⊞₊ Enter a new visit card in the archive

✕ Delete current visit card from the archive

▦ Edit the current visit card

Test Card

It contains all the information about the test.

To move within the database use the following buttons:

✕ Delete current test from the archive.

▦ Edit the current test

Import/export a Tests card

This function allows to import /export a test card with the respective visit and patient card.

1. Select the patient.
2. Choose the test and press the key by side. All data will be imported/exported in the XPO file format (Cosmed proprietary).

Diagnosis Database

The program allows to manage a diagnosis database, whose records are composed by a diagnosis ID code and a string of text.

The report of the visits can be done either by typing the desired text in the field "Diagnosis" of the Visit Card or, more quickly, retrieving from the diagnosis database the desired one.

If you want to insert, modify or delete a diagnosis from the database select **Database Diagnosis...** from the **File** menu.

Spirometry program settings

The software allows to configure some options selecting **Configure** from the **Option** menu.
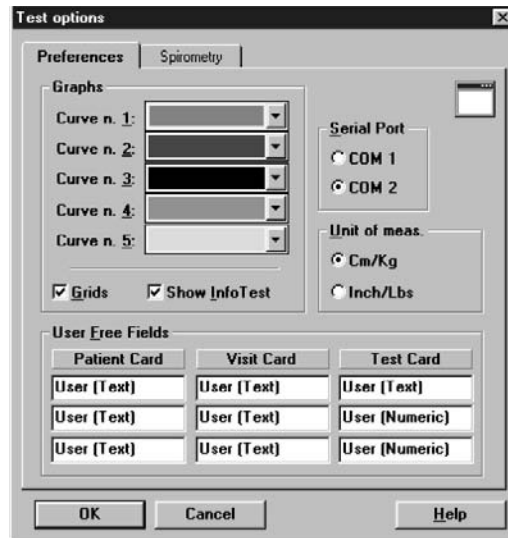
Graphs

All the graphs visualised and/or printed can be customised in colours and appearance.

1. Select the desired colours of the curves (5 curves max can be overlapped on the same graph).
2. Enable or disable the **Grid** option.
3. Enable or disable the **Show Info Test** option.

Serial port

You must select the serial port RS 232 that will be used to connect the Quark b^2 with the PC.

To select the serial port, click on the proper **COM** button (the selected port must be different from the mouse one).

Units of measurements

It is possible to configure the units of measurements, weight and height, for printing and viewing.

To select the units of measurement click on **cm/Kg** or **in/lb** according to the desired format.

Using extra fields

The Patient's database is organised in 3 different cards (Patient card, Visit Card and Test card.) where it is possible to store the information about patients and visits .

Besides the standard information, it is possible to customise some fields (user free fields), entering and labelling measurements coming from other devices.

The customisable free fields are:

•   3 fields in the Patient Card (Patient's information)

•   3 fields in the Visit Card (information about the visits)

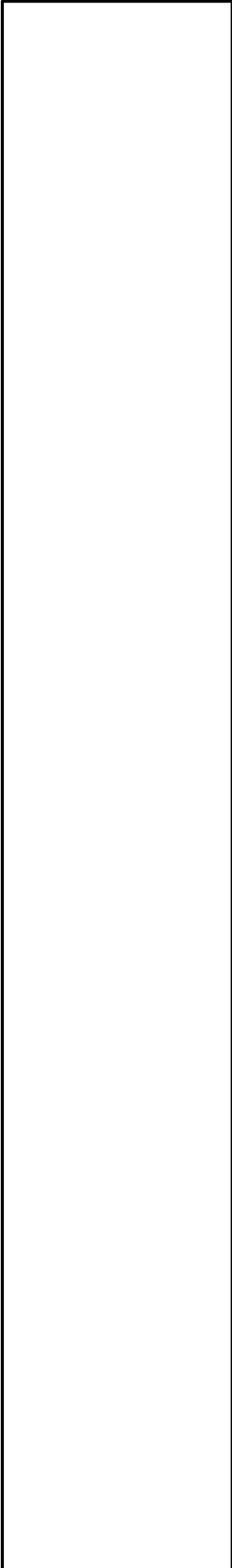•   3 fields (2 numeric) in the Test card information about Test)

Customise the fields

In the group **User free fields** type the desired text in the 9 fields available.

