



SHOCKANALYZER V2.0.14

USER'S MANUAL

Copyright © 2017

TABLE OF CONTENTS

1.	SportDevices End User Software License & Warranty Disclaimer.....	3
2.	General Safety Instructions	5
2.1	SAFETY: General Safety	5
2.2	SAFETY: When Working Inside Your Device.....	6
2.3	SAFETY: General Power Safety.....	6
2.4	SAFETY: If Your Device Gets Wet.....	6
2.5	SAFETY: If You Drop or Damage Your Equipment.....	7
2.6	Protecting Against Electrostatic Discharge.....	7
3.	Technical Specs	8
4.	Kit and Installation	9
4.1	Data Acquisition Unit.....	9
4.2	Unit connections.....	10
4.3	Installation.....	11
4.4	How does it work?.....	11
4.5	Load Cell Calibration.	12
5.	ShockAnalyzer Software.....	13
5.1	The Menu.....	13
5.1.1	File Menu	13
5.1.2	Test Menu.....	14
5.1.3	Options.....	14
5.1.4	Help Menu.....	15
5.2	The Button Bar	15
5.3	Draw Modes.....	15
5.3.1	FP, Force vs Position.....	15
5.3.2	FAV, Force (absolute) vs Velocity	15

5.3.3	FV, Force vs Velocity.....	15
5.3.4	PFV, Peak Force and Velocity.....	16
5.3.5	FPT, Force and Position vs Time	16
5.3.6	FVT, Force and Velocity vs Time	16
5.3.7	Average ON / OFF.....	16
5.3.8	Temperature ON / OFF	16
5.3.9	Spring line.....	16
5.3.10	Spring compensation.....	16
5.3.11	Toggle Load Cell.....	16
5.3.12	Multi-colour for multi-speed.....	16
5.3.13	Some Screenshots.....	16
5.4	Test Columns.....	18
5.5	Test Data Window.....	20
5.5.1	Test Details.....	20
5.5.2	Gauges and Peak Values.....	21
5.5.3	Test Sequence Table.....	21
5.5.4	Speed Check.....	22
5.6	Recording Data.....	22
5.7	Program Configuration.....	23
5.7.1	Mechanism Type Tab.....	23
5.7.2	Options Tab.....	24
5.7.3	Colours Tab.....	26
6.	LOAD CELL WIZARD	27
6.1	Load Cell Zero.....	27
6.2	Load Cell Scale	28

1. SportDevices End User Software License & Warranty Disclaimer

DISCLAIMERS

Limitations of warranties and liability: This Software, including the embedded ShockAnalyzer DAQ firmware, is provided and licensed by SportDevices on an "as is" basis, without any other warranties or conditions, express or implied, including, but not limited to, warranties of merchantable quality, satisfactory quality, merchantability or fitness for a particular purpose or non-infringement, or those arising by law, statute, usage of trade, course of dealing or otherwise. The entire risk as to the results and performance of the software is assumed by you. To the maximum extent permitted by applicable law, neither SportDevices, its dealers or suppliers shall have any liability to you or any other person or entity for any indirect, incidental, special, or consequential damages whatsoever, including, but not limited to, loss of revenue or profit, lost or damaged data or other commercial or economic loss, even if SportDevices has been advised of the possibility of such damages, or they are foreseeable. SportDevices is also not responsible for claims by a third party. Other possible damages **INCLUDE DAMAGES ON DYNAMOMETER OR SHOCKABSORBER, AND PERSONAL INJURIES**. The limitations set forth herein shall apply whether or not the alleged breach or default is a breach of a fundamental condition or term or a fundamental breach.

If you are downloading this Software, the following applies:

All risk of damage to the Software during transmission and download is assumed by you.

All "Software" products, including standard and beta release versions of SportDyno Software and SportDevices's Firmware are licensed on a (non-transferable) as-is, without warranty, basis only. There are no warranties which extend beyond those stated here. The purchase price of any ShockAnalyzer kit includes an implicit software license. This software license does not include any setup, training, calibration, or other consulting services.

By installing and/or using the Software you certify that you have read, understood and agreed to comply with and be bound by the following terms and conditions. If you do not agree with these terms and conditions do not install and/or use the Software.

The only exception to the above is that the "Software's media" will be replaced (if found to be unreadable) for a duration of 30-days from the original invoice ship date from SportDevices or authorized distributor. Any implied warranty determined to be applicable to the "Software's media" is limited in duration to the duration of this warranty.

In the event of a media defect in material or workmanship, SportDevices's sole responsibility is to repair (or at its option - replace or refund) the defective media. Final warranty determination will be the decision of SportDevices.

SportDevices shall not be responsible for (a) labor, transportation or other incidental charges or (b) consequential or other damages incurred by use of SportDevices Software media.

Media replacement performance will be initiated by returning the alleged defective media freight prepaid to SportDevices with dated purchase invoice.

Any disputes arising between the parties over any products, services, warranties, terms, agreements, etc. shall be governed under the laws of Valencia (Spain) and in an appropriate court within its jurisdiction.

This Software License Warranty Disclaimer supersedes all prior warranty statements. Inquiries concerning this Software License Warranty Disclaimer should be directed to:

SportDevices
Cami del Port 145, 46470 Catarroja, Spain

2. General Safety Instructions

Use the following safety guidelines to help ensure your own personal safety and to help protect your equipment and working environment from potential damage.

2.1 SAFETY: General Safety

When setting up the equipment for use:

- Place the equipment on a hard, level surface. If the equipment is installed in a closed-in wall unit, ensure that there is enough ventilation.
- Avoid placing objects on top of this equipment to permit the airflow required for proper ventilation. Restricting airflow can damage the equipment.
- Keep your device away from radiators and heat sources.
- Keep your equipment away from extremely hot or cold temperatures to ensure that it is used within the specified operating range. (check technical parameters section)
- Keep your equipment away from Electromagnetic emitting devices like CDI ignition, or electric motors / VFD (Variable Frequency Drive)
- Do not push any objects into the air vents or openings of your equipment. Doing so can cause fire or electric shock by shorting out interior components.
- Ensure that nothing rests on your equipment's cables and that the cables are not located where they can be stepped on or tripped over.

When operating your equipment:

- Do not use your equipment in a wet environment, for example, in a wet basement.
- Do not use AC powered equipment during an electrical storm.
- Do not spill food or liquids on your equipment.
- Before you clean your equipment, disconnect it from the electrical outlet. Clean your device with a soft cloth dampened with water. Do not use liquids or aerosol cleaners, which may contain flammable substances.
- Clean the display with a soft, clean cloth and water. Apply the water to the cloth, then stroke the cloth across the display in one direction, moving from the top of the display to the bottom. Remove moisture from the display quickly and keep the display dry.
- Long-term exposure to moisture can damage the display. Do not use a commercial window cleaner to clean your display.



CAUTION: Do not operate your equipment with any cover(s) removed.

- If your equipment does not operate normally - in particular, if there are any unusual sounds or smells coming from it - unplug it immediately and contact an authorized dealer or service center.



WARNING: To prevent the spread of fire, keep open flames away from this product at all times.

2.2 SAFETY: When Working Inside Your Device

Do not attempt to service the equipment yourself, except as explained in your documentation or in instructions otherwise provided to you by SportDevices. Always follow installation and service instructions closely.

2.3 SAFETY: General Power Safety



By default, if other values are not specified all SportDevices equipment are rated for **230 VAC / 50 Hz**. (115 VAC units will have a specific label for that)

Observe the following guidelines when connecting your equipment to a power source:

- Check the voltage rating before you connect the equipment to an electrical outlet to ensure that the required voltage and frequency match the available power source.
- Do not plug the equipment power cables into an electrical outlet if the power cable is damaged.
- To prevent electric shock, plug the equipment power cables into properly grounded electrical outlets. If the equipment is provided with a 3-prong power cable, do not use adapter plugs that bypass the grounding feature, or remove the grounding feature from the plug or adapter.
- If you use an extension power cable, ensure that the total ampere rating of the products plugged in to the extension power cable does not exceed the ampere rating of the extension cable.
- If you must use an extension cable or power strip, ensure the extension cable or power strip is connected to a wall power outlet and not to another extension cable or power strip. The extension cable or power strip must be designed for grounded plugs and plugged into a grounded wall outlet.
- If you are using a multiple-outlet power strip, use caution when plugging the power cable into the power strip. Some power strips may allow you to insert a plug incorrectly. Incorrect insertion of the power plug could result in permanent damage to your equipment, as well as risk of electric shock and/or fire. Ensure that the ground prong of the power plug is inserted into the mating ground contact of the power strip.
- Be sure to grasp the plug, not the cable, when disconnecting equipment from an electric socket.

