

Shock Analyzer Documentation

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1. Shock Analyzer Reference manual.

The Shock Analyzer Kit consists on a data acquisition unit + speed sensor + load cell sensor to acquire data from a Shock Dynamometer machine.



1.1. Data acquisition unit.

- **Display:** 16x2 char LCD display:

```
RPM: 0 STOP  
CELL: 0 T:--
```

RMP: current speed of the machine.

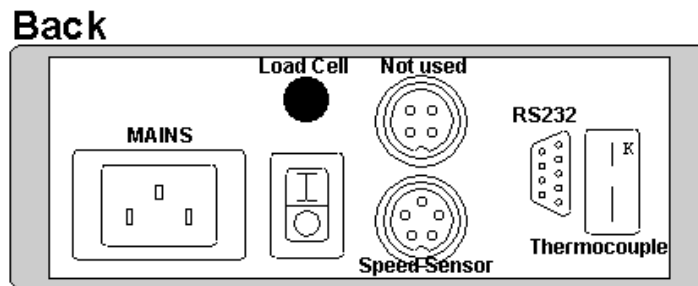
CELL: Raw value for Load Cell channel, with the 450 kg load cell, this value should match the actual reading in kg (from -450 kg to +450 kg), for the 900 kg load cell, this value should be half the actual value (-450 for -900 kg, and 450 for +900 kg)

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: ---.

- **Buttons:**
 - **Run/Stop** is used to start/stop a new test in the ShockAnalyzer software.
 - **Reset**, just reset the device

1.2. Unit connections.



1. **Mains.** Computer type mains connector. Default voltage is 230 volt, 50/60 Hz. It can be requested for 115 volt too.
2. **Load cell**, direct connection to load cell, (amplified inside the unit).

1	Cell IN -
2	Cell IN +
3	5 volt (regulated)
4	GND

3. **Speed Sensor.** Digital Inductive Sensor

1	8 volt (unregulated)
2	GND
3	n.c.
4	GND
5	Signal (active high)

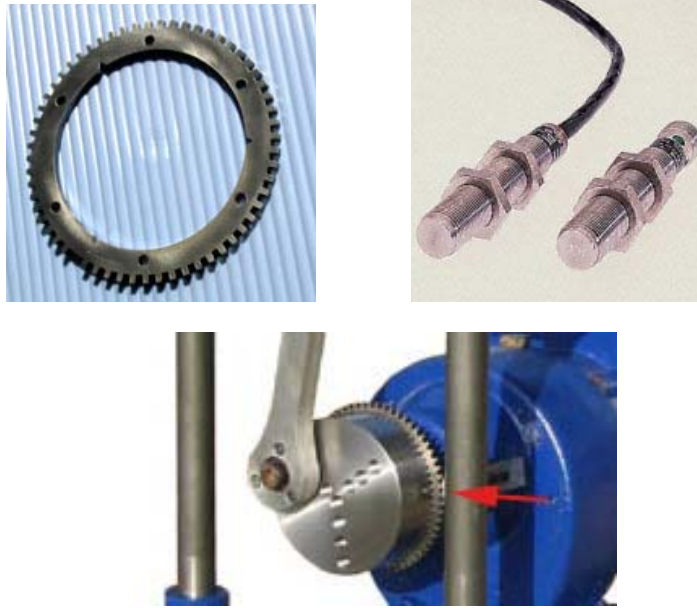
4. **RS232.** Serial RS232 connector. 115200 baud, no parity. An USB to serial adaptor can be used with new computers without serial ports.
5. **Thermocouple type K.** Input for temperature upto 1000 degrees.

1.3. Installation. .

Very important: when using a *variable frequency inverter* (recommended to drive the motor) high electric noise pulses are generated and they will strongly affect to the inductive speed sensor, this problem is **completely solved** by using the provided ground cable (yellow) connecting the machine frame to the yellow plug in the back of the data acquisition unit.

The speed sensor has to be placed near the provided gear tooth (60-1 teeth) at a distance of 1 mm aprox. This sensor is connected directly to the data acquisition unit.

The sensor has a small led that lights when the tooth is present, you can check it by moving the drum by hand and seeing how the led goes on and off.