Exercise testing

Recommendations for the exercise testing

The evaluation of the cardiorespiratory function

The physical training requires the interaction of physiological mechanisms that allow the cardiovascular and respiratory systems to supply the increasing demand of energy due to the contraction of the muscles.

During the training the systems are both engaged, an adequate answer to the effort is the measure of theirs health state.

The increase of the metabolic rate, during the exercise, needs an appropriate increase of oxygen in the muscles. At the same time, the CO_2 muscles production must be removed in order to avoid the lactic acid making.

To satisfy the increase in the gas exchange, necessary to the muscles during the exercise, is requested the intervention of many physiological mechanisms. This process involves lungs, the pulmonary circulation, the heart and the peripheral circulation.

Precautions

The physician has the responsibility that the patient subjects to the test is a suitable person able to execute an effort test.

Laboratory

The room, in which the test is performed, must be big enough to contain the whole necessary equipment, allowing an easier accessibility to the patient in case of emergency.

In the room should be placed a thermometer and a hygrometer; the heart frequency and the perceived values of the effort rise as much as the ambient temperature increases, and the variability of the cardiovascular response grows for humidity values higher of 60%. Generally it is considered 22°C the temperature adequate for the test execution, even for short efforts, values till 26°C can be considered acceptable in presence of an efficient air ventilation.

Ending the test

The patient should be monitored with ECG for at least 8 minutes, in resting conditions or until he returns to the pre-exercise conditions.

Preparing the patient

To enhance the value of a diagnostic test it's very important patient collaboration. In most cases a well-informed patient will make a better effort (in relation to his conditions) and will allow a reliable interpretation of the test. For this reason every ergometric test must be preceded from a precise training of the patient.

Before testing

The physician applying the exam must be provided with a written request including a brief description of the diagnosis (confirmed or suspected), the request's reason and the patient therapy carried out showing the dose and time of the drug assumption.

To standardise the response to the test and reduce the patient's anxiety it's suggested to provide him either written (before the exam) or oral (at the same time of the test) information. At the scheduling time detailed instructions should be delivered to the patient, consisting in smoke and food abstinence three hours before an ergometric test, or eight hours before a scintigraphic test.

Test are usually executed supporting the therapeutic outline in progress, but sometimes it could be necessary to stop some drugs, such as b-block or calcium antagonist, which could impair the effort response reducing the diagnostic accuracy of the exam.

The patient must wear comfortable suit and gymnastic shoes and two hours before test stop any kind of drugs, eat light and avoid coffee and smoke.

It's very important acquire information on the patient's clinical past before performing the test. Keep attention in particular way to the use of drugs, tobacco, to the physical fitness and symptoms produced with the exercise.

Patient assent

The patient is informed that he will be submitted to a maximum effort, which could be stopped at any moment, and of the risks of the test execution.

Ending the test

Test may end when the maximum value of the oxygen consumption has been reached and the patient's response established.

Real time test

Before starting exercise test type a new patient information or choose one from the list of patient in the file. As soon as a patient has been entered the software is ready to start a test. The name of the active patient is shown on the status bar of the program window.

Start a test

Start the test as described in the chapter *Operating modes*. If you use the device in Holter mode, please skip this until *Data management*. The following is applicable only to tests performed with the PC (telemetry or serial mode).

The software environment will change showing a new Menu bar and toolbar while the first data will be displayed in a table format.

At this point the software starts showing data on the monitor but without saving them, this in order to monitor the patient before starting the test. To start storing data press **F2**.

Abort the test without saving data

Choose **Abort** from the **Test** menu or press **Alt+F3.**

End the test saving data

1. Choose **End** from the **Test** menu or press **F3**.
2. Choose **Yes** to end the test or **No** to continue.

View data in real-time

The visualisation features and capabilities of the data and graphs are identical to the ones described in the Data management chapter. Starting the test a small window will appear on the right corner displaying time, bmp and, if selected before, the ergo protocol and trainer.
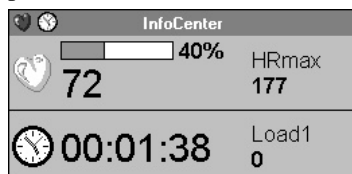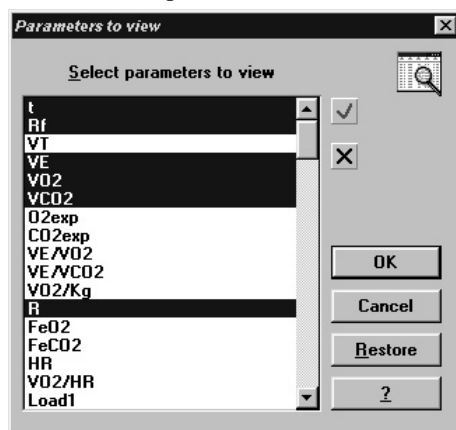
View graphs in real-time