2.4 SAFETY: If Your Device Gets Wet

⚠ CAUTION: Before you begin any of the procedures in this section, see the SAFETY: General Safety section of this document.

⚠ **CAUTION:** Perform this procedure only after you are certain that it is safe to do so. If the device is connected to an electrical outlet, turn off the AC power at the circuit breaker, if possible, before attempting to remove the power cables from the electrical outlet. Use the utmost caution when removing wet cables from a live power source.

1. Disconnect the AC cord from the electrical outlet, and then, if possible, disconnect the AC cord from the device.
2. Turn off any attached external devices, then disconnect them from their power sources, and then from the device.
3. Contact SportDevices support (info@sportdevices.com)

⚠ **Limited Warranties:** warranty is limited to normal usage of the device, any fault caused by inappropriate usage or accident will not be covered

2.5 SAFETY: If You Drop or Damage Your Equipment

⚠ **CAUTION:** Before you begin any of the procedures in this section, see the **SAFETY: General Safety and Power Safety** sections of this document.

4. **CAUTION:** If any internal components can be seen through damaged portions, or if smoke or unusual odors are detected, disconnect the device from the electrical outlet and contact SportDevices support (info@sportdevices.com)

1. Save and close any open files, exit any open programs, and shut down the computer.
2. Turn off the device and disconnect from the power source, and then disconnect from the computer.
3. Turn off any attached external devices, and disconnect them from their power sources and then from the computer.
4. Connect the device to the power source and turn on the device.
5. If the device does not start, or if and smoke or unusual odors are detected, or you cannot identify the damaged components, contact SportDevices support.

2.6 Protecting Against Electrostatic Discharge

⚠ **CAUTION:** Disconnect product from mains power source in accordance with product specific safety information located on the “Safety Information” section of this website.

Electrostatic discharge (ESD) events can harm electronic components inside your device. Under certain conditions, ESD may build up on your body or an object, such as a peripheral, and then discharge into another object, such as your device. To prevent ESD damage, you should discharge static electricity from your body before you interact with any of your device’s internal electronic components, like the Bluetooth plug-in.

You can protect against ESD and discharge static electricity from your body by touching a metal grounded object (such as an unpainted metal surface on your device) before you interact with anything electronic.

You can also take the following steps to prevent damage from electrostatic discharge:

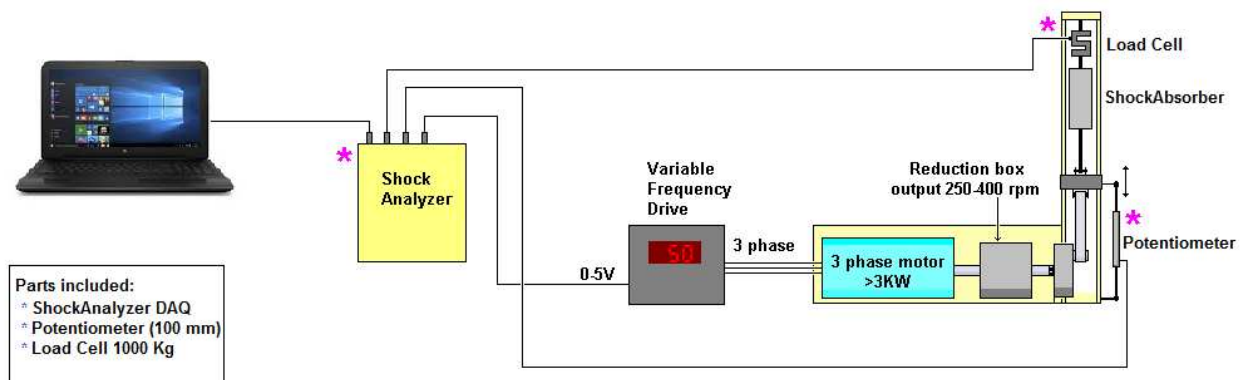
- When unpacking a static-sensitive component from its shipping carton, do not remove the component from the antistatic packing material until you are ready to install the component. Just before unwrapping the antistatic package, be sure to discharge static electricity from your body.
- When transporting a sensitive component, first place it in an antistatic container or packaging.
- Handle all electrostatic sensitive components in a static-safe area. If possible, use antistatic floor pads and work bench pads.

3. Technical Specs

- Supply Voltage 230 Vac / 50-60 Hz
- Power Consumption: max 3 W
- Working Conditions: Temperature: -10°C to 40°C, humidity < 90%
- Storage Conditions: Temperature: -20°C to 80°C, humidity < 80%
- Inputs: Potentiometer (0-5V, 10 bit)
Load Cell 2mV/V (built-in amplifier, 16 bit)
- Outputs PWM output: 0-5V @ 2.4 KHz

4. Kit and Installation

Shock Analyzer Kit (FW 2.2) consists of a Data Acquisition Unit + Potentiometer (100 mm) + Load Cell sensor to acquire data from a Shock Dynamometer machine.



Shock Analyzer (FW2.2) Connections

4.1 Data Acquisition Unit

- Display:** 16x2 char LCD display:

```

POS:  0 STOP
CELL: 0 T:--

```

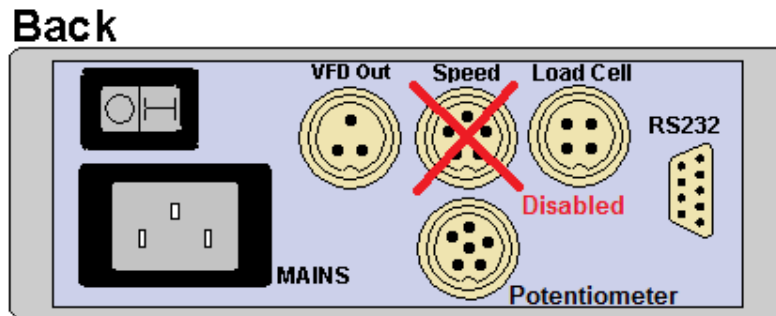
POS: current position of potentiometer (fixed 0 to 1023)

CELL: Load Cell channel converted to Newtons, it depends on the calibration of the unit.

STOP/RUN, Current data transmission mode. It will be on "run" when acquiring data.

T: Temperature for the thermocouple type K input (usually tied to the shock absorber). Temperature can be in range from 0 to 999 degrees. If there is no sensor connected the reading will be: ---.

4.2 Unit connections



- Mains.** Computer type mains connector. Default voltage is 230 VAC, 50/60 Hz. It can be requested for 115 VAC too.
- VFD Output.** PWM output for the Variable Frequency Drive. From 0 to 5 Volt.

1	GND
2	PWM Output (0 to 5 volt)
3	8 volt, unregulated

- Speed Sensor.** Hall Effect Sensor (**disabled**)

1	5 volt (digital 5 volt)
2	GND
3	Not used
4	GND
5	Signal (active high)

- Load cell,** direct connection to load cell, (built-in amplifier).

1	White, Cell IN +
2	Black, GND
3	Red, 5 volt
4	Green, Cell IN -

- Potentiometer**

1	GND
2	Reserved
3	5 V
4	Potentiometer input (0-5 V)
5	GND
6	5 V

- RS232.** Serial RS232 connector. 115200 baud, no parity. An USB FTDI to serial adapter can be included with the Kit. Sportdevices strongly recommends FTDI based adapters.
- Thermocouple type K.** (front plate) Input for temperature up to 1000 °C. Note: thermocouple is not included with the kit

4.3 Installation

Using a VFD (*Variable Frequency Drive*) is strongly recommended to drive the 3-phase motor at several speeds. VFDs generate high electric noise pulses in the wires and at the motor. It is recommended that the wires from VFD to motor are as short as possible, and if possible, they are installed inside a metallic pipe.

Linear Potentiometer has to be installed between the moving beam and the machine frame (bottom). It can be installed behind the beam so it becomes hidden. It is also possible to install the potentiometer in the shockabsorber, same as for on-vehicle data acquisition, although this makes necessary to modify all shockabsorbers that are going to be tested



Load cell has to be placed at the upper side of the machine.



