Related topics

Force measurement, precision of measurement, resolution, use of an interface.

Principle and task

The temporal course of random, minimal differences in force is recorded. These experiment instructions describe the possibilities offered by the software to measure and evaluate minimal force differences in general rather than representing a specific experiment.

Equipment

COBRA-interface 2	12100.93	1
PC COBRA data cable RS232, 2 m	12100.01	1
Measuring module Newton	12110.00	1
Newton sensor	12110.01	1
Softw. COBRA Force (Win)	14290.61	1
Basic Softw. f. PHYWE Windows prog.	14099.61	1

The PHYWE WINDOWS® Basic Software (14099.61) must be installed on the computer being used in order to run the software.

Set-up

— Plug the force measuring module into the MODUL 1 input of the interface. To take reproducible measurements of very small forces, make sure the measuring equipment is insulated from vibrations. It is helpful to lay foam pads laid beneath the support feet and close the room off to prevent drafts. Beyond that, select a suitable set-up to handle the measurement problem.

Procedure

— Depending on whether COBRA is connected to COM 1 or COM 2 of the computer, double click on the icon to start the program F(t)_COM 1 or F(t)_COM 2.

— As soon as the <Start> button is pressed, the system performs a tare, this takes about 5 seconds The force meter must not be moved or jarred during taring. If it is jarred, the system may briefly display the message "Overflow" accompanied by a beep. After incorrect taring, the message "Tara Error?" is displayed on the monitor. In this case, you can restart taring by pressing the <Tara> button once the yellow highlighting has gone out. Should the "Tara Error?" message not disappear even after several taring attempts, then either there are too many vibrations in the

Fig. 1: Automatic taring, absolute and relative measurement of force is possible.
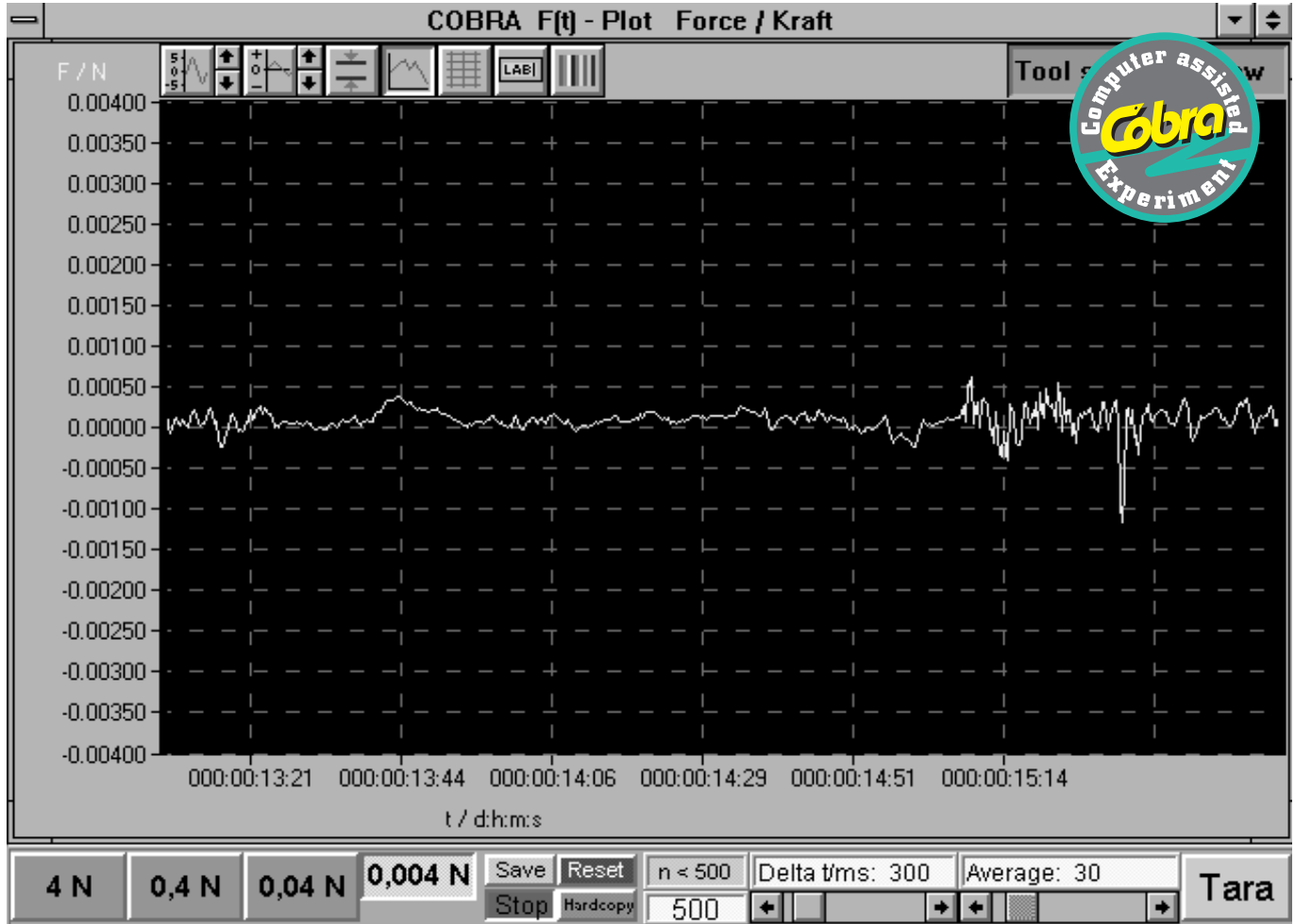
room or the set sample time <Delta t/ms> is too small. If you are using a slow computer, the set sample times should be greater than 300 ms. An <Average> value of less than 10 is recommended for taring.