1. Choose **Graph** from the **View** menu.
2. Follow the instructions described in *data management* section to edit the graphs.

Parameters to view

While the test is running, it is possible to choose the parameters to view.

1. Select **Parameters to view/Test execution…** from the **Options** menu.
2. Select the parameters and confirm.

Manual protocol

If you are using the K4 b^2 with a treadmill without serial interface, it is possible to enter manually from the PC the event, the phase and the marker.

Enter Load and Phase

1. During the test select **Load** from the **Events** menu.
2. Select the phase and/or type the value of the load and press **OK** to confirm.

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Tip: pressing the Shift key while choosing the marker option will allow you to enter the label for that marker.

Set the markers

Select **Marker** from the **Events** menu.

Automatic protocol

The software allows to automatically control the ergometer according to the protocol previously selected. Anyway it is allowed to change it even after the test is started.

Modify the load during the test

1. During the test choose **Ergometric protocol** from the **Events** menu.
2. Select the row corresponding to the desired load and press **OK** to confirm.

Set the BPM alarm

The software allows the user to set the alarm level for the heart rate, in order to monitor the patient response.

Enter the BPM

1. Choose **BPM alarm** from the **Events** menu.
2. Set the alarm by moving the scroll bar and press **OK** to confirm.

It also allows to enable or disable the acoustic alarm by the option "Acoustic alarm".

Data management

As soon as the test has been completed or downloaded, all data stored can be retrieved for a complete management.

Viewing data

Data can be viewed in the following formats:

Table form	numeric values of the various parameters (columns) corresponding to each step (rows).
Graphic form	graphical presentation on Y1, Y2, X charts.
Summary	results of the test and statistical analysis of the blocks.
Predicted	predicted values, maximum value measured.

View data in table form

1. Select **Data…** from the **View** menu.
2. Select the test to visualise in the list box and press **OK**

▲▲▲
Note: Double-click in the window to open the edit test.