When adjusting the upper bar, the user must ensure that the shock absorber can move along all its displacement and it doesn't reach its boundaries because in such case, the force applied to load cell will be very high and it could be damaged.

4.4 How does it work?

Shockanalyzer DAQ reads the potentiometer position and load cell force 1000 times per second. This information is sent to the computer, which records them in the new tile. Computer also calculates instant position and velocity.

For multi-speed tests, the computer uses the table defined by the user to program a different % output for the VFD to reach each velocity.

Current version of FW only supports open loop velocity estimation. This means that the user should calibrate max speed for each shockabsorber.

4.5 Load Cell Calibration.

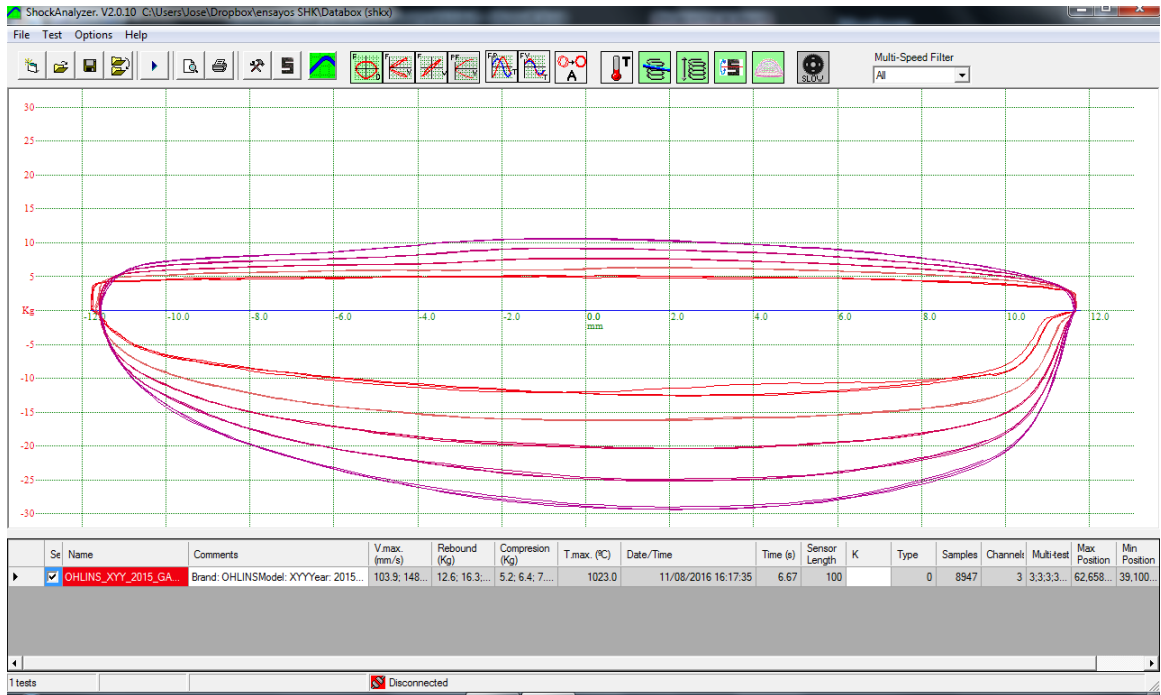
The digital value read from the load cell is converted to Newtons using a scale coefficient.

Calibration is performed without the shockabsorber. It consists of two steps:

- Zeroing the cell (no load)
- Calibrating the scale (with some load)

See section 3 (Load Cell Wizard)

5. ShockAnalyzer Software.



5.1 The Menu

5.1.1 File Menu

File	Test	Options	Help
Remove all			Ctrl+N
Open			Ctrl+O
Change Directory			Ctrl+C
Save as			Ctrl+S
Export to Excel			
Export Speed Report			
Preview			F11
Print			F12
Exit			Ctrl+Q

Remove All. It removes all tests from the program (but not from the disk).

Open. It shows a window to choose the tests to be loaded in memory. It is possible to load them one by one or several at once.

Change directory. It allows changing the directory where tests are automatically saved. Current directory is shown in the title of the window (upper text).

Save as. It allows saving the test with a different name or in a different place.

Export to Excel. This option saves a CSV file (Comma Separated Values) that can be loaded by Excel. This file includes the test header and the pre-processed data for all recorded turns of the test. This data consists of: #tooth, Angle, RPM, Speed (selected units: mm/s, m/s or inches/s), Force (selected units: Kg, N or Lb) and temperature.

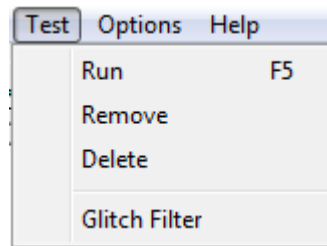
Export Speed Report. This option saves a text file with the maximum and minimum speeds for the speed values configured at the "speed_data.ini" file in the installation folder. This configuration file consists of a sorted list of speeds in mm/s.

Preview. It shows a preview in the screen of the tests in the same way as they will appear in the printer.

Print. It prints the selected tests. It shows a window so the user can first choose and configure the printer.

Exit. It exits from the program.

5.1.2 Test Menu



Run (F5). It shows the 'Input Data' window. In this window will enter the data for the test. Then, the user can start the test by clicking over the 'Ok' button.

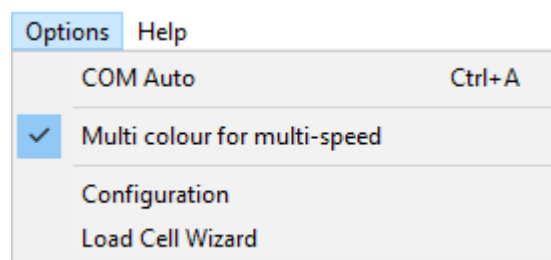
Remove. It removes the selected test from the program (not from the disk).

Delete. It deletes the test run from the program **and from the DISK**. Be careful.

Glitch Filter. This option detects glitches in any channel and fixes them by calculating the average between the closest points.

A glitch is normally a single abnormal low or high value between normal values. They are normally caused either for an error in the ADC converter, or by an error during the data transmission to PC. They do not happen very often (fortunately), and the test can normally be recovered successfully.

5.1.3 Options



COM Auto. It will open the 'Automatic COM Port Selection' window. The process will search a data transmission from ShockAnalyzer unit at every port. When it is

received it will be shown in green. If none receives data the user should check if there is another program using the COM port, and repeat the process.

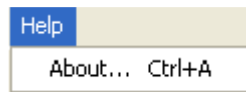
It is very useful when used with USB adaptors, where the COM id is an unknown number.

Multi colour for multi-speed. When active, this option allows applying different colours to each subtest/speed of a single test. And when disabled, it will show all subtests/speeds with the same colour, and will apply different colours for different tests.

Configuration. It shows a window with the program configuration, it is explained below.

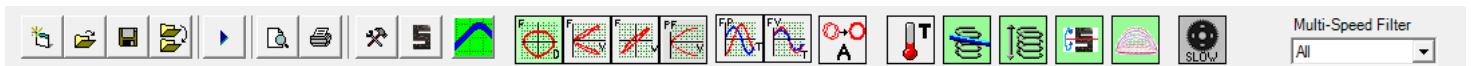
Load Cell Wizard. It opens the Load Cell Wizard window. See section 3.

5.1.4 Help Menu



About. It shows information about SportDevices, developer of the software and manufacturer of the unit.

5.2 The Button Bar



By clicking over these buttons the user can do more quickly the same actions that using the menu. Options are:

Shinning sheet: New. File/new menu.
Open Folder: Open. File/open menu.
Disk: Save as. It saves the test with another name or in another directory.
Two folders: Change directory. File/change directory menu.
Play: Run. Test / run menu. (F5 key)
Sheet & glass: Preview. File/preview menu (F11 key)
Printer: Print. File/print menu (F12 key)
Tools: Configuration. It opens program configuration window.
Load Cell: Load Cell Wizard, see section 3.
SportDevices icon: About. Help/about menu.
Draw Modes Buttons. See below.

5.3 Draw Modes

5.3.1 FP, Force vs Position

It draws the force versus the direct position reading. It shows a “smile” type graph.

5.3.2 FAV, Force (absolute) vs Velocity

It draws all force curves versus the absolute function of speed. It shows a “C” type graph.

