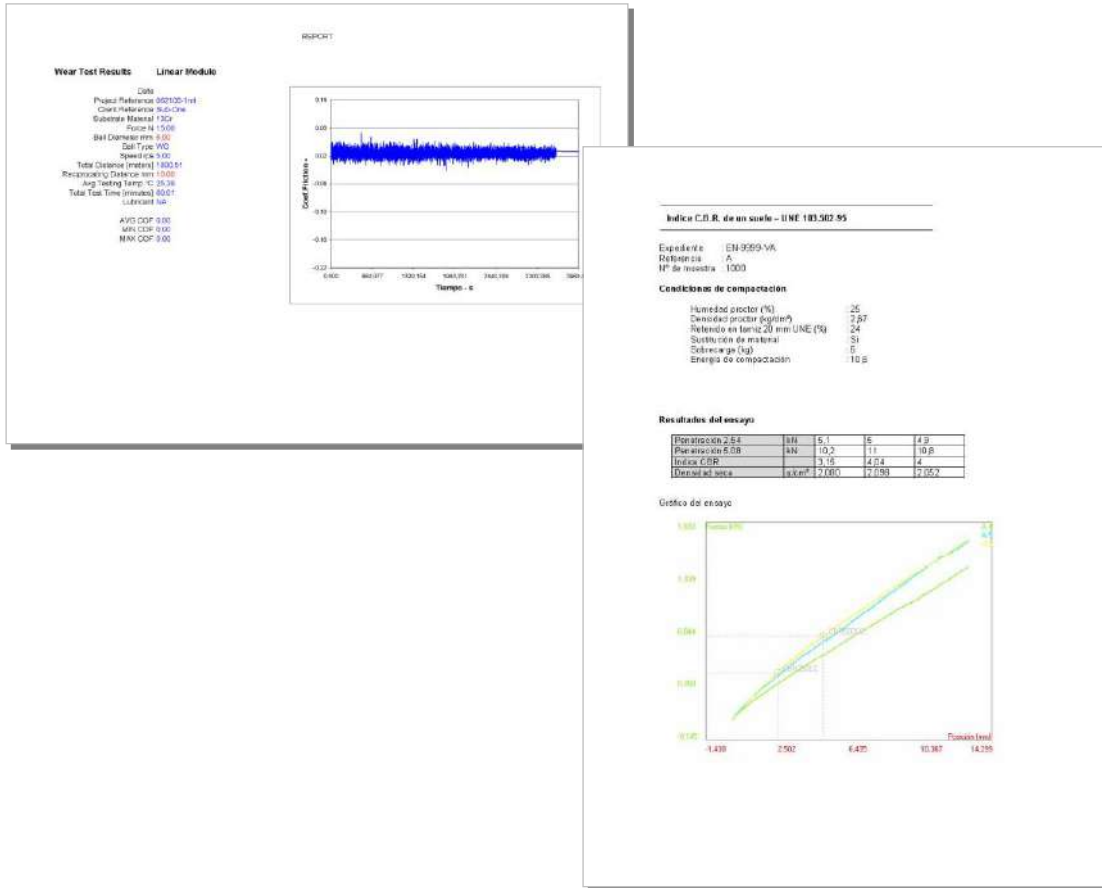


## Test reports

It is possible to obtain a test report just after the test ends up. The report can be customized by the user through Microsoft Excel, creating templates. According his needs he can apply different report formats.





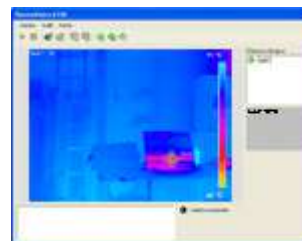


### Integrated management of different devices

SCM4000 software allows direct management of different control and measurement devices from a single working environment. As an option and under demand, SCM4000 can link to third part system to include the information this devices provide into the test data files: signal from other sensors, controllers, images, etc.

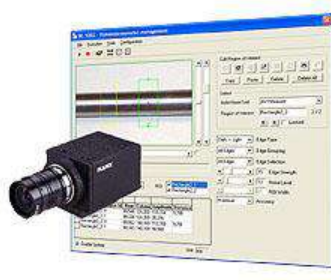
### IR camera management

Contactless temperature measurement from an IR camera can be added to the recorded data or can be shown during the test. In this case it is possible to have a recording of the temperature values in different points of the sample and simultaneously a set of thermographic pictures from the sample.





### Video extensometer management



SCM4000 software can also connect to the video-extensometer VE-1002 management software.