t hh:mm:ss	Rf b/min	VT l	VE l/min	VO2 ml/min	VCO2 ml/min	VE/VO2 ---	VE/VCO2 ---	VO2/Kg ml/min/Kg	R ---	FeO2 %	FeCO2 %	HR bpm	VO2/HR ml/bpm	Load Watt	FetO2 %
00:00:00	12.2	1.151	14.1	556	505	25	27	7.32	0.90	15.86	4.35	61	9.1	0	14.79
00:00:06	10.2	1.626	16.6	595	574	27	28	7.84	0.96	16.40	4.20	65	9.1	0	15.61
00:00:10	12.7	0.610	7.7	250	236	31	32	3.30	0.94	16.94	3.70	67	3.7	0	15.88
00:00:15	12.2	0.865	10.6	344	341	30	31	4.52	0.99	16.91	3.91	66	5.2	0	15.83
00:00:21	10.8	1.043	11.3	403	372	28	30	5.30	0.92	16.62	4.01	66	6.1	0	15.54
00:00:26	11.7	0.725	8.5	271	243	31	35	3.56	0.89	17.10	3.48	66	4.1	0	15.64
00:00:32	10.8	0.721	7.8	259	234	30	33	3.41	0.90	16.93	3.66	65	3.9	0	15.59
00:00:37	11.3	0.805	9.1	288	270	31	33	3.80	0.93	17.12	3.62	65	4.4	0	15.63
00:00:43	10.1	0.823	8.3	284	260	29	31	3.73	0.91	16.82	3.81	62	4.5	0	15.58
00:00:48	11.5	0.769	8.8	285	260	30	33	3.75	0.91	17.05	3.59	63	4.5	0	15.57
00:00:54	9.4	0.796	7.4	249	225	30	33	3.27	0.90	16.96	3.67	63	3.9	0	15.56
00:01:00	10.0	0.840	8.4	299	261	28	32	3.94	0.87	16.73	3.77	63	4.7	0	15.27
00:01:07	9.1	0.722	6.5	237	203	27	32	3.11	0.86	16.65	3.78	63	3.7	0	15.16
00:01:14	8.9	0.721	6.4	234	199	27	32	3.09	0.84	16.64	3.77	63	3.7	0	15.25
00:01:20	10.0	0.728	7.2	263	227	27	32	3.46	0.86	16.63	3.80	64	4.1	0	14.97
00:01:25	11.4	0.798	9.1	349	288	26	31	4.59	0.82	16.44	3.83	65	5.3	0	15.12
00:01:30	10.5	0.947	10.0	376	316	26	31	4.95	0.84	16.51	3.85	66	5.7	0	15.15
00:01:36	10.8	0.888	9.6	339	294	28	32	4.46	0.86	16.72	3.74	65	5.2	0	15.25
00:01:42	10.8	0.917	9.9	352	309	28	32	4.63	0.87	16.73	3.77	64	5.5	0	15.35
00:01:47	10.9	0.846	9.2	323	283	28	32	4.25	0.87	16.77	3.74	64	5.0	0	15.29
00:01:53	10.9	0.848	9.2	315	274	29	33	4.15	0.87	16.86	3.61	64	4.9	0	15.63
00:01:58	10.7	0.881	9.4	329	292	28	32	4.32	0.89	16.78	3.77	64	5.1	0	15.33
00:02:04	11.0	0.761	8.4	289	249	29	33	3.80	0.86	16.86	3.61	65	4.4	0	15.51
00:02:09	10.5	0.817	8.6	286	261	30	33	3.77	0.91	16.95	3.64	64	4.4	0	15.62
00:02:15	11.2	0.876	9.8	320	283	30	34	4.21	0.88	17.06	3.50	65	4.9	0	15.65
00:02:20	11.1	0.907	10.1	337	286	29	35	4.44	0.84	16.97	3.46	66	5.1	0	15.69
00:02:25	10.9	0.795	8.6	275	246	31	35	3.62	0.89	17.14	3.46	65	4.2	0	15.68
00:02:31	11.5	0.795	9.1	312	269	29	34	4.10	0.86	16.89	3.57	65	4.8	0	15.58
00:02:36	10.7	0.829	8.9	303	269	29	33	3.99	0.88	16.87	3.67	65	4.6	0	15.50
00:02:42	10.9	0.736	8.0	269	234	30	34	3.54	0.86	16.96	3.53	64	4.2	0	15.57
00:02:47	10.7	0.821	8.8	299	260	29	34	3.94	0.86	16.89	3.59	65	4.6	0	15.45
00:02:52	11.3	0.875	9.9	335	297	29	33	4.41	0.88	16.91	3.65	65	5.1	0	15.50
00:02:58	11.5	0.863	9.9	332	293	30	34	4.34	0.88	17.05	3.58	65	4.9	0	15.61

Creating graphs

The software is provided with powerful functions for creating charts. You can add custom graphs to create exactly what you need.
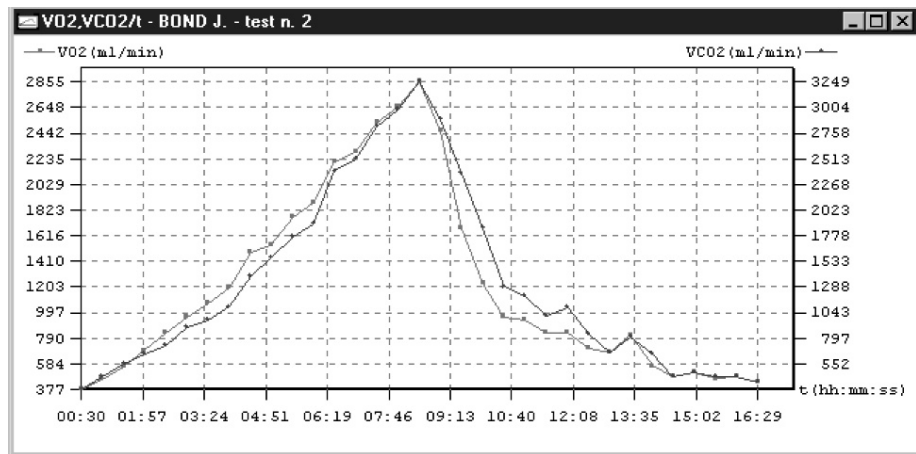
View data in graph form

1. Choose **Graph…** from the **View** menu.
2. Select the tests to visualise from the list and press **OK**
3. Choose the parameters you require on the X, Y1 and eventually for Y2; select if necessary some of the following options by pressing the **more** button and press **OK** to confirm.

