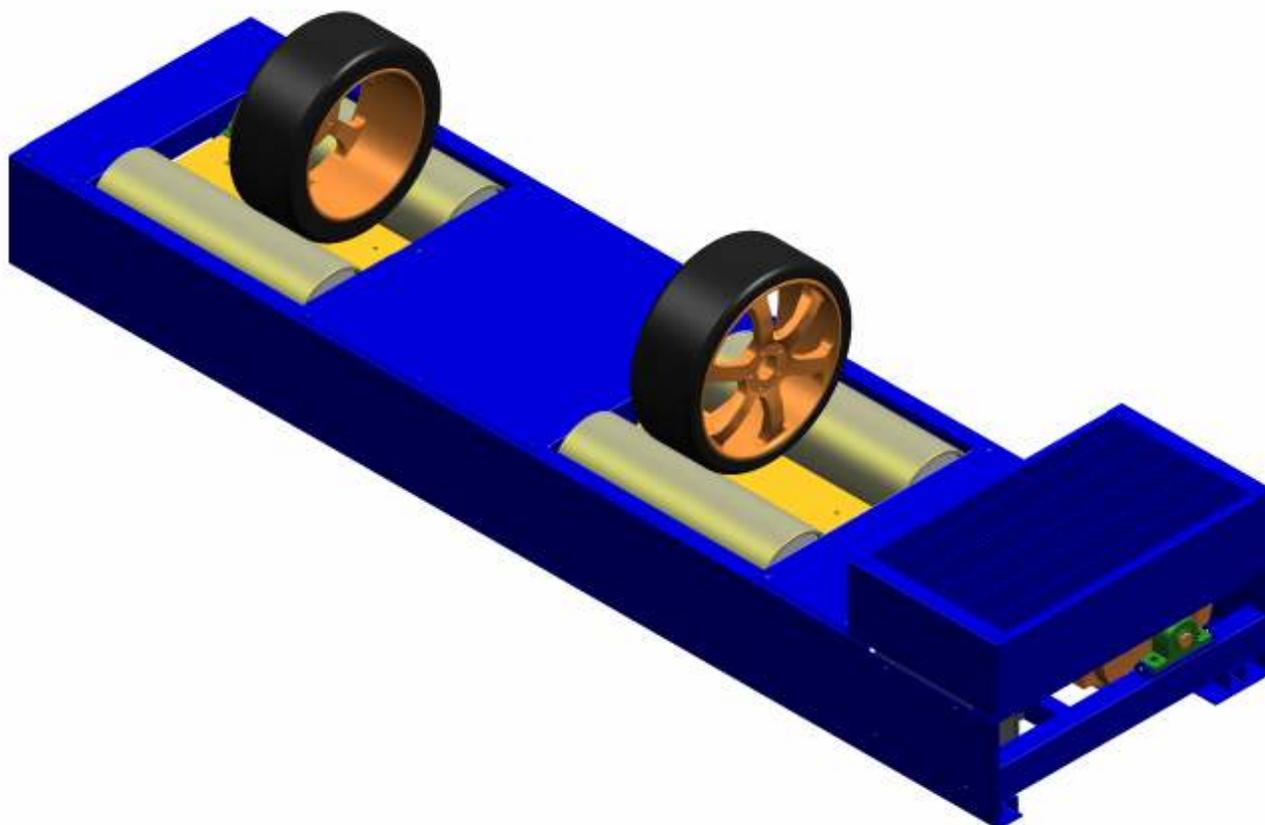


Operator manual chassis dynamometer BPA-2RJ



Edition

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The contents of this version have been checked with great care. However, errors cannot be fully excluded. Please contact Bapro srl if you find errors of any kind.

Subject to technical change without notice.

This operator manual is intended for users with previous technical knowledge in the field of vehicle testing technology as well as basic computer knowledge.

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Safety instructions

Operator diligence duty

The chassis dynamometer is designed and manufactured considering the harmonised standards in force within the European Community. It represents the technical state of the art and guarantees maximum safety when used.

The vehicle must be exclusively used in the ways illustrated in the operator manual.

In particular, the operator must make sure that:

- The vehicle is only used observing the standards.
- The vehicle is used only when found to be in perfect condition and in particular, only after checking that all the safety devices work properly.
- The equipment necessary to protect the machine operating, maintenance and repair personnel is available and used.
- The operator manual - in a readable condition - is available at any moment at the work place.
- Only qualified and authorised personnel, use, maintain and repair the chassis dynamometer.
- These persons are regularly instructed before starting work and then at least once a year on all matters concerning safety at the work place and environmental protection, as well as knowing the instruction manual and the safety instructions it contains.

All the safety and warning symbols on the machine remain in place and are legible.

Practical safety instructions and the symbols used

The following chapter contains practical safety instructions, so as to indicate the inevitable residual dangers during machine operation. These residual dangers represent a risk to:

- persons
- the product and vehicle
- the environment

The purpose of the symbols used in the operator manual is to attract the operator's attention to the safety indications:

	<p>Danger – Risk of electric shock</p> <p>This symbol indicates the presence of live parts inside the equipment</p>
	<p>Danger</p> <p>This symbol indicates that improper machine use or use in particular conditions may cause risks to persons.</p>
	<p>Caution</p> <p>This symbol indicates precautions to follow so as to use the dynamometer safely.</p>

	Do not disassemble This symbol expressly forbids disassembling or repairing vehicle parts.
	Use indications This symbol indicates that the operator must follow a special procedure in using the dynamometer.
	Note This symbol informs the operator about particular aspects of dynamometer use.

Essential safety protection measures for normal operation

The dynamometer can only be operated by trained and authorized personnel, acquainted with these use instructions and who observe them during operation.

Before starting the dynamometer make sure that:

only authorized personnel are near the dynamometer and that no one runs the risk of being harmed when the machine is started. Pay attention to all rotating parts: they are potentially dangerous.

Each time the dynamometer is used, first check that it has no visible damage and make sure that it is only put into operation in perfect condition. Any damage and faults must be reported immediately to a senior company member.

Before each start up, make sure that the safety devices are working perfectly. The main switch has an emergency stop function; in the event of an emergency, turn the main switch to the "0" position.

When the machine is operating, make sure that ear-defenders are used to avoid damage to hearing.

Tests performed on vehicles with combustion engines are potentially dangerous due to carbon monoxide emissions. Check the operating conditions to avoid poisoning.

Protect the machine against humidity and dirt.

Essential cautionary safety measures for maintenance operations

For inspection and maintenance, observe the intervals indicated in the operator manual. Block access to the dynamometer operating area to unauthorized persons, before starting maintenance and repair operations.

Before starting repair and maintenance operations, remove the dynamometer power supply plug, or in the case of a fixed power supply, switch off the main switch and block it with a padlock. The key to the padlock must be kept by the person performing the maintenance and repair operations.

When replacing heavy machine parts, exclusively use suitable load suspension and slinging equipment in perfectly efficient condition.

Lubricants, refrigerants, cleaning substances or anyway pollutants must be disposed of properly.

Repairs to the dynamometer's electrical equipment must only be performed by a trained and authorized electrician.

Regularly check the electrical equipment.

Tighten any slack connections.

Immediately replace damaged cables.

Keep the electrical equipment compartment constantly closed; only authorised persons with spanners/tools may access it.

Electrical equipment compartments must not be sprayed with water jets for cleaning.

Observe the regulations for environmental protection

In the case of operations with and on the machine, observe the legal requirements concerning the avoidance of waste, recycling and the correct disposal of waste.

In particular, during installation, maintenance or repair operations, polluting the ground or the sewage systems with pollutants such as:

lubricant grease and oils

hydraulic oils

refrigerant liquids

detergents containing solvents

i s f o r b i d d e n

These substances must be conserved, transported, collected and disposed of in suitable containers.

Measures, laws and standards

The following standards were considered when the machine was designed

- Machine Directive 89/392 modified by Dir. 91/368 and Dir. 93/44.
- Low Voltage Directive 73/23 modified according to Dir.93/68.
- Electromagnetic Compatibility Dir. 89/336 modified according to Dir. 92/31.

Description

The chassis dynamometer BAPRO permits tests to be performed on cars and light vehicles through an eddy currents brake.

The dynamometer is based by a microcontroller system that perform the control function and by a software that run on a personal computer (linked to the dynamometer through a serial port RS232).

The following types of tests are possible:

road load simulation on the basis of the vehicle's physical parameters (coefficient of aerodynamic drag, frontal area and mass);

simulations with a constant traction force (road inclination and vehicle mass);

constant speed simulations;

power tests with a set speed ramp (constant acceleration: "sweep test")

check tachometer e speedometer.

The following optional extras are available:

vehicle cooling fan with a constant speed with direct control by the software;

vehicle cooling fan with a variable speed in function to the rollers speed.

Control software

The test bench appears to the PC as a programmable instrument. The software is used for setting the dynamometer parameters and then for interrogating the dynamometer to acquire the data measured so that it can be displayed. The application is based on LabVIEW 6.0 so that it can be easily modified and expanded on the basis of future requirements.

The remote control exploits the keyboard emulation principle and is of the infrared type.