The sensor is thought to be placed horizontally in the machine (0 degrees) but if its position is different, it can be configured in the software: "sensor offset". The rotation should be **clockwise**. You can get it by swapping the cables from three-phase motor.

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



When adjusting the upper bar, the user should 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.

1.4. How it works?.

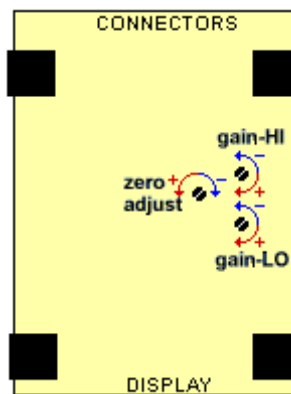
The device senses all pulses from the speed sensor, and does an analog conversion from the Load Cell channel and the Thermocouple channel for every tooth pulse, and transmits all these data to the computer. Thus the data acquisition frequency is variable with the drum speed. The elapsed time between pulses is also transmitted to the computer to know the speed and the position for the machine at every moment.

When the missing tooth is detected (the elapsed time between teeth is greater than 50% from the last one) N-1 pulses have to been received, if other number of pulses have been read this is consider as an error, and the computer software discards all the cycle and starts it again, this ensures the data integrity for every cycle.

1.5. Load Cell Calibration.

The value shown in the screen is useful to check and calibrate the Load Cell. For the 450 kg load cell, this value should match the actual reading in kg (from -450 kg to +450 kg). For the 900 kg load cell, this value should be half the actual value (-450 for -900 kg, and 450 for +900 kg)

There are three potentiometers under the box that are used for the calibration:

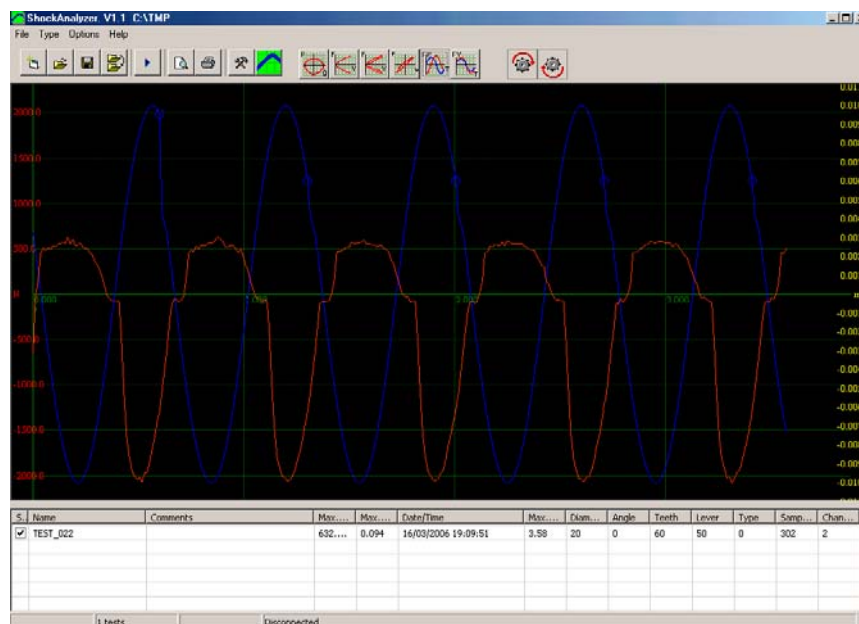


We provide the units calibrated for their load cells, but it is recommended to check the calibration sometimes.

Calibration should be check for zero load (display=0) and load case, without the dumper. A known weight should be used for the calibration.

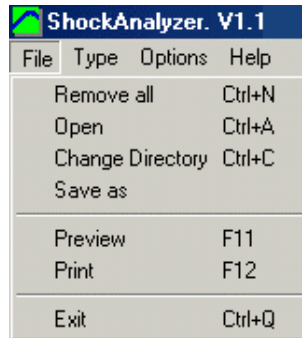
It will be interesting to use a weight as heavy as possible for each load cell, but it may be difficult to handle. When using lower weights (for example 50 kg for the 450 kg load cell) this may introduce a “scale” error, and the error at 450 kg will be unknown.