5.3.3 FV, Force vs Velocity

It draws all force curves versus direct speed. It shows a “bended 8” type graph.

5.3.4 PFV, Peak Force and Velocity

For multi-speed tests, it draws a graph with the peaks of force and velocity for each subtest / speed. In this way it produces a summary of all subtests in a single graph

5.3.5 FPT, Force and Position vs Time

It draws force and position channels (and temperature) versus time. It shows "oscilloscope" type graphs.

5.3.6 FVT, Force and Velocity vs Time

It draws force and velocity channels (and temperature) vs time. Force is in phase with the speed when the machine pulls from dumper, and uses to be constant when the machine pushes the dumper.

5.3.7 Average ON / OFF.

This option enables or disables the average calculation. When enabled all turns of the same test are averaged to create a single graphs. It increases accuracy and the clearness of the drawing.

5.3.8 Temperature ON / OFF

It draws / hides the temperature curves from the tests (if recorded).

5.3.9 Spring line

It draws a line corresponding to the gas/spring effect coefficients recorded for each test.

5.3.10 Spring compensation

The spring coefficients analyzed in the previous point are used to subtract the spring effect from the test.

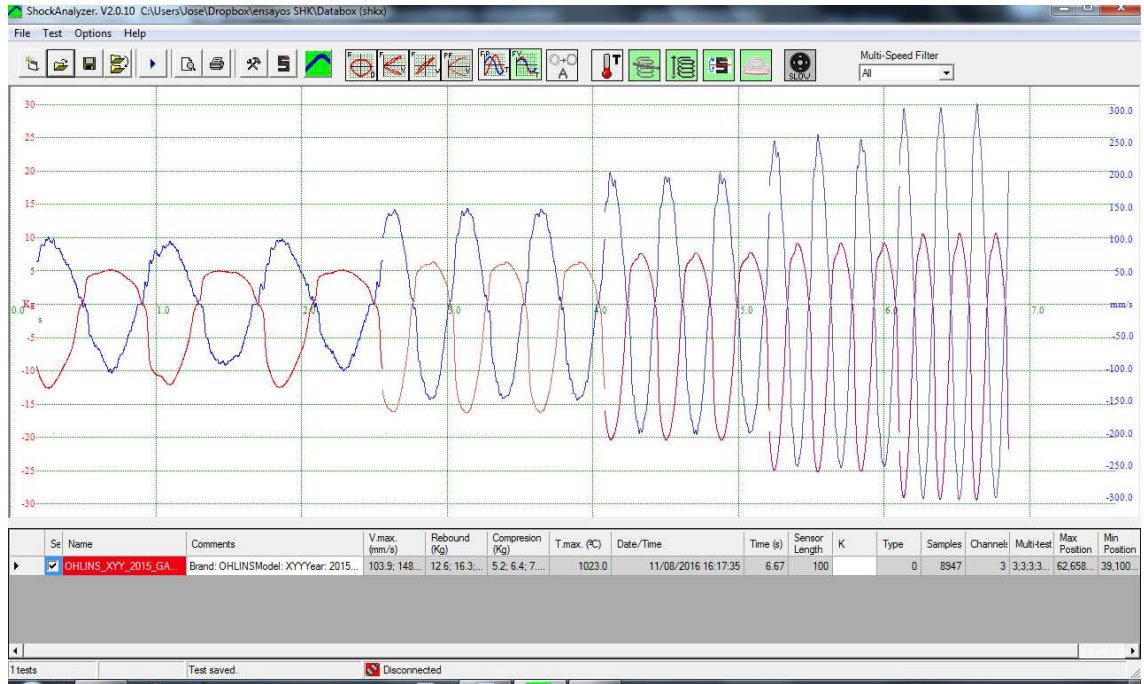
5.3.11 Toggle Load Cell.

This option is used to toggle compression vs extension sides of the load cell force curves.

5.3.12 Multi-colour for multi-speed

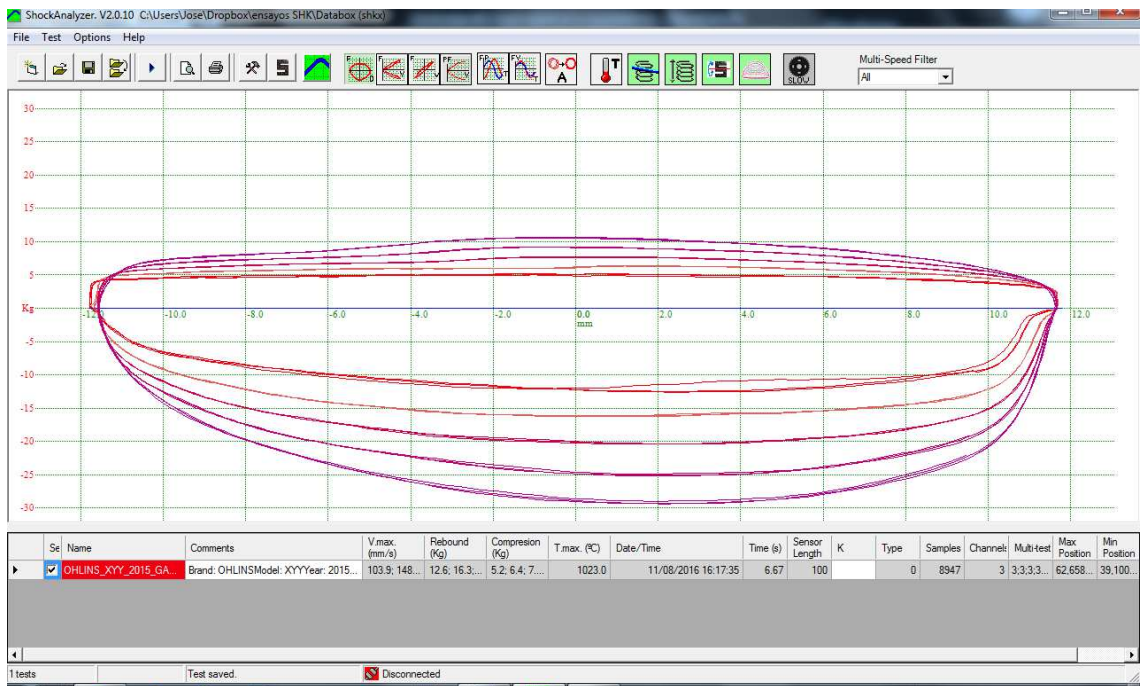
When active, this option allows applying different colours to each subtest/speed of a single test. And when disabled, it will show all subtests/speeds with the same colour, and will apply different colours for different tests.

5.3.13 Some Screenshots



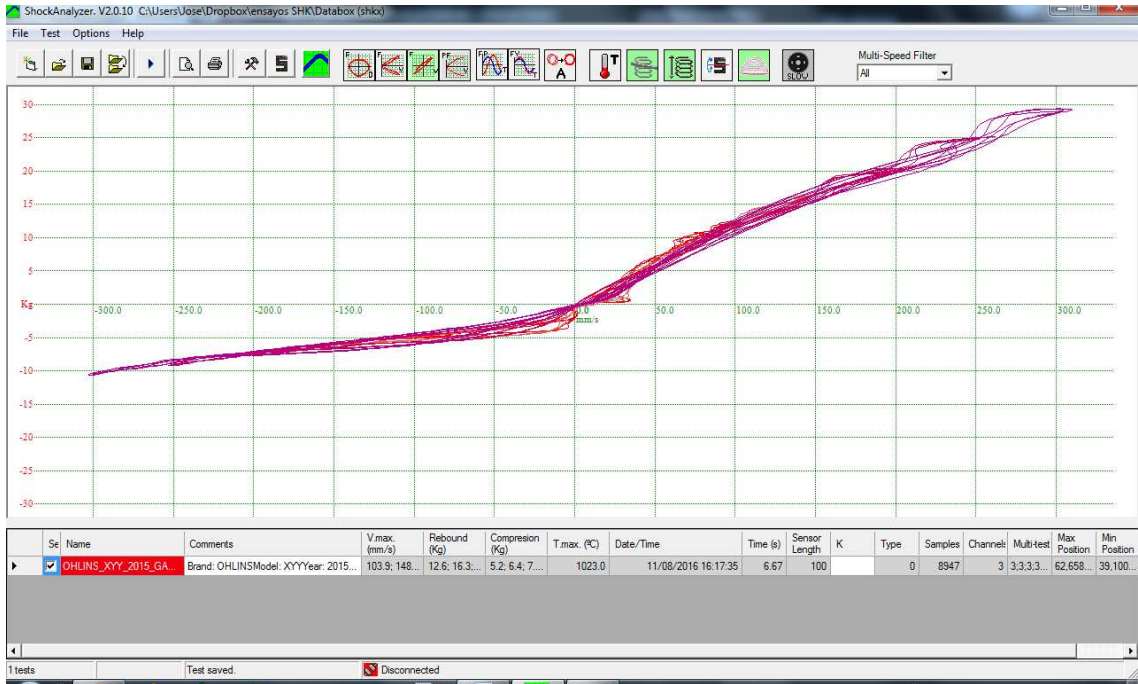
Force and Velocity vs Time

Force is in phase with speed, when the machine pushes the shockabsorber the Force is approximately constant (the shock does not absorb too much power)
 When the machine pulls from the shock the force is proportional to speed, the shock is converting energy to heat.