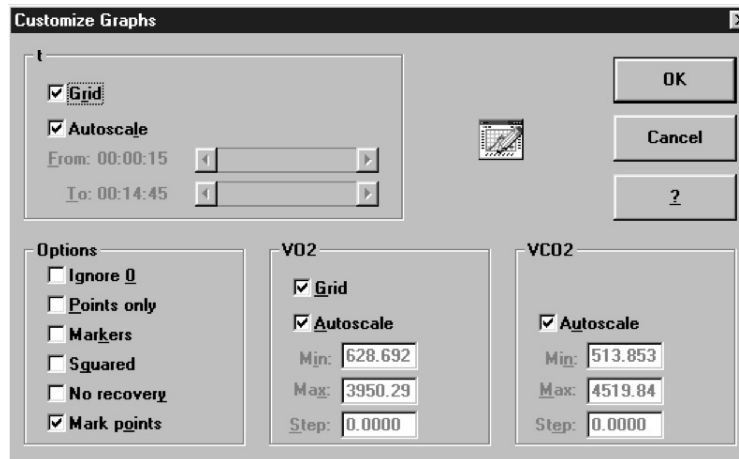It is possible to access quickly 5 common graphs from the **View/Graph…** dialog box.

Right-clicking, the graph can be exported in bmp file format.

Customise the graphs

1. With a graph on the screen, choose **Customise graph** from the **View** menu.
2. On the Customise graph dialog box, select options to obtain the wished graph.

Option	Function
Grid on X, Y axes	show the grid lines in correspondence with x or y axes that make the graph easier for you to analyse data.
Autoscale	maximum and minimum values of the graph will be measured automatically.
Ignore 0	points with 0 value measured won't be shown.
Not interpolated	make the graph scattered.
Marker	highlight with a symbol all steps of the test in which the marker button was pressed.
Squared	makes the graph a square
Without recovery	exclude from the graph all points of the recovery phase.
Mark points	marks each point with a symbol
Min. Max.	allows to set manually the axes values.
Step	Set the axes' scale step.

Switch from graph to data and vice versa

When the active window is a graph (or a report in data form), it is possible to view very quickly the data (or the graph) corresponding to that test.

Choose **Current test data** (if the active window is a graph) or **Current test graph…** (if the active window is a data report) from the **View** menu.

Viewing predicted values

For some parameter it is possible to compare the maximum value measured during the test with its predicted value and the LT value both in percentage and absolute.

View predicted values

Choose **Predicted** from the **View** menu.

Parameter	Values @LT	% Max	Max	Predicted	% Predicted
t (hh:mm:ss)	----	----	00:14:13	----	----
Load (Watt)	----	----	450	225	200.00
Real Load (Watt)	----	----	----	----	----
Revolution (RPM)	----	----	----	----	----
VO2 Wass. (ml/min)	----	----	3534	2964	119.24
VO2/Kg Wass. (ml/min/Kg)	----	----	46.50	39.00	119.24
VE (l/min)	----	----	139.0	161.3	86.19
Rf (b/min)	----	----	34.2	50.0	68.45
VT (l)	----	----	4.48	2.81	159.30
R (---)	----	----	1.02	----	----
VO2/HR (ml/bpm)	----	----	24.7	16.3	150.93
VE/VO2 (---)	----	----	57	----	----
VE/VCO2 (---)	----	----	35	----	----
P Sist (mmHg)	----	----	----	----	----
P Diast (mmHg)	----	----	----	----	----
HR max (bpm)	----	----	153	181	84.53
HRR (bpm)	----	----	28	----	----
BR (%)	----	----	22.27	----	----
REE (kcal/day)	----	----	----	1738.7	----
VO2@LT (ml/min)	----	----	----	1274	----
VO2 Jones (ml/min)	----	----	3534	3059	115.54
VO2/Kg Jones (ml/min/Kg)	----	----	46.50	40.25	115.54

Anaerobic (Lactate) Threshold detection

The software allows to detect the Lactate Threshold (Anaerobic Threshold) according to the "Modified V-slope method" reference. The LT can be detected both manually and automatically.