2. ShockAnalyzer Software.



2.1 The Menu.

FILE:



Remove All. It removes all tests from the memory, 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).

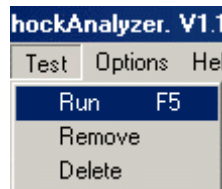
Save as. It allows saving the test with a different name or in a different place.

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 you can first choose and configure the printer.

Exit. It exits from the program.

TEST:

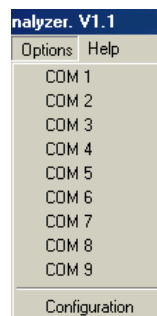


Run (F5). It shows the 'input data' window. In this window will enter the data for the test. Then, you can start the test by clicking over the 'Ok' button.

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

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

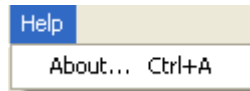
OPTIONS:



COM1-COM9. It selects the serial port in which the unit is connected. If a port fails, it will appear in grey. If there is not any available port, it is recommended to close all programs and open **ShockAnalyzer** again.

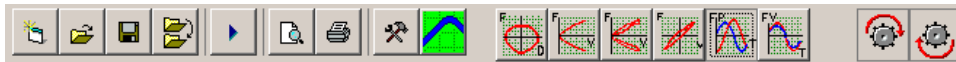
Configuration. Shows a window with the program configuration, it is explained below.

HELP MENU:



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

2.2.The Button Bar.



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

New. File/new menu.

Open. File/open menu.

Save as. It saves the dyno run with another name or in another directory.

Change directory. File/change directory menu.

Run. Test/run menu. (F5 key)

Preview. File/preview menu (F11 key)

Print. File/print menu (F12 key)

Tools. It opens program configuration window.

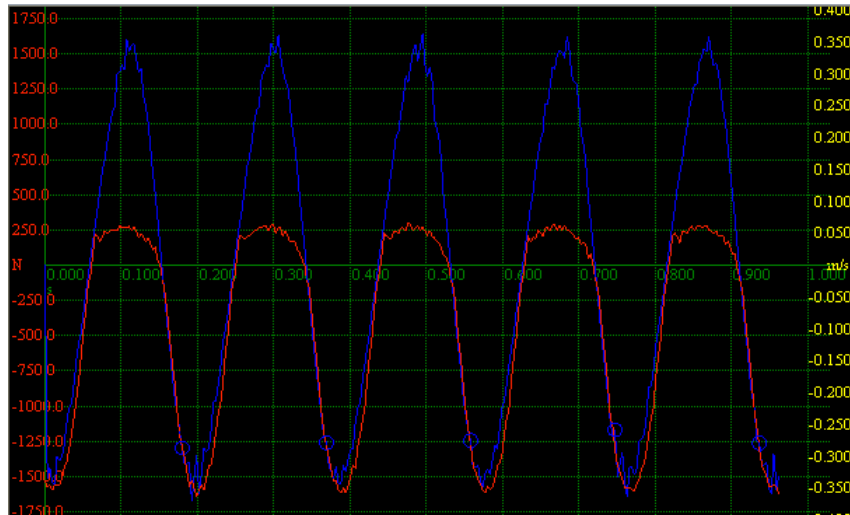
About. Help/about menu.

2.3 Draw Modes:

- Force vs Position,
- Force (average) vs Velocity, it calculates the average for all cycles and draws it versus the velocity.
- Force (all) vs Velocity (absolute),
- Force (all) vs Velocity,
- Force and Position vs Time, it draws force and position channels (and temperature) vs time.
- 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.