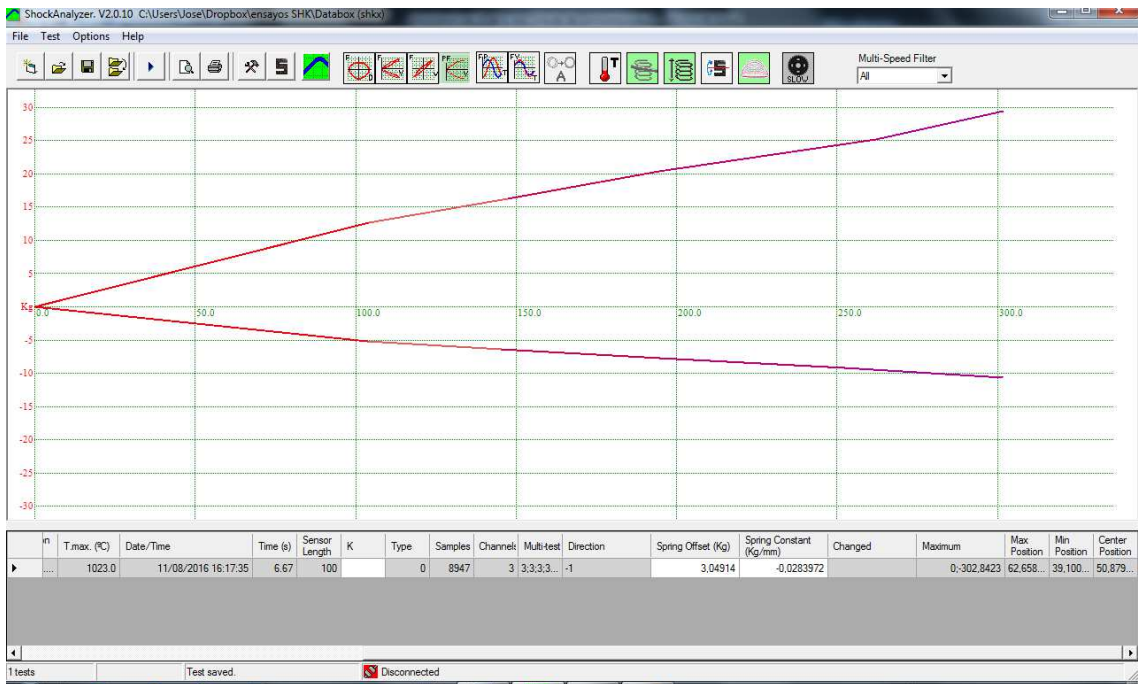
Force vs Position

Position is related with speed, at central position speed is maximum, at upper and bottom position speed is zero.



Force vs Velocity

For positive speed (push) force is close-constant (flat), for negative speed force is proportional to speed.

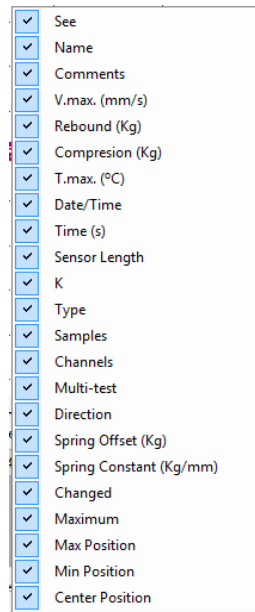


Peak Force and Velocity

5.4 Test Columns

See	Name	Comments	V.max (mm/s)	Tension (Kg)	Compression (Kg)	T.max (°C)	Date/Time	Time (s)	Stroke	Angle	Teeth	Connect Rod	offset	K	Type	Samples	Channel	Multi-test	Direction	Spring Offset (Kg)	Spring Constant (Kg/mm)
<input checked="" type="checkbox"/>	STD POST FREDDO	no reg	47.2; 134.9; 277.9	77.2; 133.7; 226.1	32.5; 45.2; 66.9	38.8	30/07/2010 6:31:39	19.91	100	-20	120	300	0	0	0	602	3	2;2;2	-1	15.3	0.003

When clicking the right mouse button over the channel names, it shows the list of column names so the user can make visible or invisible each column.



The following data is shown for every loaded test, by double-clicking over the row the data window will be displayed, and the user can change some of these data

Show, the user can check / uncheck this column to show / hide the test,

Name, name of the test,

Comments, commentaries for the test,

V. max, maximum speed detected during the test (km/h or mph), it supports the sub-test format, example: 47; 134; 277 (mm/s) (each value corresponds to each sub-test, 3 sub-tests in the example)

Rebound, maximum force pulling the shockabsorber detected during the test, it supports the sub-test format, example: 77; 133; 226 (Kg) (the program can be configured to Newton, Kg or Pound)

Compression, maximum force pushing the shockabsorber detected during the test. It has the same format as Tension column.

T. Max. Maximum temperature detected during the test (it does not support sub-test format)

Date/Time, date and time when the test was done,

Time, duration of the test,

Sensor Length, potentiometer length (100 mm normally)

K, not used

Type, type of machine, 0 for "Piston Crank" (default), 1 for Scotch Yoke Slider,

Samples, number of samples read by the unit, (cycles * teeth-1)

Channels, number of channels stored (default = 3),

Multi-test, number of turns of each sub-test. Example: 2; 2; 2; is 3 sub-tests of 2 turns each.

Direction, direction of the rotation: -1 = Clock-Wise, 1: CounterClockWise

Spring Offset, when using the Spring Compensations, this offset is the force of shockabsorber at middle position (approximately 3 o'clock and 6 o'clock drum positions)

Spring Constant, when using the Spring Compensations, this coefficient shows how the spring effect force increases as the shock is compressed. Theoretically, at low speeds

the force measurements should be only caused by the spring effect (gas) not to the hydraulic effect, which is related with speed.