View the Lactate Threshold

Choose **Lactate Threshold** from the **View** menu.

Detect the Lactate Threshold

1. Choose **Calculate LT** from the **Test** menu.
2. For calculating it automatically on the "Lactate Threshold" dialog box click on the **Auto detect** button.
3. For adjusting manually the point you want to detect, move the scroll bar on the dialog box by pressing the arrow buttons. Data and graph of the LT will be automatically redrawn.
4. Press **Ok** button to save your choices.

▲▲▲
Note: Double-click in the window to open the corresponding dialog box.
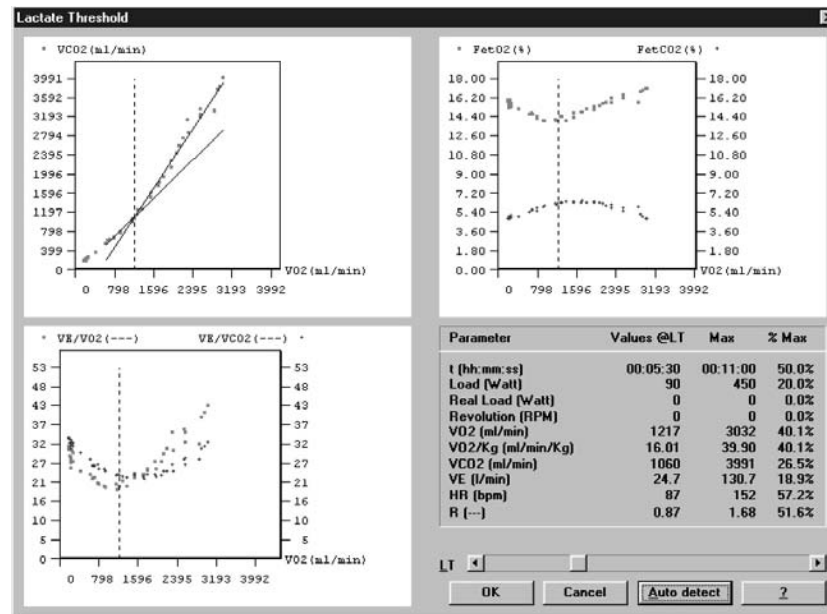
Customise graphs for the LT viewing

The software allows to customise two of the three graphs for the LT visualisation.

1. Choose **Lactate Threshold** from the **Options** menu.
2. Choose the parameters you want to be shown on the LT window and press **OK** to confirm your choices.

Fittings

The purpose of the fitting function is to find the function that fits as better as possible the measured data.

The software allows to fit data according to 3 different functions:

| Model	Function	Algorithm	Available for
Linear	$Y=A*X+B$	Least squares	Any Y vs any X graph
Mono-Exp	$Y=A+B*exp[(t-t_0)/tau]$	Levemberg Marquardt	Any Y vs Time Graph
Mean value			

This function is available only if the active window is a single Y graph (i.e. VO_2 vs time or VO_2 vs Load).

Fit a graph with a linear regression

1. Make active the graph window (any Y vs any X graph).
2. Right-click and select **Fitting.**
3. Choose **Linear** in the type combo box
4. Select the first point (**X1**) moving the mouse on the desired place in the graph pressing the **Left** key or using the + and – keys.
5. Select the second point (**X2**) moving the mouse on the desired place in the graph pressing the **Right** key or using the + and – keys.
6. Press **OK** to confirm.