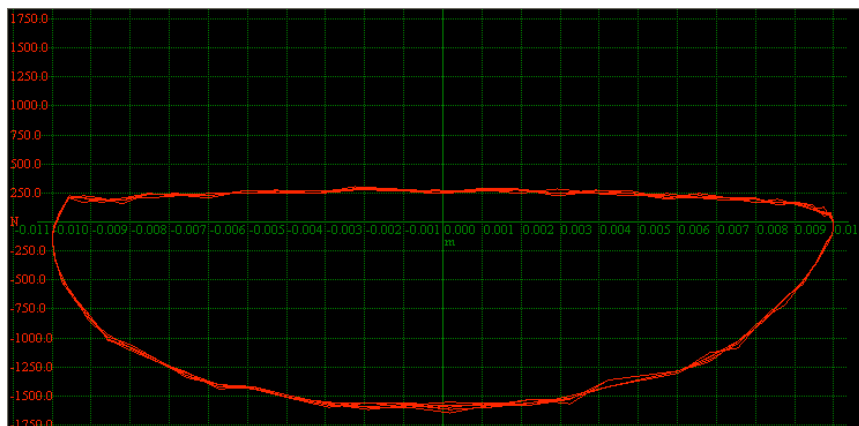
- Push cycle, the user can enable/disable the push cycle of the graph,
- Pull cycle, the user can enable/disable the pull cycle of the graph,

Some screenshots:



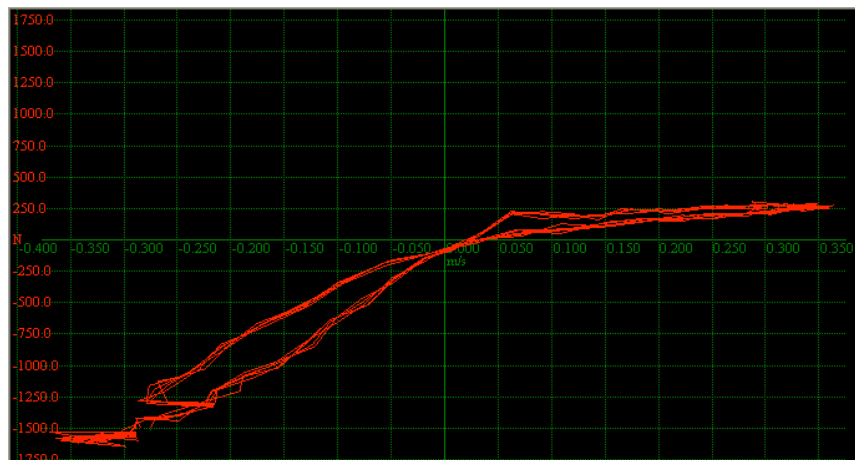
Force and Velocity vs Time

Force is in phase with speed, when the machine pushes the dumper the Force is approx. Constant (the dumper doesn't absorb too much power)
 When the machine pulls from the dumper the force is proportional to speed, the dumper 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.

2.4 Test Columns

S.	Name	Comments	Max....	Max....	Date/Time	Max....	Diam....	Angle	Teeth	Lever	Type	Samp....	Chan....
<input checked="" type="checkbox"/>	TEST_022		632....	0.094	16/03/2006 19:09:51	3.58	20	0	60	50	0	302	2

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

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

Name, name of the test,

Comments, commentaries for the test,

Max speed, maximum speed detected during the test (km/h or mph)

Max Force, maximum force detected during the test, two values will be displayed for "push" force and "pull" force, (Newton, Kg or Pound)

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

Max Time, duration of the test,

Diameter, diameter corresponding to the drum position used for the test, the suggested drum has 10 positions (see below), each one with one angle and diameter.

Angle, angle for the drum position used for the test,

Teeth, number of teeth of the gear tooth, default is 60-1,

Lever, lever length, default is 50 mm,

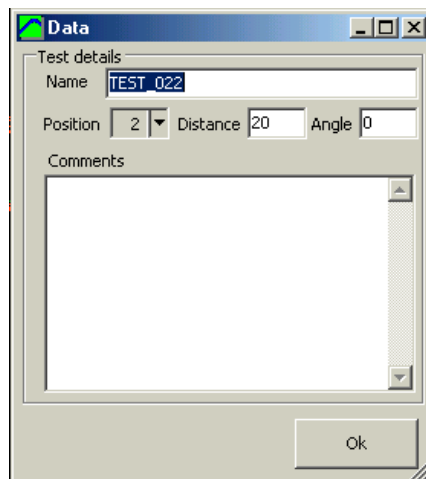
Type, type of machine, 0 for "Piston Crank" (default), 1 for Scotch Yoke Slider,