The control software manages procedures that have been simplified as far as possible considering the type of user who must use the test bench. As a general principle, all the functions must be available without the use of a mouse; the commands must be available through the function and arrow keys and the standard keyboard. On the data display pages there is a tool bar at the bottom of the screen; here, the functions available in the current menu are associated to the function keys (from F1 to F4). For the purpose of selecting the two main functions, controlling the lifting device and forcing the maximum fan speed, the definition of fixed function keys is foreseen (F6 and F5).

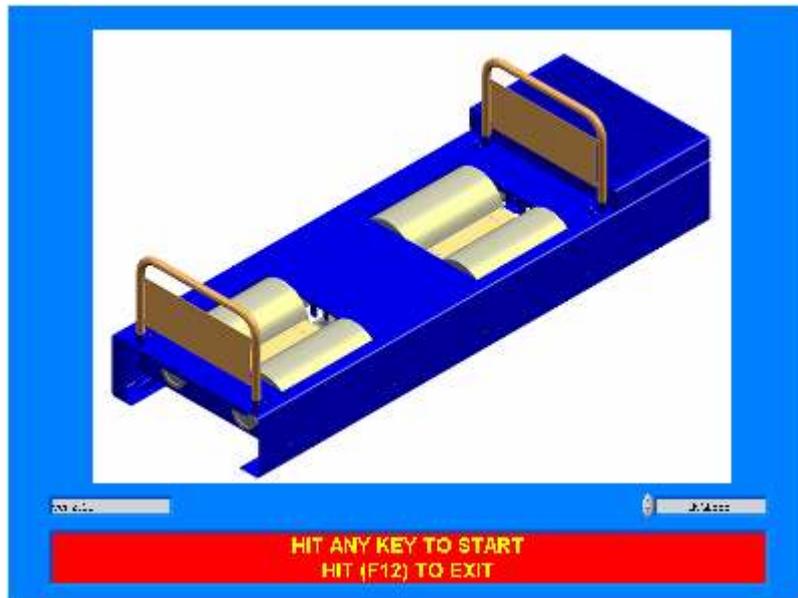
The F5 key on the keyboard permits forcing the fan speed to maximum speed; this function is available from every menu.

The F6 key on the keyboard permits controlling the lifting device on condition that the rollers are running at a speed of lower than 3 km/h (limit set by the control system): this function is available from every menu.

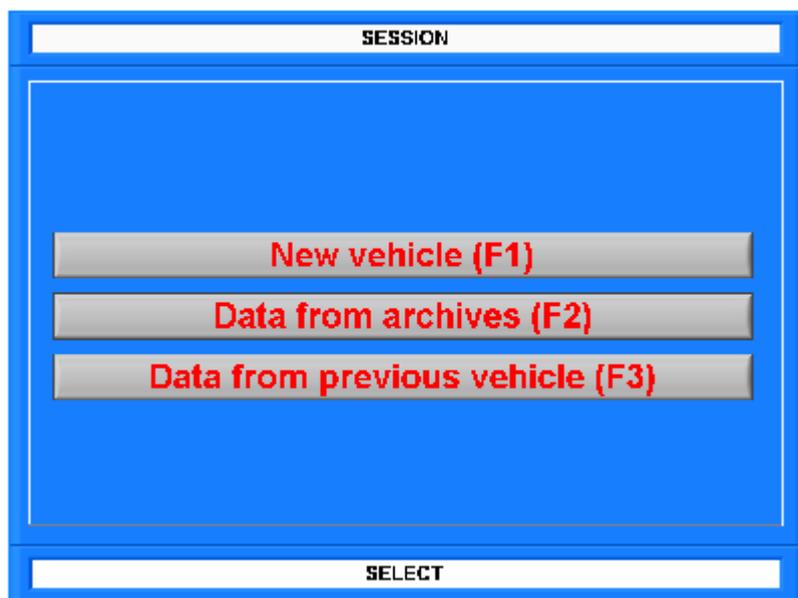
Another two keys assigned in a fixed way are Esc and Return: the escape function is that of going up to the higher level menu; the return key corresponds to the confirmation action of a certain operation.

Test session setting

When the program opens, a page appears displaying an image with the logo of the equipment and the request to "Press a key to start or press (F12) to exit".



We are then asked if we want to run a new test session (F1 key), recall the data from the tests archive (F2 key) or run the test session with the data of the previous vehicle (F3 key)



The setting of a test session foresees a page on which we are asked for (with the corresponding selection keys):

car model [F1]

number plate [F2]

customer [F3]

operator [F4]

engine displacement [F7]

fuel supply cycle type [F8]: petrol or diesel

engine type [F9]: atmospheric or supercharged

type of rpm reading [F10]: automatic, electronic reading or non

traction [F11]: front, rear (integral in the four-wheel drive version)

SETTING OF TEST SESSION

01/11/2008 - 19.06

Vehicle model (F1): Opel Astra F G20XE

Number plate (F2): TO 56353S

Customer (F3): Nika

Operator (F4): Alessandra

Displacement (F7): 2000

Fuel (F8): Petrol

Engine type (F9): Atmospheric

Rev meter (F10): Automatic

Drive (F11): Front Scales and Units

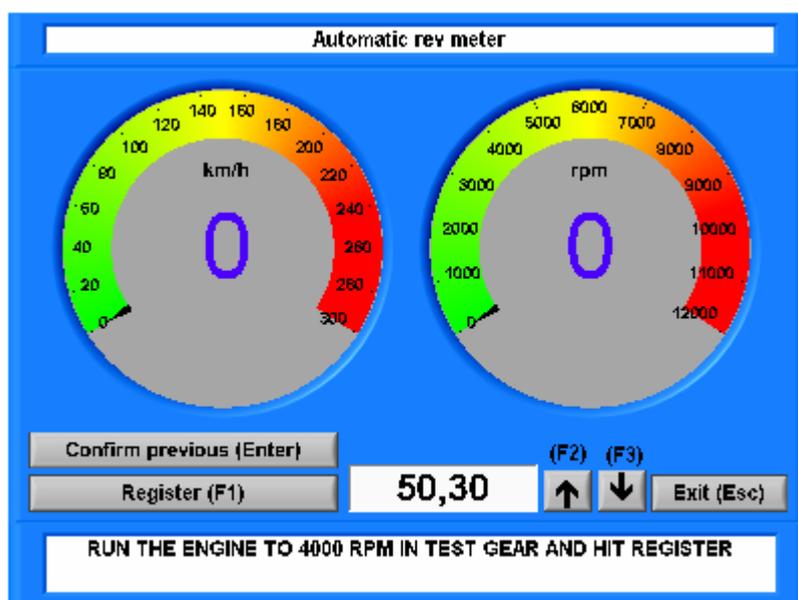
Cancel (Esc) Next (Enter)

INTRODUCTION OF DATA SESSION

Calibration automatic rev-meter

If we have decided to measure the rpm automatically, a window appears for system calibration, in which there are two large graphic indicator for the speed and the RPM. If this measurement was already executed in the previous test, the calibration number appears at the bottom on the center and we can continue by pressing Return. If not, to execute the measurement, we have to follow the instructions displayed in the writings appearing in the bar at the bottom; in other words, we have to bring the engine to 2000 rpm in the test gear (typically the fourth gear: it's important to understand that the successive measurements made by the dynamometer will always refer to that gear and that therefore the measurements of rpm and torque will not be reliable for other gears). Once at 2000 rpm press Store (F1 key).

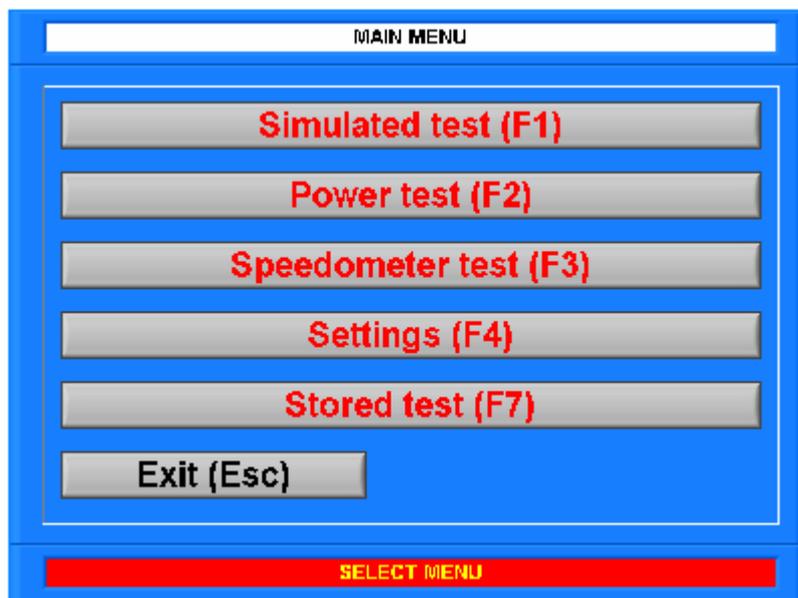
Now we can check with the RPM indicator if the calibration is good: otherwise it's possible to fine tune the calibration to obtain the best reading.



Main menu

The main page contains the following 5 menus:

Simulated test (F1), Power test (F2), Speedometer test (F3), Settings (F4), Stored tests (F7). The ESC key is present. At the bottom of the screen there is a flashing bar with the label "Select desired menu".