Changed, file has been edited; the program will ask if changes want to be saved

Maximum, Maximums and minimums for speed at each sub-test

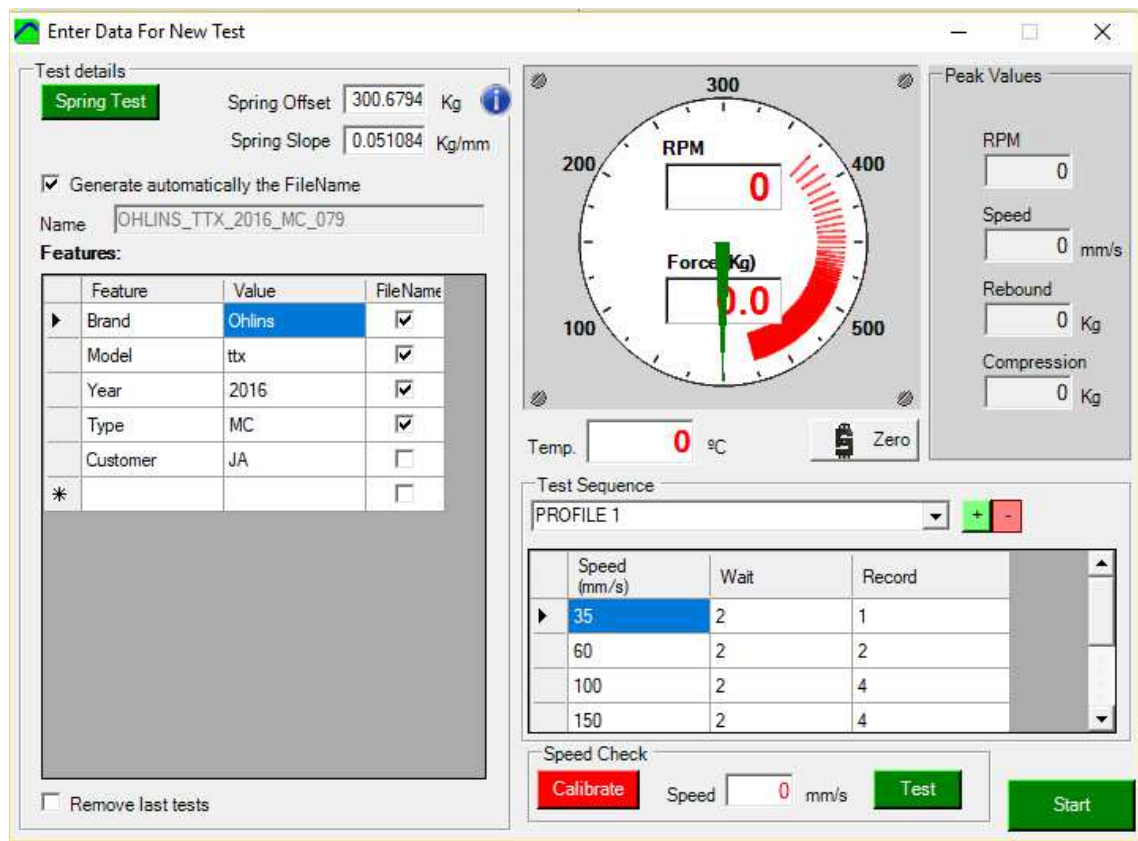
Max position, max. Position of sensor during the test (mm), it depends on stroke and shockabsorber position

Min position, min. Position of sensor during the test (mm), it depends on stroke and shockabsorber position

Center position, central position during the test.

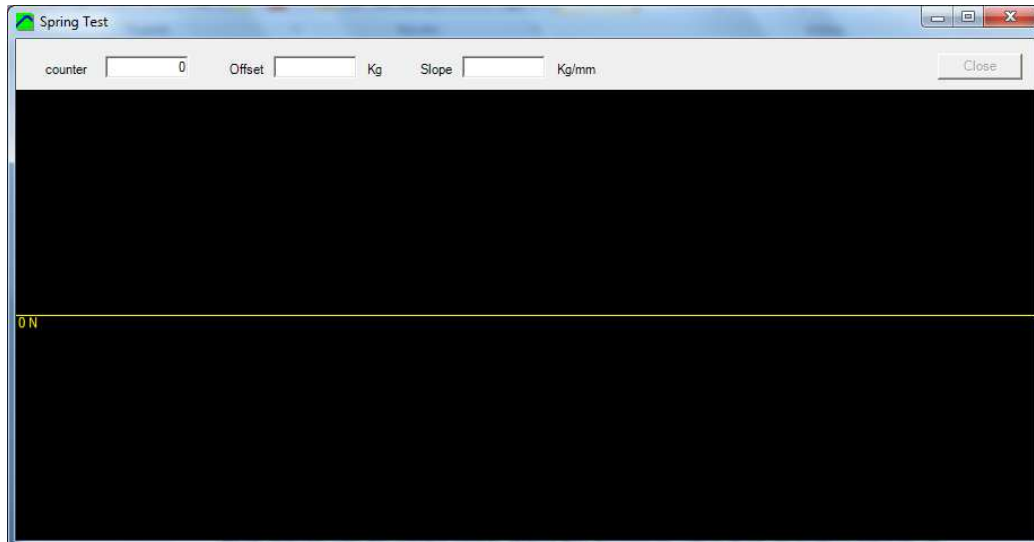
5.5 Test Data Window

This window is used to enter data when a new test is going to be recorded.



5.5.1 Test Details.

Sprint Test Button. This button opens the Sprint Test window. This window performs a single slow turn to record the force offset and spring slope. This values are stored for next tests.



Spring Offset and Spring Slope. These values are recorded by the Spring Test. They are kept from one test to the next. It is recommended to repeat the test for different days, and of course every time the shock absorber is changed

Generate automatically the Test Name. This option, when active, will use the features list to generate an automatic test name, to ease the file naming for new tests. Note that if active, the name cannot be edited manually

Name. Here the name for a new test has to be entered. The program increases the ending number of test name every time a test is done.

Features. This table record multiple features from the shock absorber, such as: brand, model, year, and anything that the user wants to add

Remove last tests. If active, the program will remove all tests every time a new time is done.

5.5.2 Gauges and Peak Values

Gauge will show RPM speed and Load Cell force in the main gauge

Temperature box, will show the temperature from the thermocouple sensor (if connected)

Peak values, ShockAnalyzer software will show in these four boxes the peak values for RPM, Speed, Extension Force and Compression Force during the tests with this window.

Peak Values can be configured to detect the maximum value from all testing interval, or the maximum value for each turn, at Configuration Window (see section 2.7)

Zero cell. This button has the same effect that zeroing the load cell from the load cell wizard. Anyway it is strongly recommended to compensate the load cell offset (due to gas pre-charge) using the “spring test” function, not a manual zeroing.

5.5.3 Test Sequence Table

This table must be filled for all test types: single-speed or multi-speed. When multiple speeds are recorded for a single test, this table is used to enter the different speed steps the motor will perform.

Profile. ShockAnalyzer software allows to record several test sequences and recall them when necessary, so is not necessary to entered all data manually again

The values for the table are:

- **Speed**, millimetres per second. Current firmware provides one method to calculate the VFD output:
 - **Open-loop**, based on the **Max rpm** setting on the configuration, which is accurate enough thanks to the internal VFD closed loops. It is recommended to calibrate this setting for each shock absorber.
- **Wait turns**, number of turns to wait before starting to record data, this field is provided to let the motor accelerate up to the desired speed. For low speeds the user can enter 1 turn, and for high speeds 3 turns.
- **Record turns**, number of turns to record, minimum is 1.

5.5.4 Speed Check

Prior to the recording of the test, the selected speeds (for the Test Sequence Table) can be tested to calibrate the open loop factor, and to see if the motor is able to reach that speed, and if the **max. Speed** setting is correct and the open-loop mode is working correctly.

Calibrate button: for the calibration the software will set 50% of max PWM output and will read the reached RPM. With the measured speed it will adjust the open loop coefficient, which will be used when a new speed is commanded.

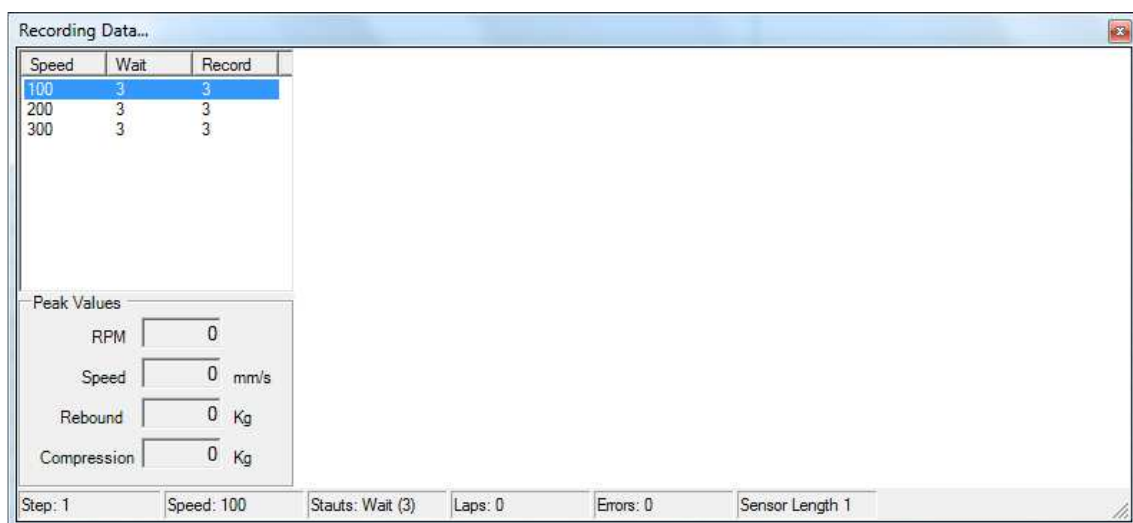
Note that the automatic process may lead to a wrong calibration, by now the manual process (at configuration window) provides much safer results.