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

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

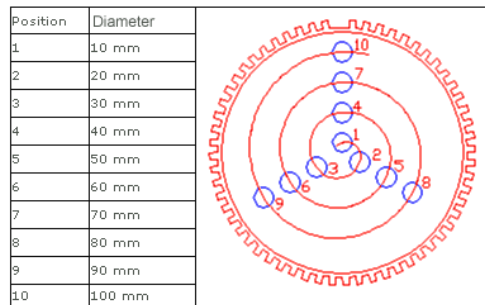
2.5 Test Data

This window is used when editing the data from an existing test, or when entering data for a new one.



The program increases the number at the end of the test name each time a test is done.

The user should ensure the selected position matches the actual one on the machine.



Each position number has associated a diameter and an angle that the program will use to calculate the dumper movement.

2.6 Configuration

Configuration is distributed in three tabs:

Mechanism Type



Dyno Name, name for the reports (print),

Lever, length of the lever used to move the dumper (not the drum diameter),

Lenght of Test, number of turns to record for the test,

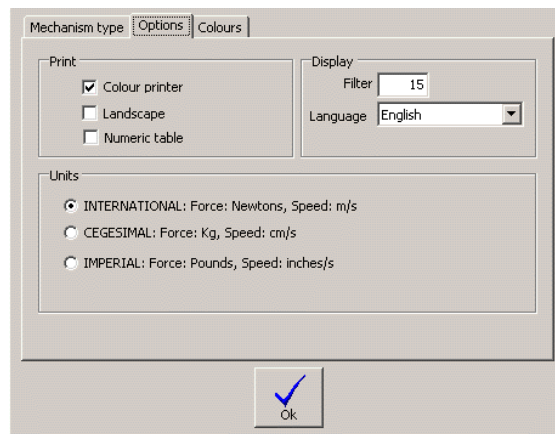
Piston Crank, (by default) in this machine the mechanism is like into an engine, the created motion is not completely sinusoidal but the program has the mathematical model to calculate it.

Scotch Yoke Slider, this machine creates a perfect sinusoidal motion, but it is more complex to build,

Number of Teeth, number of teeth for the gear tooth, including the missing tooth (by default 60),

Write (button), used to transmit the number of teeth to the data unit, only for displaying purposes, it doesn't affect the accuracy of the system (if the unit has an improper value),

Options



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,

Numeric Table, a numeric table can be printed with the curves, the data shown is taken from the data of the test: position, speed, force.

Units:

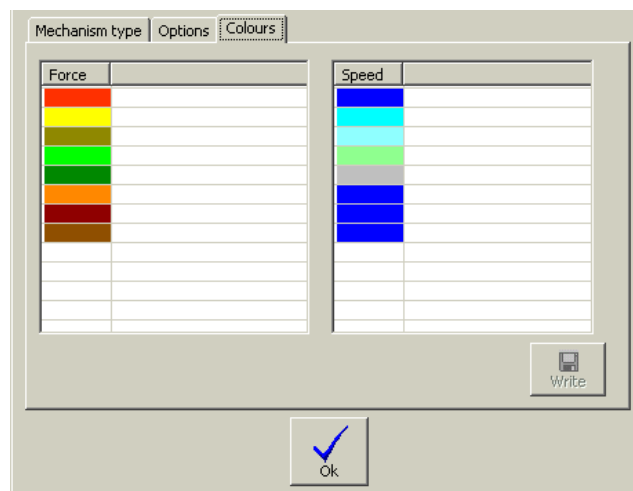
International (scientific), Force is shown in Newtons and speed in meter/s

Cegesimal (common), Force is shown in kg and speed is cm/s

Imperial: Force in Pounds and Speed in inches/s

Language, at the moment only english and spanish are available. New translations can easily be done by editing the english.lan file with notepad, and saving it as "french.lan" for example.

Colours:



Each channel for each test can have a different colour. The user can edit them from this window. After editing, the write button has to be pressed to save the changes.