Simulation menu

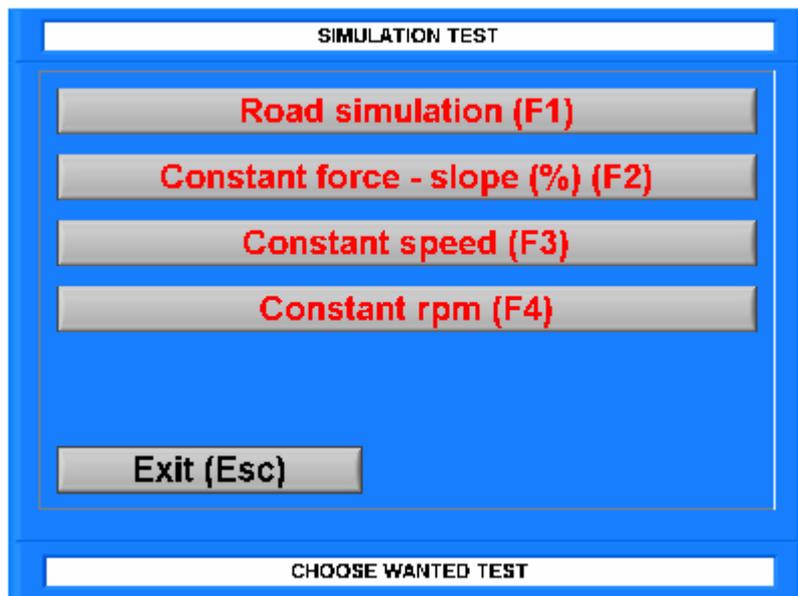
The simulated tests page includes the following menus:

Road simulation (F1)

Constant force - slope % (F2)

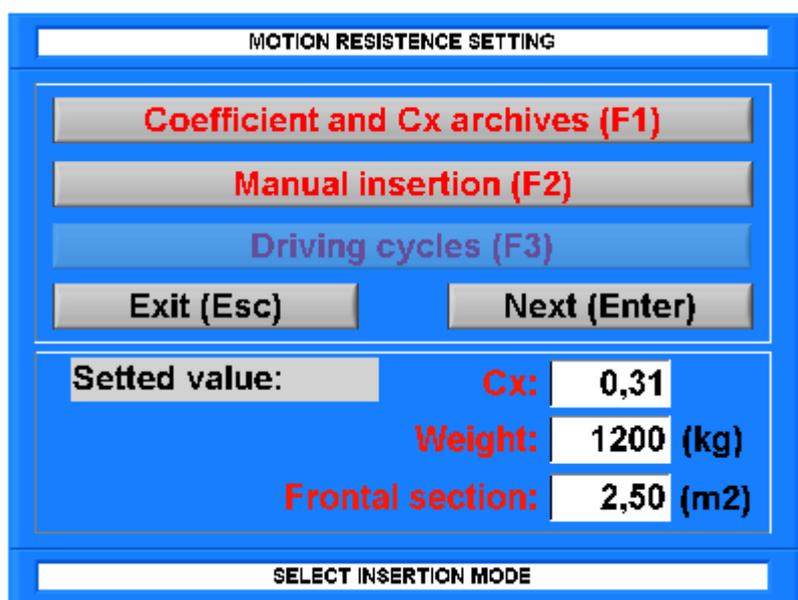
Constant speed (F3)

Constant RPM (F4)



Road simulation

By the F1 key of the simulated tests menu, we access the page for setting the parameters concerning motion resistances and successively data display.



Setting the road simulation coefficients can take place in different ways, selected using the function keys:

Coefficient archive and Cx (F1): car database on the basis of type.

RESISTENCE MOTION - ARCHIVES			
Model (F1)	Cx	Section (m2)	Weight (kg)
Aprilia RSV1000R	0.34	1.3	185
Bmw F850	0.36	1.2	193
Ducati Multister	0.32	1.1	188
Ducati Multistrada 1000DS	0.34	1.1	200
Ducati 998R	0.31	1.3	170
Ducati 999S	0.31	1.2	192
Honda CBR 600RR	0.33	1.3	189
Honda CBR 1000RR	0.33	1.4	179
Kawasaki Ninja ZX-6RR	0.30	1.1	181
KTM 950 Adventure	0.34	1.4	198
MV Agusta Brutale 750S	0.34	1.2	185
MV Agusta 1000 S 1+1	0.31	1.2	193

Cancel (Esc) Next (Enter)

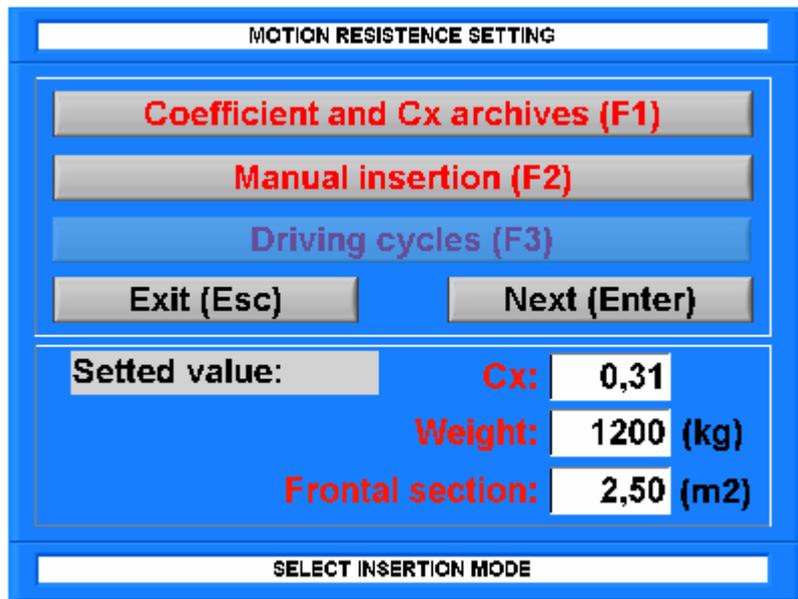
SELECT MODEL

Manual insertion of resistances to motion (F2): we set the aerodynamic resistance coefficient (Cx), Frontal section (in m²) and Weight (in kg) to calculate the parameters with which to program the dynamometer.

RESISTENCE MOTION - MANUAL INSERTION	
Cx (F1):	0,00
Frontal section (F2):	0,00 (m2)
Weight (F3):	0 (kg)
Cancel (Esc)	Next (Enter)
INTRODUCE PARAMETERS	

By pressing the Continue key (Return) - enabled when the simulation data is anything but zero - we program the dynamometer.

The data set are displayed in the bottom part of the screen, (Cx, Section, Mass) and remain stored so that once set, it is not necessary to re-enter the menu to re-perform the procedure every time.

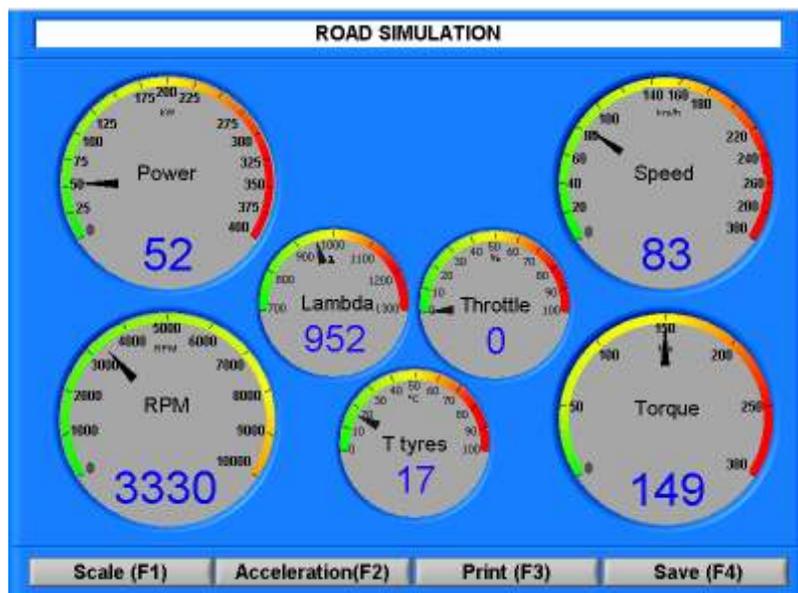


Data display during road simulation

The data is displayed both graphically and numerically. The values are represented via modules that replicate the index instruments by displaying the numerical values of the size measured in the lower part of the module.

There are 5 pages with indicators that can be displayed by repeatedly pressing the Return key: all instruments, large power instrument, large speed instrument, large rpm instrument, large and graphic torque instrument.

Inactive indicators are turned grey or made to disappear.



The graphic page is comprised of a graphic module of the "strip chart" type at the centre of the screen, with a series of instruments at the bottom indicating turbo pressure (in the case of turbo engines), tyre temperature and lambda. The writing "Road Simulation" appears as the title at the

top of the screen (in the other simulated tests there will be "Constant force" or "Constant speed" depending on the type of test in progress).