Test button:

Test method consists of:

- Enter the desired speed in mm/s
- Press Test button
- Look at the RPM gauge, and verify the current speed according to the calculated target rpm at the box under speed in mm/s. Speed box in the Peak Values area can also be used to verify the linear speed.
- Press Stop button

5.6 Recording Data



This screen will show the recording process, each new turn is numbered in the right area. If the recording of a new turn fails the program moves the cursor back and overwrites the data for the existing turn with the incoming data.

When all the specified turns and sub-tests have been recorded, then the program automatically exits this window and the Stop Process is started (see section 2.7.2.3).

Peak Values

The program will show in these four boxes the peak values for RPM, Speed, Extension Force and Compression Force during the tests with this window.

Status bar (bottom)

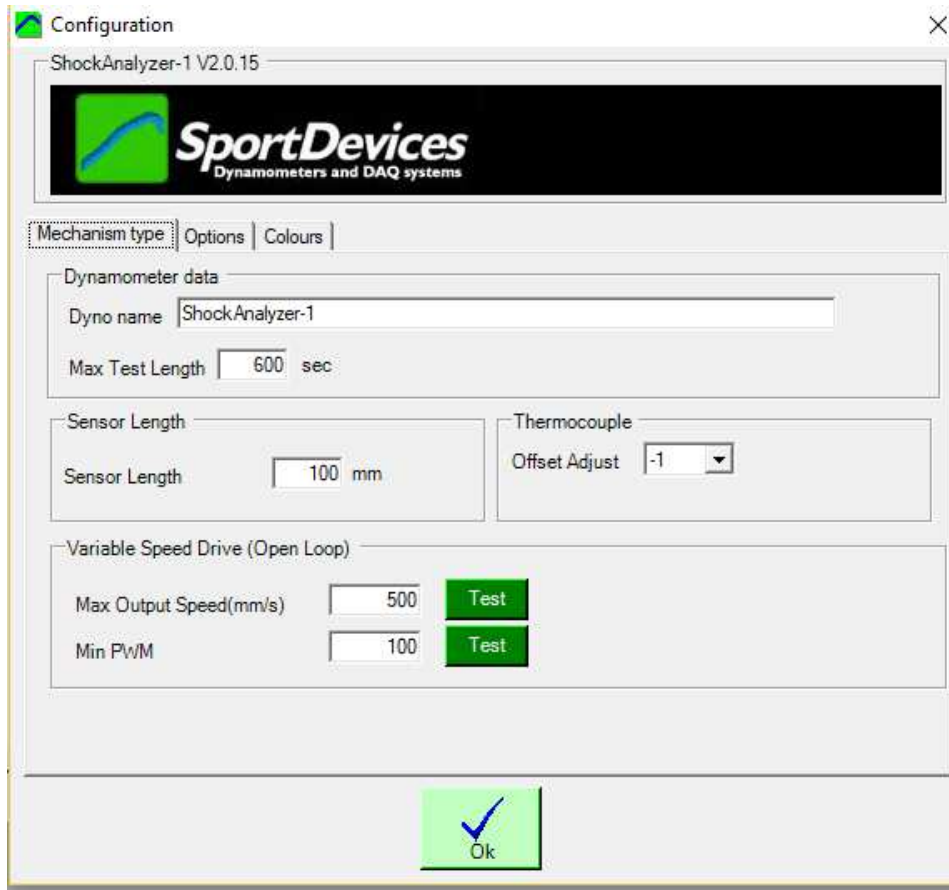
The program shows several data on the status bar:

- **Step:** from the Test Sequence List (for multi-speed tests)
- **Speed:** Current target speed (mm/s)
- **Status:** Wait / Record
- **Laps:** Number of recorded turns
- **Errors:** Number of laps that raised an error (maximum is 3)
- **Sensor length,** TBD

5.7 Program Configuration

Configuration is distributed in four tabs:

5.7.1 Mechanism Type Tab



Dyno Name, name for the printed reports

Max. Test Length, maximum number of turns of test recording,

Sensor Length, by default we provide a 100 mm potentiometer

Thermocouple offset adjust, this value allows compensating small offset errors in thermocouple. It allows to add or subtract some degrees to the readings.

5.7.1.1 Variable Speed Drive (Open Loop Control)

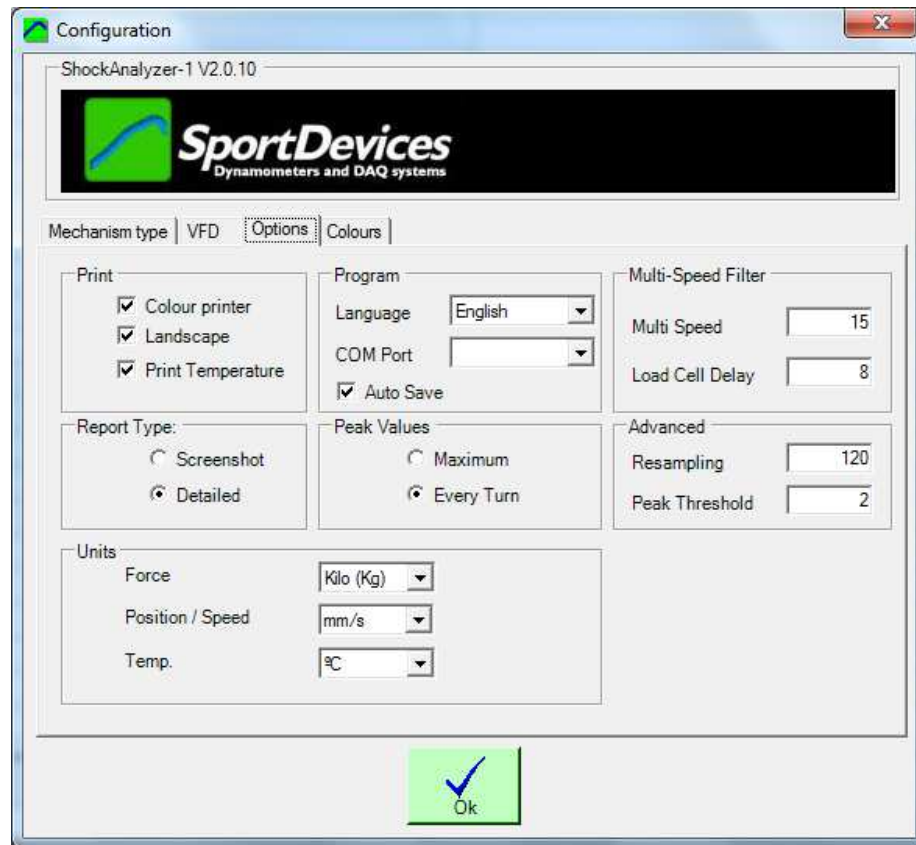
Max Output RPM (mm/s), this value is used for the calculation of the linear speed for multi-speed tests. It is the maximum speed of reduction gearbox (with VFD set to 100%) when working on load condition (shockabsorber), it could slightly change from one shockabsorber to other.

Press the **Test Button** to see the actual max speed when the output is set to 100%. During the test a RPM box is displayed on the right-bottom corner to show the current RPM value.

Min PWM, this value is used by the program when a slow movement has to be performed, for instance for the Spring Test.

It should be a value low enough to create a slow movement, but high enough to move the machine. A very small value (ex: 1) will create some output, but the motor will not move. The allowed range is 1 to 1023 (1023 = 100% output). Typical values are in the range from 20 (2%) to 100 (10%)

5.7.2 Options Tab



Printer Settings:

Colour Printer, when printing in a non-colour printer all curves will use the same colour to ease the visual reading,

Landscape, portrait / landscape, the curves will be printed vertically or horizontally,

Print Temperature, it will show the thermocouple channel (if recorded)

Report Type:

- **Screenshot**, the program will generate a report with the same format as the current display mode selected on main screen
- **Detailed**, the program will generate a report with a fixed format:
 - Summary of Test data, forces and speeds
 - Force vs Displacement graph
 - Force vs Speed graph

Program Settings:

Language, English, Spanish and Italian languages are available. New translations can easily be done by editing the English.lan file with Notepad, and saving it as "Francaise.lan" for example.

COM Port, all available COM ports on the computer are displayed here. The user can change it manually, or he can use the **COM Auto** function in the Options Menu.