— You can set the sample rate by adjusting the scroll bar beneath <Delta t/ms>. Each connected computer has its own maximum sample rate. If the sample rate is too high, there are data communications errors evidenced by irregular advancement of the F-t recorder.

— Automatic Taring:
If the vibration in the measurement set-up are only very minimal, automatic taring should work (You may need to click on the <Tara> button several times). In this case, it is also possible to measure absolute forces. The graph is set to the most sensitive measuring range by clicking on the icon in the upper left with the sine curve symbol. Select the following settings for the yaxis:

Precision:	5
Maximum:	0.004
Minimum:	−0.004
Units/division:	0.0005

The system is now ready to take measurements. Figure 1 shows the influence of various <Average> values on the evenness of the measurement curve.

— Manual Taring:
Minimal vibrations, especially those promoted by large weights placed on the force meter plate, make automatic taring impossible. To be able to perform taring in an acceptable time interval, the number of times the measurement can be averaged is limited. If there are vibrations during taring, then "apparent" forces may be attained that can no longer be compensated since these forces, being caused by interference, constantly change their direction of effect. In this case, the message "Tara Error?" is displayed below the <0,004 N> button. Set the graph to a sensitive measuring range by clicking on the icon with the sine curve symbol in the upper left. Select the following settings for the y-axis:

Precision:	5
Maximum:	0.1
Minimum:	−0.1
Units/division:	0.01

Fig. 2: Manual taring with keyed-in entry of compensation values in the input window to the lower right and/or by clicking on the arrow buttons.
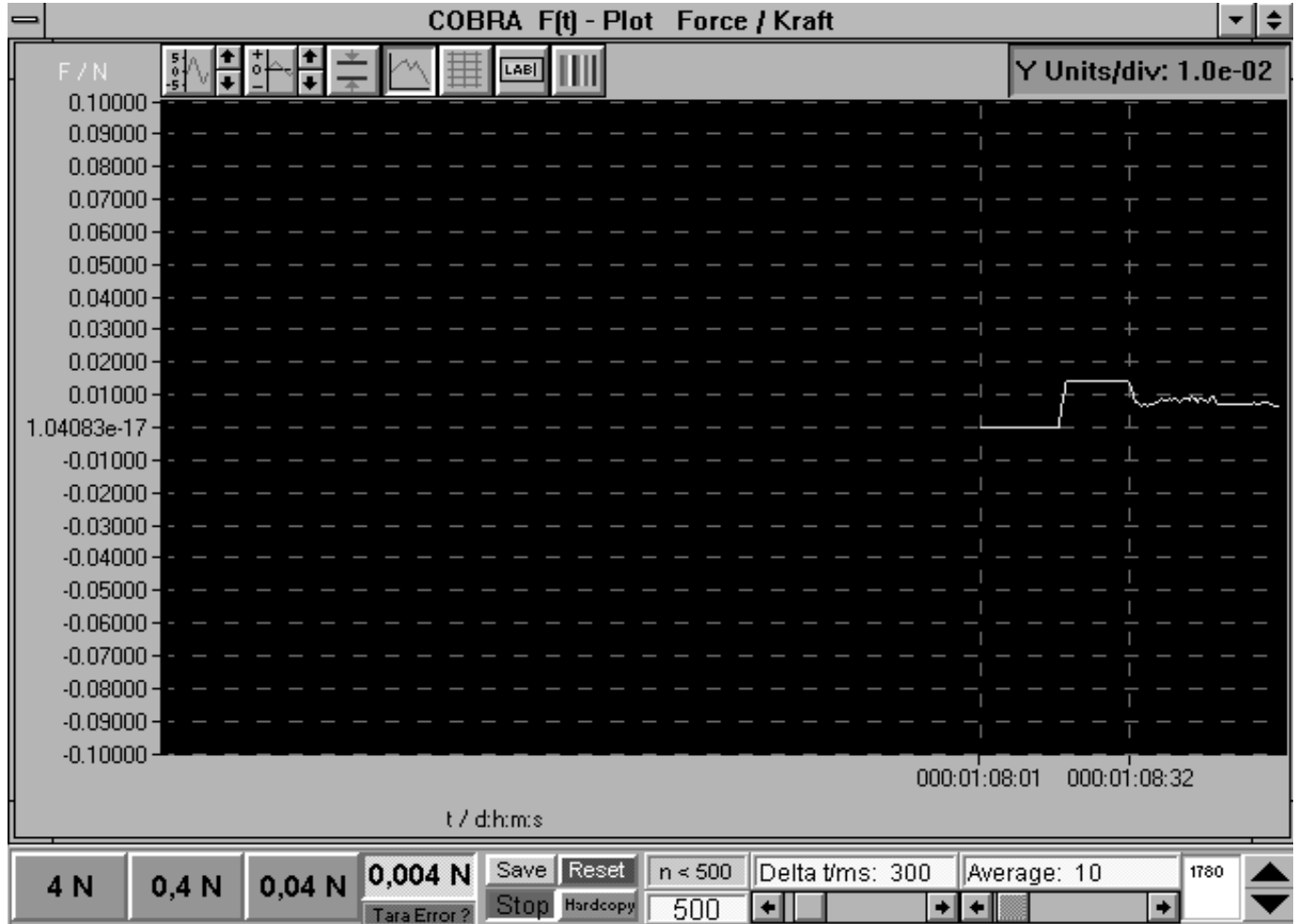
There should be a yellow curve in the graph with these settings. If there is no yellow curve, then you must increase the interval (maximum, minimum).

Click on the <Tara Error ?>. An input field appears in the place of the <Tara> button. Enter the numbers 500, 1000, 1500, 2000 one after the other (confirm each entry with the "Return" key on the keyboard). There will be a jump in the force curve exactly between two of these numbers. If there is no jump, then enter the respective negative values. Right after there is a jump, click on the arrow buttons to the right of the input field to shift the curve far enough that it is about in the middle between the previous positions. The curve always moves in the direction indicated on the arrow button (Fig. 2). Using the horizontal cursor lines, measure the plateaus of the force curve and enter them as the maximum and/or minimum in the input window for the y-axis. The measuring system is now ready to record changes in force (Fig. 3). The absolute force data does not matter with the manual taring procedure. (Use the same procedure to tare the measuring system for the ± 0.04 N measuring range.)

Notes

— Click on <Reset> to set the number of measurement points (n) to zero.

— <Save> (green) saves the recorded measurement data (n) as an ASCII file on the hard drive or on a floppy disk. This data can be read by and altered using common spread sheet or word processing programs. The files should have the ending *.AFD (**A**SCII **F**ile **D**ata) so that the measurement data files can be easily identified. The system only saves the number of measurement data currently entered under „n".

— The <Hardcopy> button is for printing out the entire screen display on the printer set under WINDOWS. Before using this function, you should change the colour combination of the graph to save on ink or toner. To do this, click on the rainbow-coloured button in the upper right above the graph (to the right of the <LAB> button). The following settings are recommended for the printout:

Chart	white
Data 1	black

Fig. 3: Manual taring, only relative changes in force can be measured.
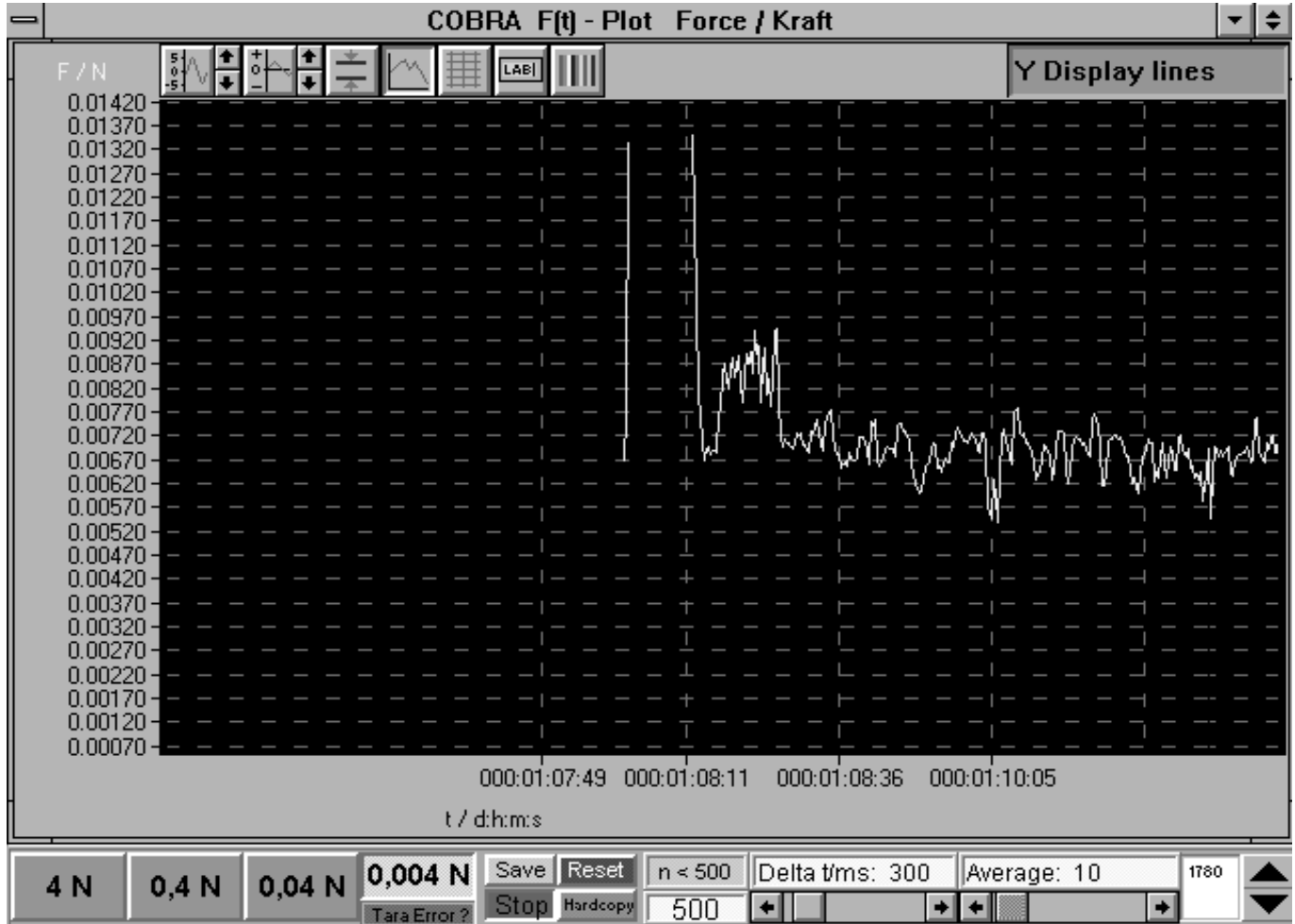
— The other buttons above the graph have the following functions from left to right:

  — Stretch and shrink y-axis, use the arrows to do this in set steps, click on the button with the curve to enter maximum and minimum values via the keyboard.

  — Shift the curve along the y-axis, without changing scale (arrows).

  — Show horizontal cursor lines which can be moved with the left mouse button. The absolute and relative values of each position are displayed beneath the graph.

  — Connect measurement points with lines.

  — Show grid, a coordinates of the origin system or a single-colour background.

  — Change x- and y-axis labels.

  — Change colour of the graph.

— You can end the program by double-clicking on the symbol at the extreme upper left.

— The graphic system used has a resolution of 640×480 pixels. If you are using a monitor with a higher resolution, then the program only uses a specific segment in the upper left of the screen on the monitor.