The graphic will represent the following as a function of time (time zero is the instant the test starts):

power at the wheel (in kW)

engine rpm (if the reading of the same has been set) (in rpm)

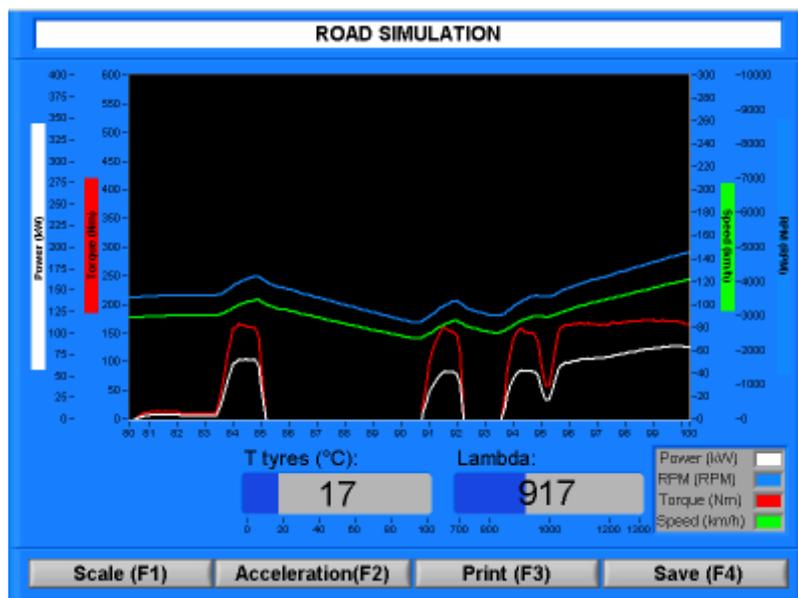
engine torque (if engine rpm reading has been set) (in Nm)

speed (in Km/h)

lambda value (if a petrol engine)

turbo pressure (if a turbo engine) (in mbar)

tyre temperature (in °C)



The power scale is set manually using the F1 "SCALE" key. Four standard scales are foreseen for power, chosen by repeatedly pressing the F1 key.

The F2 key permits access to the "Acceleration" menu (only to display the diagram).

When this function is active, the key is coloured red.

The F3 key permits access to the "PRINT" menu of the screen-shot type.

The F4 "ARCHIVE" key permits us to begin to record the measured parameters.

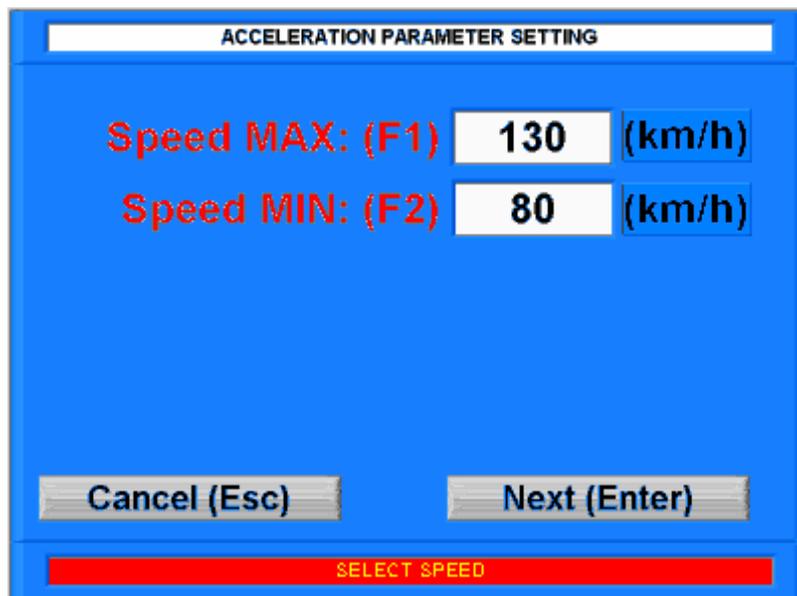
When recording is in progress, the key is coloured red. Data recording is stopped by pressing the F4 key again (which returns grey).

The ESC key is used to leave the test menu and to go up by one menu level, whilst the RETURN key permits is to choose the best display (circular menu).

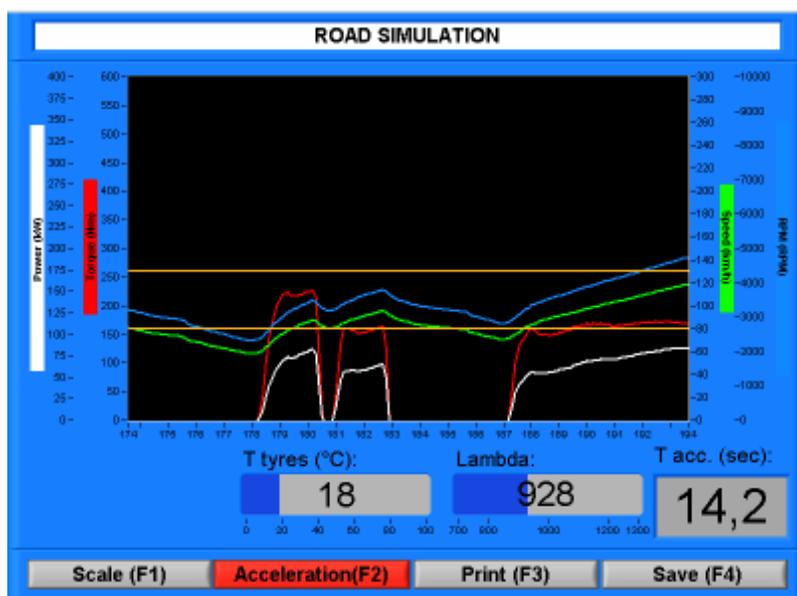
Acceleration test

One option of road simulation is acceleration control by setting to speed limits (MAX and MIN). Activation of the acceleration menu is indicated by the red colour of the acceleration key.

The road simulation parameters (already inserted) are exploited and the operator is asked to set two speed limits through a dedicated panel.



The management software starts the chronometer when the lower speed limit is exceeded (increasing speed). Once the final speed is reached, the chronometer stops and the measured data is displayed. The value remains until the passing of the lower limit with increasing speed happens again. The acceleration measurement (chronometer) remains active until the F2 key is pressed again.



Data printing

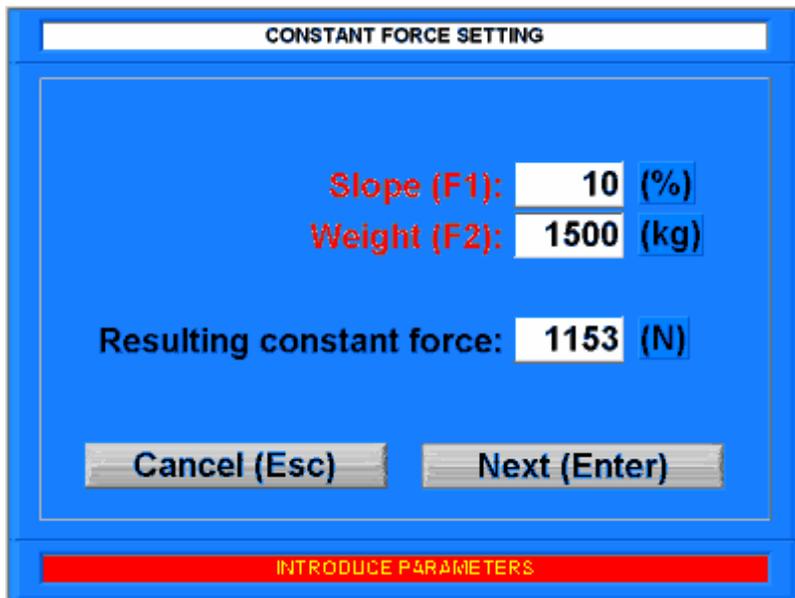
The data printing directly from the simulation menu must reproduce the dimensions developed on the strip chart. The sheet will be arranged horizontally and will bear all the workshop and car data at the top. When printing, it is possible to choose between compact printing (only data sheet) or full printing (data sheet plus heading with drawings).

Data saving (Archive)

When the "Archive" key (F4) is pressed, it lights up in red and we proceed to store data, until the key is pressed again. The data is saved with a name deriving from the date on which the recording is made and can be seen in the "Stored tests" menu (accessed from the main menu) in graphic module displaying the following characteristics: power, rpm, torque, speed, turbo pressure and lambda.

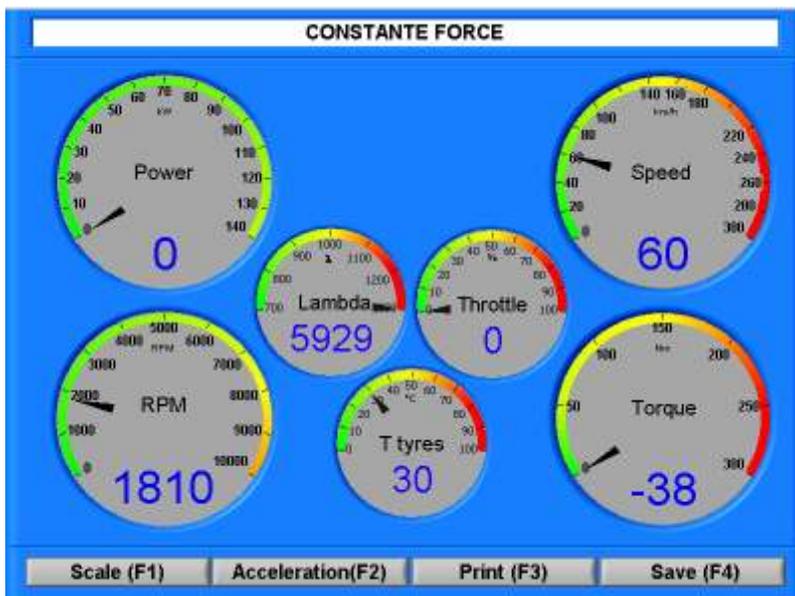
Simulation page at constant force – slope % (settings)

The value of the force with which the braking is to be performed is calculated. We must insert the car's weight (in Kg) and the inclination (as %) of the road.