Auto save, (active by default) the program will automatically save every new test. If disabled, the program will ask the user to save the test when the user is going to remove it or exit the program.

Peak Values:

Peak Values can be configured to detect the maximum value from all testing interval, or the maximum value for each turn.

These peak values are shown at Gauge Window and the Recording Test Window.

Multi-Speed Filter: (advanced)

Multi-speed, this is the main filter, 15 by default.

Load Cell Delay: this value is used for compensating the potentiometer delay and the load cell amplifier delay. It should be kept to 8 (ms).

Advanced:

Peak Threshold: This value is the threshold used to detect when the shockabsorber changes its direction, to avoid that small fluctuations in position measurements are confused with a change of direction. By default it is set to 1

Start PFV from zero: PFV graph (summary of max speeds and forces) can start from the first sample (say at 50 mm/s) or from zero. This option has only effects on drawing

Show dots at PFV graph: as PFV is a summary of speed and force for each multi-speed test, these dots show where the actual values have been taken.

Change dir when loading tests: by default the software will change the working directory where the new files are stored every time a new test is loaded or when a test is stored manually in another directory.

Use this option if there is a fixed working directory, but it is necessary to load old tests for comparison from several directories (to not change the working dir)

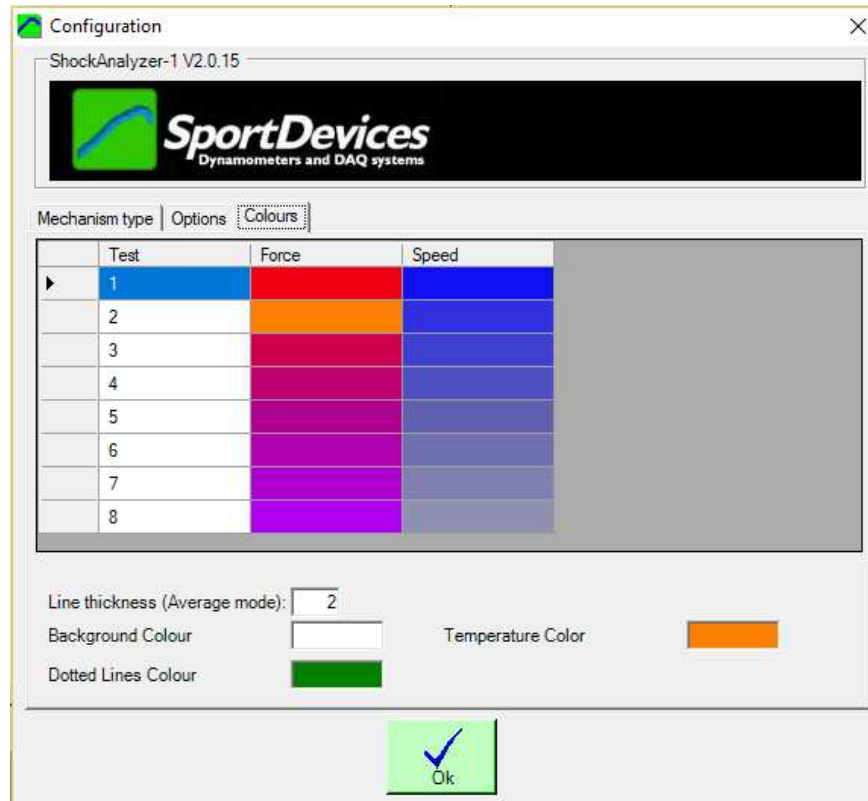
Units:

Force: Load cell force can be shown in Newtons, Kilos or Pounds

Position/speed, position and speed are displayed in meters, milimeters or inches.

Temperature, can be displayed in Celsius degrees, or Fahrenheit.

5.7.3 Colours Tab



Colour table, depending on the mode (multi-colour for multi-speed, or for test), each channel for each test can have a different colour, or each subtests/speed will be show in different colours. The user can edit them on this window.

Line Thickness, by default, the program uses **thick lines** (width=2) for Average mode, but this can be configured in this window.

Background colour, background colour can be edited for main window, by default white.

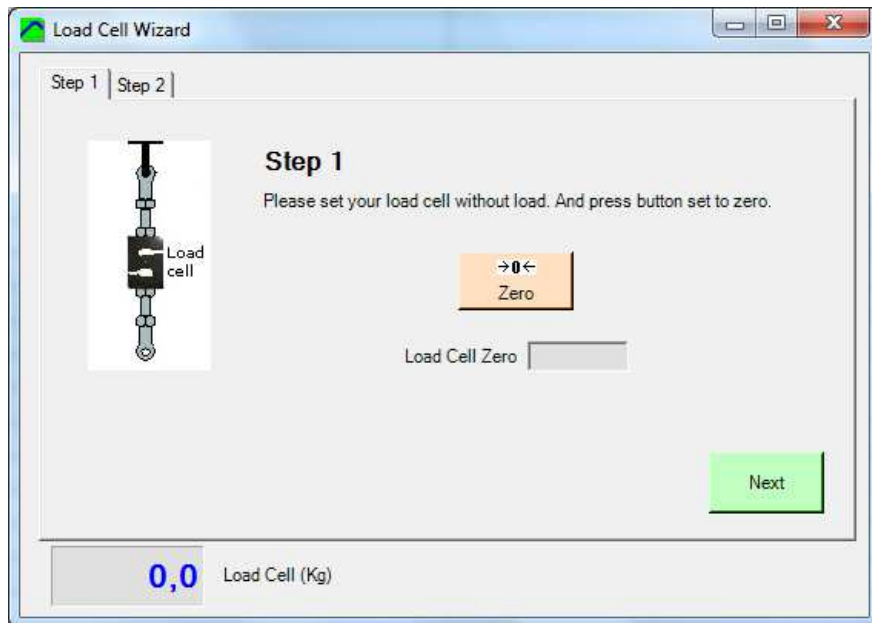
Dotted lines colour, scales line colour can be edited, by default green.

Temperature colour, when using thermocouples, the software will use this colour (by default orange) for the temperature channel.

6. LOAD CELL WIZARD

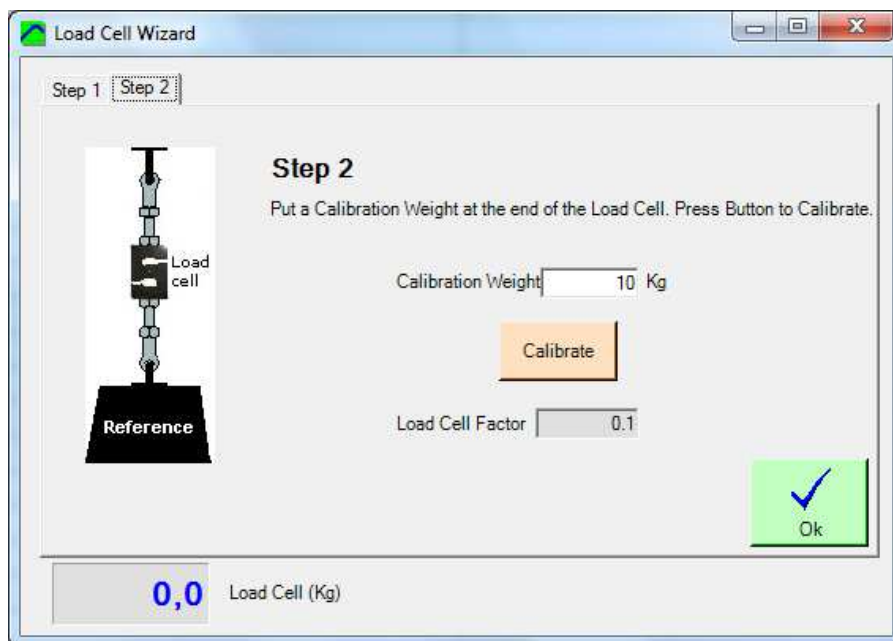
This window eases the Load Cell calibration process. It is divided into two steps:

6.1 Load Cell Zero



With the load cell in no load condition, press the “set to zero” button and check the “load cell zero” value is between 30000 and 35000, otherwise there may be some problem on the wiring or ShockAnalyzer DAQ.

6.2 Load Cell Scale



With the calibration weight pulling the load cell, enter the calibration weight value on the white box and press the “calibrate” button. Check that the load cell reading (blue number, Kg) matches the “reference load” number.

Finally, press **OK** button to finish the calibration process.