The recorded measurement taken by the extensometer is later used by the SCM4000 software for the evaluation of the result.

### Third part devices management

Under demand it is possible to add the management of: temperature controllers, digital displays, data acquisition hardware, etc

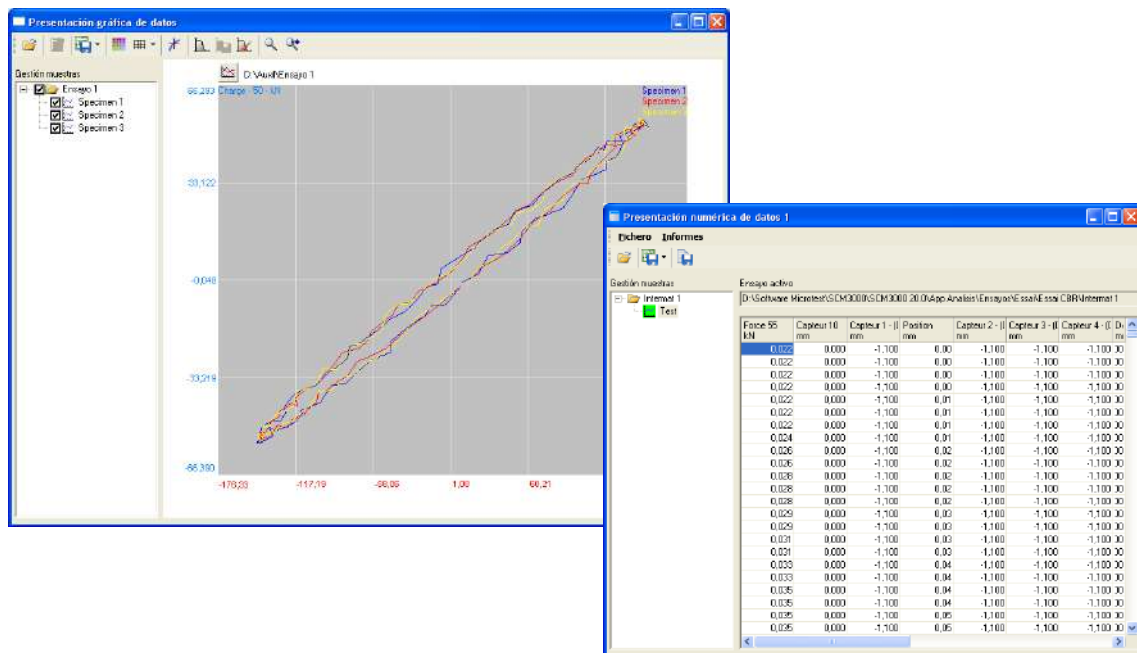


### Data analysis

The performed tests can be later processed by means of this data recovering and analysis module.

By means of this module, the user can: compare different tests, display the graphics in different ways, analyze the numerical data in tables, and export the data to different file formats to be post-processed.

A statistical analysis can also be performed from the results obtained in a set of similar tests (same method).

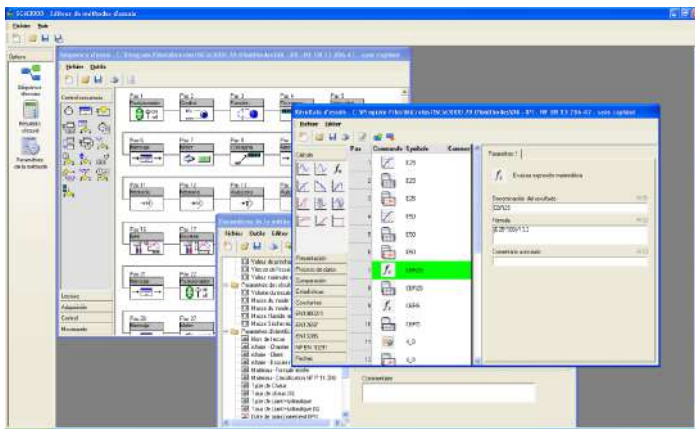


## Test Method Editor

The Test Method Editor is a powerful tool that allows the user the creation of test procedures and automatic sequences to be run later in the Control Panel.

By means of different options the user can:

- Establish the sequence of operations to be run by the system in the Control Panel.
- Define all the necessary parameter to identify and tailor the test method: sample characteristics, test parameters, calculation parameters, etc.
- Define the results to be calculated and be displayed during the test.



The user creates the test method according a procedure or standard, to be run later in the Control Panel.

It is possible to create and execute standardized methods as well as personalized methods.