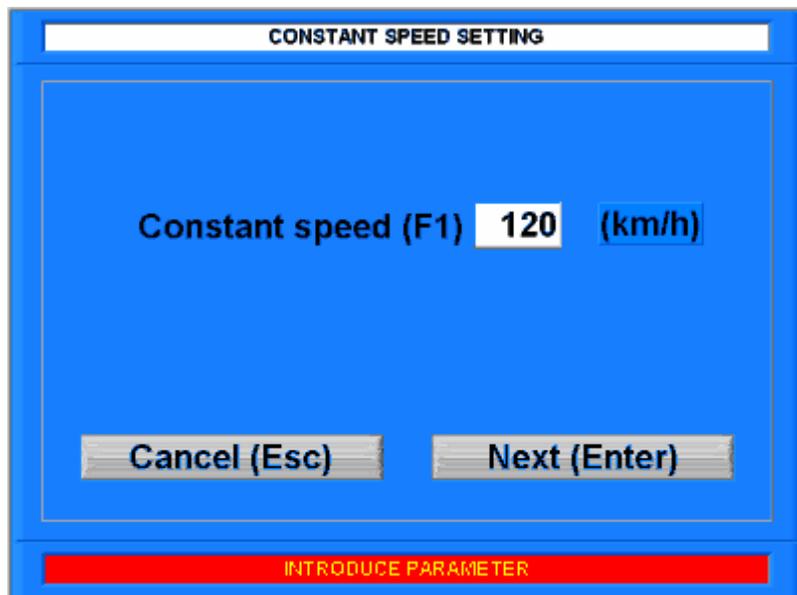
Data display during constant force simulation

The data is represented as for road simulation (diagram and instruments). The heading will be the wording "Constant force". There is another large force instrument that indicates the force set (in N) in the circular menu.



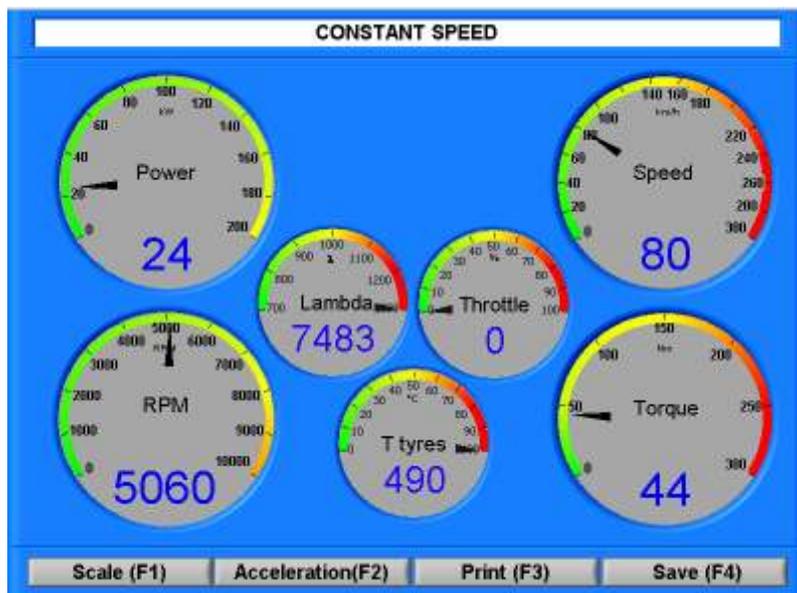
Simulation page at constant speed (settings)

We are asked to insert the constant speed value with which to perform the test.



Data display during simulation at constant speed

The data is represented as for road simulation (diagram and instruments). The heading will be the wording "Constant speed".



Engine power control menu

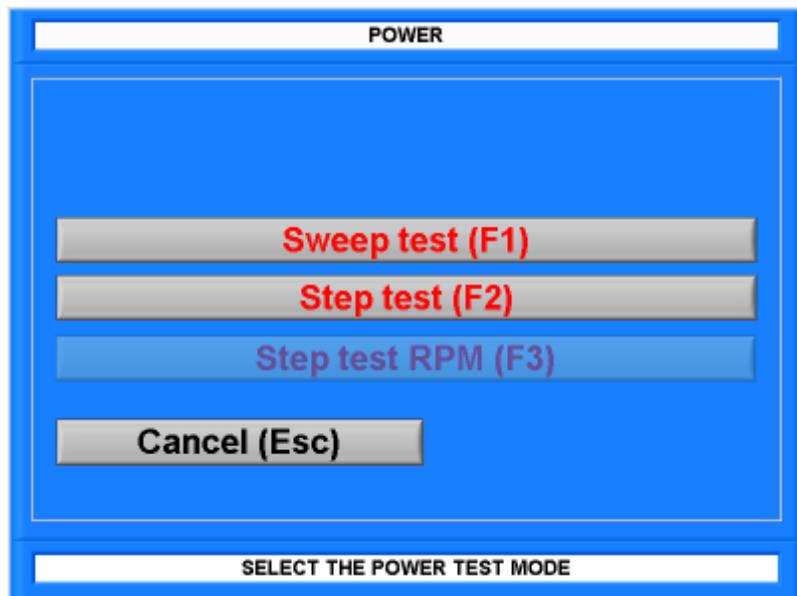
This page permits us to choose the type of test to perform:

Sweep test (F1)

Step test (F2)

Step test RPM (F3) (optional)

The Esc key permits us to leave and go up by one level in the menus.



Sweep test menu

Data setting consists of asking the user to supply the maximum estimated power of the car, or, by pressing the "Curve" key, we access an archive from where it is possible to choose a reference curve, previously stored in a file.

90 kW (F1)

140 kW (F2)

200 kW (F3)

Curve (F4)

This data is used to assign the diagram display scale of the power.



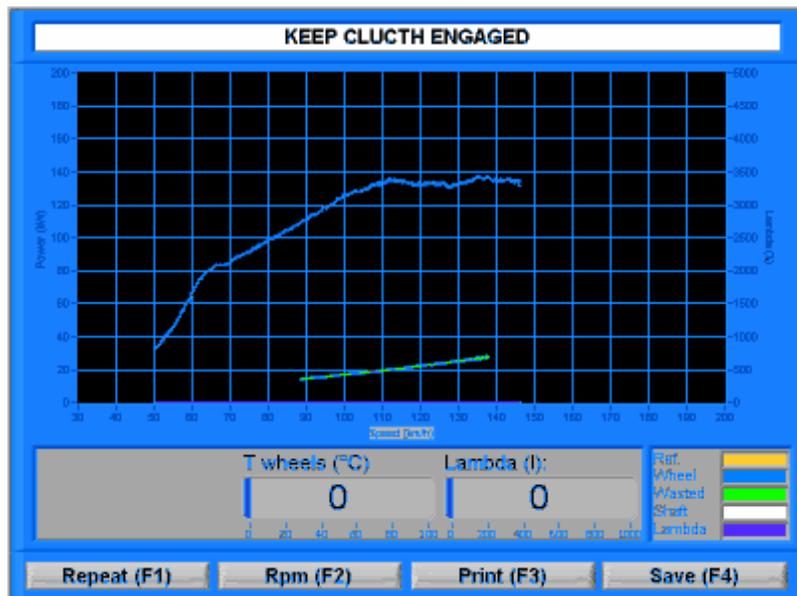
After selecting the presumed power, the page with the diagram and the message "Press the clutch before exceeding the rpm" appears at the bottom of the screen.

Data display during the sweep te

The display of the data in the sweep test includes a diagram in function to the speed (with a variable end scale on two scales of 200 and 300 km/h depending on the speed we are reaching).

To perform the reading, we must initially accelerate the car up to the test gear, (typically the fourth); we then continue to accelerate up to a speed of between 40-45 Km/h; we note that in the diagram, starting from 30 Km/h the speed is visualized by a vertical red line up to 50 Km/h. The test in fact starts at 50 Km/h and therefore, when we approach this speed, press the accelerator down fully. From this moment, the vertical red line disappears and the car effectively starts the test.

The power trend at the wheel, in function to the car's speed is traced in real time with a blue curve (we are in the acceleration phase); when we decide to interrupt the test, it is necessary to press the clutch. The message "Keep the clutch depressed" appears, indicating that friction data due to the tyres and the transmission is being acquired that is then traced with a green line on the graphic module. The clutch must be held down until this message disappears. At that moment is test is



Calculation of the shaft power

The power delivered to the shaft derives from the sum of the forces measured during the acceleration phase (delivered by the engine and available at the wheel) and in the deceleration phase (power lost due to friction at the tyres and in transmission). Once the absorbed power has been calculated, it is displayed with a green line and the power to the shaft (corrected on the basis of the atmospheric parameters) is traced with a red line.

Displaying the data

The results are displayed both graphically and with text, highlighting the maximum values reached in relation to the speed or the engine rpm (if acquired or calculated).

The scale adopted in the graphic will be automatically defined on the basis of the maximum power measured by choosing between the pre-set values.

The Repeat key, (F1) permits a new test to be performed "on the run".

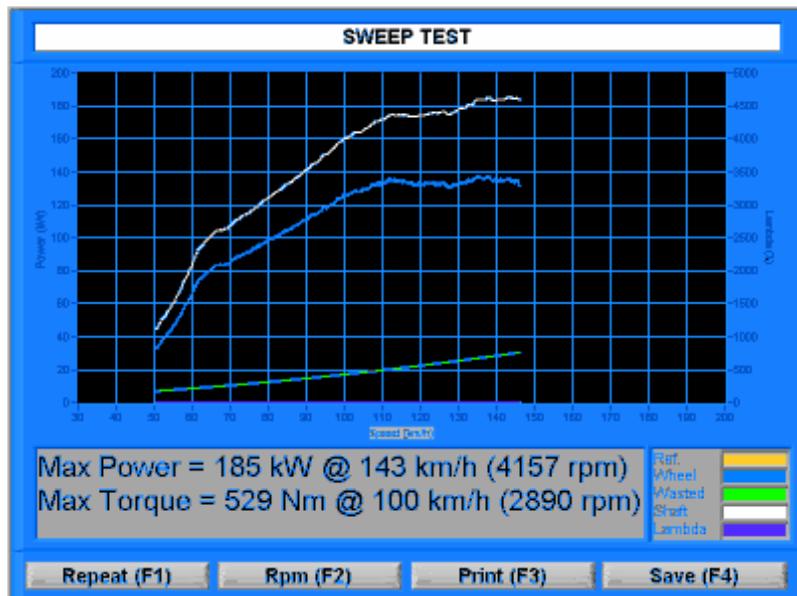
The Rpm key (F2) permits passing to the visualization in function to the rpm; when we are in the rpm mode the key proves to be "pressed" and the label will be Speed [F2]'

The Print key (F3) permits us to print the data that has just been measured.

The Archive key (F4) permits saving the collected data.

The graphic module has the possibility of storing a reference power curve (typically the one obtained before the interventions on the car), by pressing the Return key; this is very useful when we want to perform a series of tests in succession.

Pressing the Esc key permits return to the main menu.



Data printing

The data is printed on an A4 format sheet, arranged vertically. The sheet has a heading in which all the workshop data and all the data inserted at the start of the test session (car model, registration number, engine displacement, fuel supply, engine type, traction..) are inserted.

At the bottom of the screen, we find the maximum values reached for power (indicating the correction type), torque, speed, rpm, lambda (if present), turbo pressure (if present), indicating the speed at which they were reached and the corresponding engine rpm.

If the power diagram is displayed in function to the rpm, the print-out will show the rpm data, whilst if the diagram represents the data in function to the speed, the print-out will show the speed.

During printing, it is possible to choose between compact printing (just data sheets) or full printing (data sheet plus heading with drawings).

Data saving

The data files contain all the car's data inserted during the setting phase. The following data will then be present in tabular form:

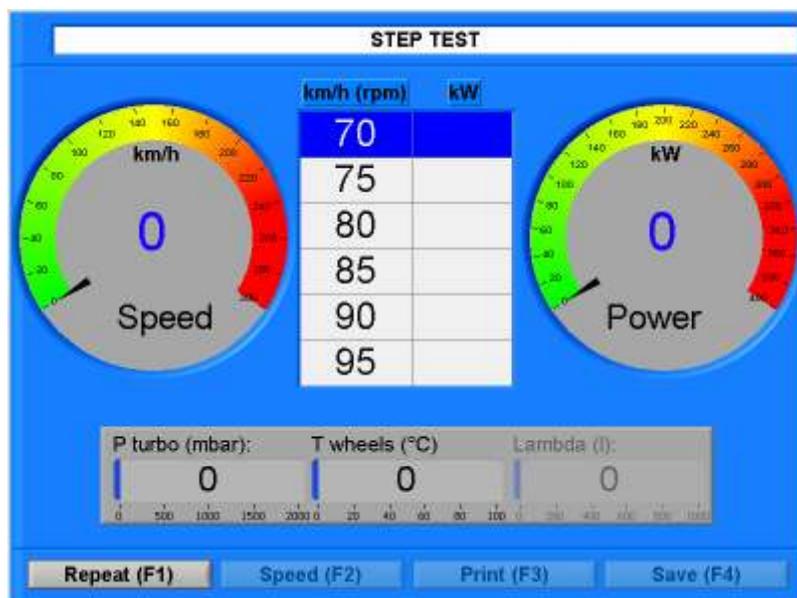
time, power, speed, engine rpm, torque, lambda value, turbo pressure. To display them, it is necessary to return the main menu (Esc key and to enter the "Stored tests" menu).

Step test menu

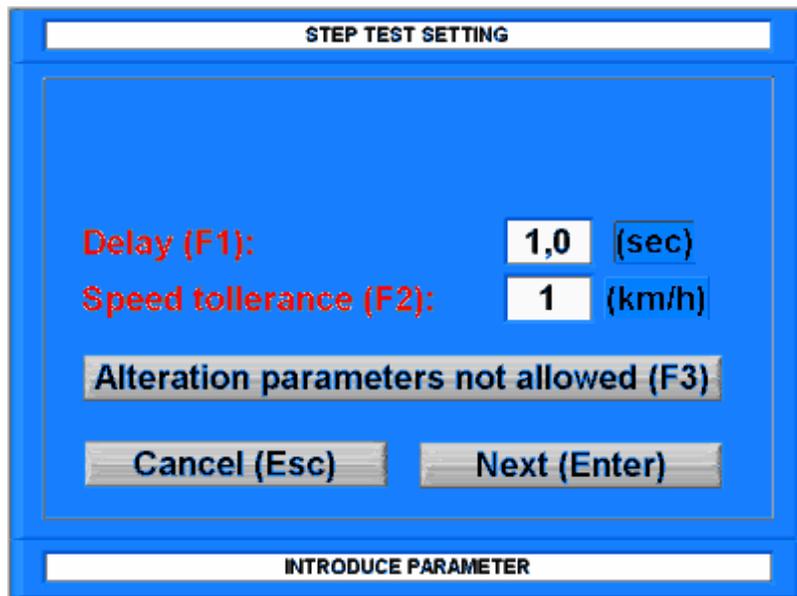
The step test is performed automatically. The operator must keep the accelerator fully depressed and only at the end of the test must he perform the operations to determine the power dissipated through friction (as in the sweep test). The operator can choose to force the measurement when conditions make this necessary, by pressing the Return key.

Data setting for the step test

The step test method consists of taking six set speed readings (these can be modified by the operator by selecting the speed to change – then by pressing the “Modify” key, a page appears in which he can insert the new value).



It is possible to choose to delay the execution of the measurement (to permit the stabilization of the pressure in turbo engines), by pressing the F1 key and by inserting a new value in seconds. The speed tolerance within which to take the measurement is modified by pressing the F2 key and by inserting the new value in Km/h. To enable keys F1 and F2 we must press the “modify non enabled parameters (F3) key, that will be highlighted in dark grey once pressed.



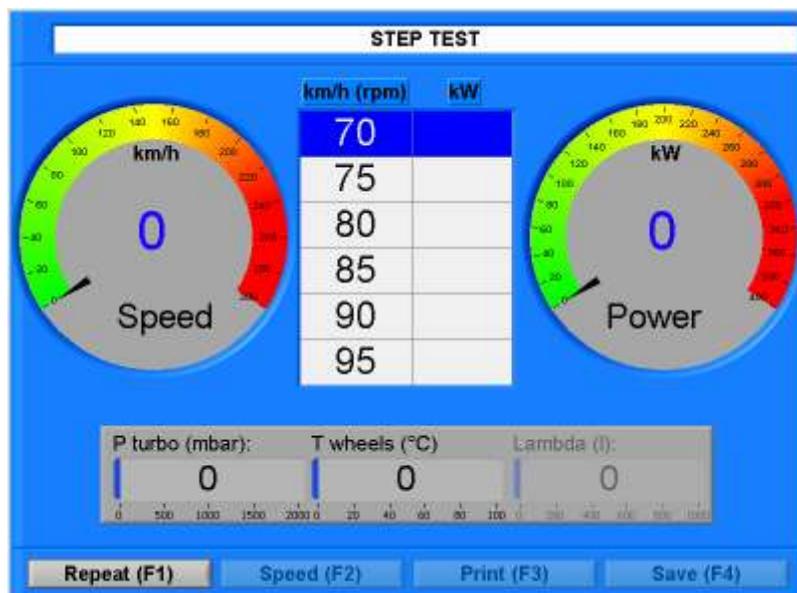
The test proceeds automatically if the values measured in the time window fall within the previously set speed tolerance. If the speed leaves the tolerance field, we have to wait until the stabilization period passes. There will be the possibility of executing the test by forcing the measurement to be taken (using the Return key).

Data display during the step test

On the page, there will be two index indicators present: one for the power, to the right, and one for the car's speed to the left. Between the two indicators there is a table with the six test values that are highlighted in blue when used as a reference.

At the bottom of the screen, the indicators already present in the sweep test are present.

During the test, the speed reference values are lit in succession and after the last measurement has been taken, the friction values are checked.



Data display analysis

In the stored test menu a table is displayed with the speed, rpm, shaft power, torque, power at the wheel, dissipated power, turbo pressure, lambda probe data. Two options are available: Print (F3) and See file (F1) to access an archive of stored tests.

The screenshot shows a software interface titled "STEP TEST ANALISYS". It features a table with 8 columns: Speed, Rpm, Power, Torque, P wheel, P dissipated, Turbo pressure, and Lambda. Below the table are three buttons: "Read file (F1)", "Print (F3)", and "Exit (Esc)".

Speed	Rpm	Power	Torque	P wheel	P dissipated	Turbo pressure	Lambda
70	2829	42,9	145	33,7	5,8	1	5000
80	3235	50,8	150	39,9	6,9	1	5000
90	3642	62,9	165	49,9	8,0	0	5000
100	4047	70,1	165	55,3	9,2	0	5000
110	4452	74,0	159	57,6	10,5	0	5000
120	4860	83,5	164	65,0	11,9	0	5000

Data saving

The data is saved with a name that derives from the date on which the recording is made in the form of a table with the following columns: speed, rpm, torque, power at the wheel, dissipated power, turbo pressure and lambda probe.

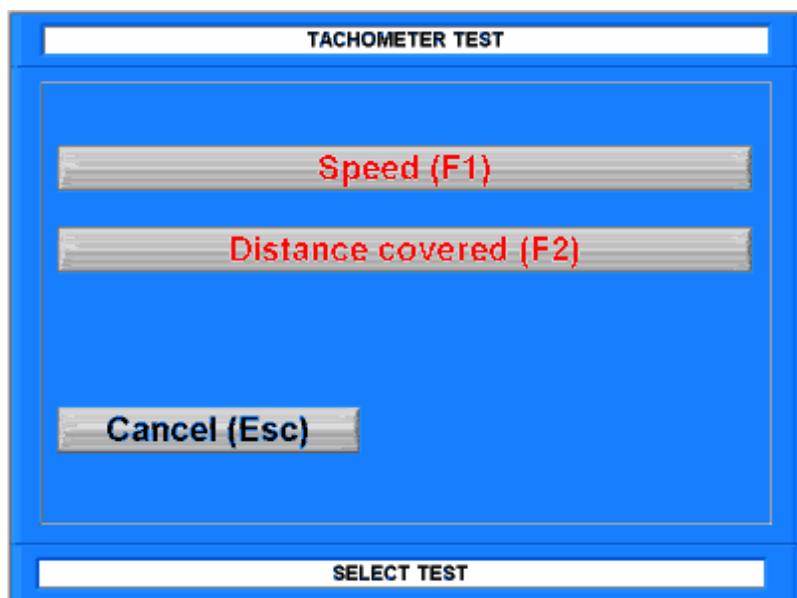
Data printing

The data is printed on an A4 format sheet, arranged vertically. The sheet has a heading in which all the workshop data and all the data entered at the start of the test session (car model, registration number, engine displacement, fuel supply, engine type, traction..) are inserted.

In the central part, there is a table for the step test, where the following are highlighted: speed, rpm, power, torque, power at the wheel, dissipated power, turbo pressure and lambda.

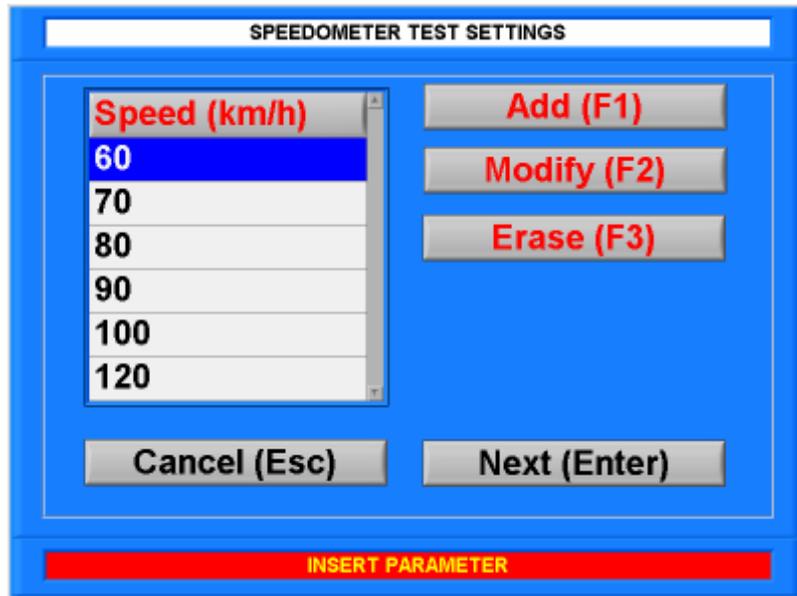
Tachometer test

We check both the speed indication and the counting of the route space.



Speedometer test

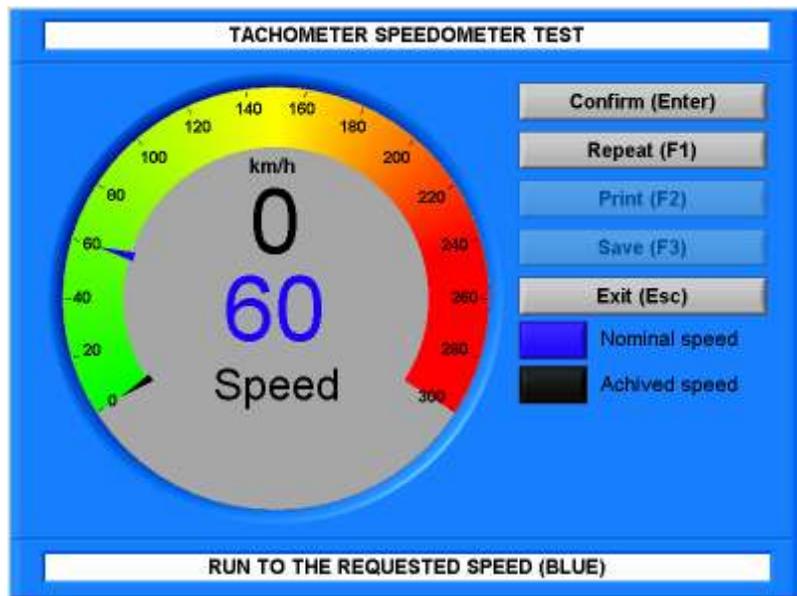
For the speed, there is a table with 6 pre-set speeds that can be varied with the same procedure illustrated for setting the data in the step test.



By pressing the Return key we display a large graphic indicator and a numerical speed indicator. On the top right, the following keys are present:

Confirm [Return] to confirm the data read, Repeat [F1] to repeat the control, Print [F2] and Archive [F3] highlighted only at the end of the control.

The software requests going to the first speed indicated and to confirm the data by pressing return: after confirmation, it displays the acquired data and asks if we want to store or to repeat the measurement. If the value is stored, the software automatically passes to the next speed. In this phase, the speed is represented by an index instrument on which there is also a red hand with the reference. The reference speed is displayed on the right of the page. At the end of the various measurements it is possible to print and to save the data in a file.



Data saving

The tachograph test at speed data is saved in a dedicated folder. To display it, we have to return to the main menu (Esc key) and to enter the "Stored Tests" menu.

The data is saved with a name that derives from the date on which the recording takes place in the form of a table, with the following columns: nominal speed, speed reached, corresponding difference, percentage difference.

Data printing

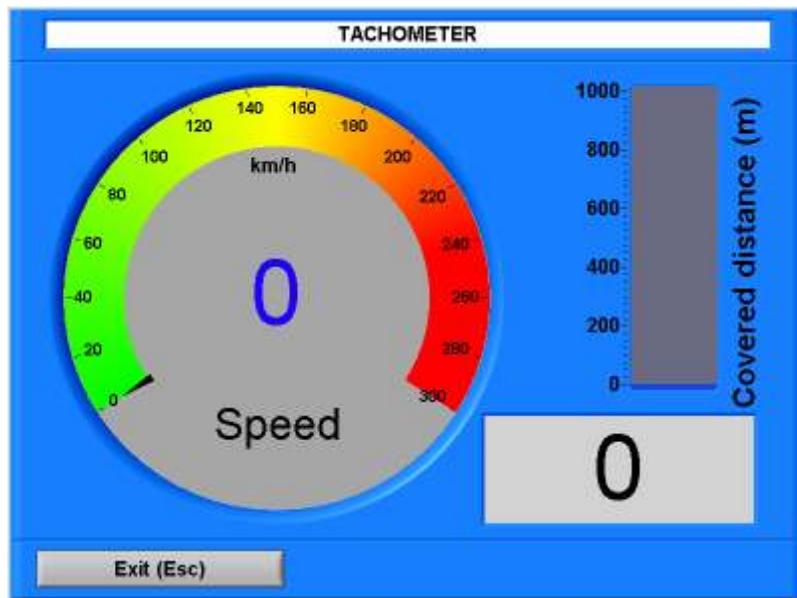
The data is printed on an A4 format sheet, arranged vertically. The sheet has a heading in which all the workshop data and all the data entered at the start of the test session (car model, registration number, engine displacement, fuel supply, engine type, traction..) are inserted.

In the central part, there is a table for the speed test, where the following are highlighted: nominal speed, speed effectively reached, the difference between the two, and the difference expressed as a percentage.

Route space test

The route space is counted by asking the user to set the distance to be covered (also in this case, it is pre-set data, but it is possible to make variations).

After this phase, the software displays the speed with an index instrument, the distance covered (in meters) and the distance the test is performed on.



Settings

This menu permits us to make several settings in the road simulator.

Serial port [F1]: we can choose the desired serial port from those installed in the computer.

Work folder [F2]: we can change the folder in which the data of the executed tests is saved.

Electronic revolution counter calibration [F3]: this function permits us to vary the setting for engine rpm reading on the basis of the number of sparks read for every engine turn.

Measured power correction factor [F4]: 4 correction factors are implemented (DIN 70200, EWG, ECE-R 15 ('Petrol only'), ISO 1585). The correction factors vary in function to the type of engine being tested: reference is made to the data inserted at the start of the test session.

Lambda probe [F7]: it is possible to choose between two voltage ranges (0-1, 0-5 volts and linear).

By pressing the Read (F8) key, it is possible to check the reading of the ambient temperature, the atmospheric pressure, the tyre temperature and the turbo pressure via sensors installed on the test bench board.

After setting the parameters, we press the OK key to return to the main menu.

SETTINGS MENU

Serial port: COM1

Working directory: F:\sicoba

Electronic rev meter calibration (F1): 1

Correction (F2): DIN 70200

Lambda Probe (F3): 0-1

Background color:

Read (F4) T ambient (°C) 0

P atmospheric (mBar) 0

T wheels (°C) 0

P turbo (mBar) 0

Cancel (Esc) Next (Enter)

INTRODUCE PARAMETERS

Stored tests

This menu was conceived to permit loading, comparing and printing data saved in the past. The structure is entirely similar to the bench work menu.

The data is grouped, according to type, in table form, that can be scrolled through with the F1 and F2 keys. The tables show the date of test execution, the type of car, operator data, customer data and the car's registration number.

The following keys are present on the main menu of this function:

- Road simulation (F1),
- Constant force simulation (F2),
- Constant speed simulation (F3),
- Sweep test (F4),
- Step test (F7),
- Speedometer control (F8).



Simulation analysis (Road, Constant force, Constant speed)

Using the F1 key, we access a panel where there is a page with a graphic module.

To load a file, we have to press the See test key (F1) to display the archive. Here there is a table with these columns: date on which the test was performed, test type, model and car registration number. On the right hand side of the page, there are two keys with arrows for scrolling through the archive (press F1 to scroll up and F2 to scroll down). In the lower part there is the Cancel key (Canc) to eliminate any test not significant from the archive, Continue (Return) to select the desired test and Annul (Esc) to return to the "stored tests".

Once the file has been chosen, the following data is displayed on a graphic: power, torque, rpm, speed, lambda and turbo pressure. The diagrams we are not interested in can be "switched off" by removing ticks from their boxes: their scales disappear and the graphic page seems larger and more legible.

In the simulation file display menu, the following functions will be active:

See test (F1) to load the files from the archive

Create file (F2) to convert the data into an ASCII file for reading with Excel.

Print (F3) for printing the data in compact or full form.

Exit (Esc).

From the "stored tests" menu, it is possible to display the constant force simulation tests by pressing the F2 key, and then by following the same procedure seen for the road simulation tests. Likewise, by pressing the F3 key we can visualize the constant speed simulation tests.

Engine power control analysis

We can analyze both the sweep tests and the step tests.

For the sweep tests we can load two files at the same time, by pressing the See test key (F1): the first file is the comparison file and remains stored until we leave the function, whilst the second file to compare can be changed during data analysis.

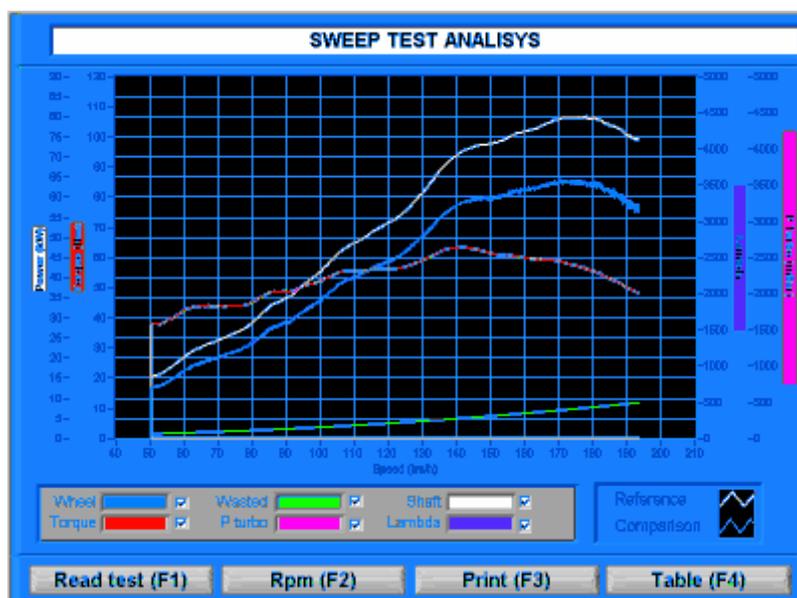
The menu foresees the following functions:

See test (F1) to load both the comparison file and the one to be analyzed (the comparison file is the first to be loaded when we enter the menu),

Rpm-speed (F2) to perform the comparison in terms of rpm or speed (useful when tests in different gears have been performed),

Print (F3) permits the displayed data to be printed: therefore, if we are performing a speed comparison it will print a speed graphic, whilst if the comparison is in function to the rpm, the print will refer to the rpm; the same happens for comparison with the table,

Table (F4) visualizes the data in tabular form.



If we want to visualize the test in function to the number of rpm, we press the Rpm key (F2); the graphic concerned will appear and the Speed key (F2) will be highlighted in dark grey at the bottom.

From the table menu, it is possible to compare the speed, power, torque, rpm, turbo pressure and lambda data. We use the Print key [F3] to print the data and using the File key [F1] we can create an ASCII file that can be opened with Excel.

SWEEP TEST TABLE											
Reference Test						Comparison Test					
Speed	Rpm	P shaft	Torque	P turbo	Lambda	Speed	Rpm	P shaft	Torque	P turbo	Lambda
53	4000	15,8	39	0	0	53	4000	16,3	39	0	0
56	4250	17,5	39	0	0	56	4250	18,0	40	0	0
59	4500	19,6	42	0	0	59	4500	20,1	43	0	0
62	4750	21,6	44	0	0	62	4750	21,8	44	0	0
66	5000	23,0	44	0	0	66	5000	23,0	44	0	0
69	5250	24,0	44	0	0	69	5250	24,2	44	0	0
72	5500	25,1	44	0	0	72	5500	25,2	44	0	0
76	5750	26,4	44	0	0	76	5750	26,5	44	0	0
79	6000	27,9	44	0	0	79	6000	28,3	45	0	0
82	6250	30,5	47	0	0	82	6250	30,7	47	0	0
86	6600	33,0	49	0	0	86	6600	32,7	49	0	0
89	6750	34,3	49	0	0	89	6750	34,2	49	0	0
92	7000	35,8	49	0	0	92	7000	36,3	49	0	0
96	7250	38,3	51	0	0	96	7250	38,6	51	0	0
99	7500	40,5	52	0	0	99	7500	40,8	52	0	0
102	7750	43,0	53	0	0	102	7750	43,3	53	0	0
106	8000	46,0	55	0	0	106	8000	46,3	55	0	0
108	8250	47,9	55	0	0	108	8250	48,2	56	0	0
112	8600	49,4	55	0	0	112	8600	50,0	56	0	0
115	8750	51,2	56	0	0	115	8750	51,8	57	0	0
118	9000	52,8	56	0	0	118	9000	53,2	56	0	0
122	9250	54,3	56	0	0	122	9250	54,3	56	0	0

Buttons: Create file (F1) | Print (F3) | Exit (Esc)

From the "Stored tests" menu, by pressing the F7 key, we can analyse the step test data. A table appears with the following items: speed, power, torque, power at the wheel, dissipated power, turbo pressure, lambda probe.

Using the See file (F1) key, we access an archive where it is possible to select the test desired.

STEP TEST ANALYSIS							
Speed	Rpm	Power	Torque	P wheel	P dissipated	P turbo	Lambda
70	2829	42,9	145	33,7	5,8	1	5000
80	3235	50,8	150	39,9	6,9	1	5000
90	3642	62,9	165	49,9	8,0	0	5000
100	4047	70,1	165	55,3	9,2	0	5000
110	4452	74,0	159	57,6	10,5	0	5000
120	4860	83,5	164	65,0	11,9	0	5000

Buttons: Read file (F1) | Print (F3) | Exit (Esc)

Speedometer control

From the "stored tests" menu, by pressing the F8 key, we can control the car's speedometer. A table is displayed, from which and by pressing the See file key (F1) we access an archive from where it is possible to select the desired test. In the corresponding table, we can observe the nominal speed, the speed reached, the difference between the two and the difference expressed as a percentage value. The Print key (F3) is present and the Exit key (Esc) to return to the "Stored tests" menu.