Fit a graph with a Mono-exponential regression
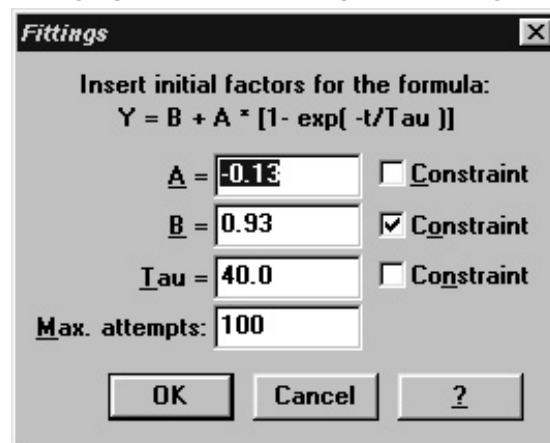
1. Make active the graph window (any Y vs any X graph).
2. Right-click and select **Fitting.**
3. Choose **Mono-exponential** in the type combo box
4. Select the first point (**X1**) moving the mouse on the desired place in the graph pressing the **Left** key or using the + and – keys.
5. Select the second point (**X2**) moving the mouse on the desired place in the graph pressing the **Right** key or using the + and – keys.
6. Enter (if necessary) the initial values of A, B and TAU (these are the values from which the iterative algorithm starts in order to reach the best values; the closer are the initial coefficients to the best ones the higher is the possibility to reach the best fit).
7. Press **OK** to confirm.

Calculate the "Mean Value"

1. Make active the graph window (any Y vs any X graph).

2. Right-click and select **Fitting.**

3. Choose **Mean value** in the type combo box

4. Select the first point (**X1**) moving the mouse on the desired place in the graph pressing the **Left** key or using the + and – keys.

5. Select the second point (**X2**) moving the mouse on the desired place in the graph pressing the **Right** key or using the + and – keys.

6. Press **OK** to confirm.

*Note: The results of the O2 Fittings function are not stored therefore, in order to keep the information, print the page using **File/print Active Window**.*

Oxygen Kinetic

This function is available only if the active window is a VO2 vs time graph and it has a sense only with Constant Load Exercise Tests.

The aim of this function is to find the dynamic response of the rising and falling edges of the VO2 together with the Oxygen Deficit and Oxygen Debt.

Run the O2 Kinetic function

1. Make active a VO_2 vs Time graph window.

2. Press the right key of the mouse and select **O2 Kinetic**.

3. Select the beginning of the exercise phase (**t1**) moving the mouse on the desired place in the graph pressing the **Left** key or using the + and - keys.

4. Select the beginning of the exercise phase (**t2**) moving the mouse on the desired place in the graph pressing the **Right** key or using the + and - keys.

5. Enter (if necessary) the initial values for A, B and Tau (these are the values from which the iterative algorithm starts in order to reach the best values; the closer are the initial coefficients to the best ones the higher is the possibility to reach the best fit) and press **OK**. You can lock data checking the relative field
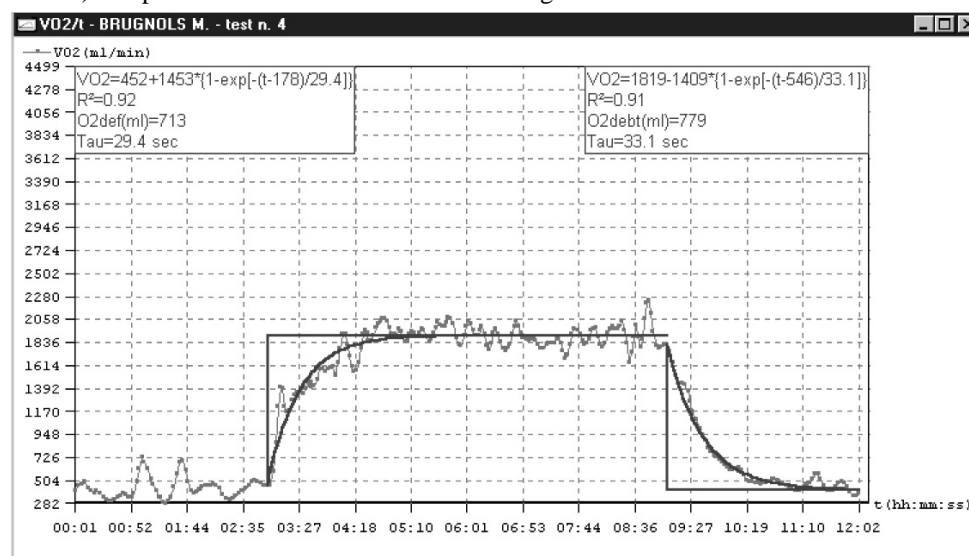
Information about the Test

The Test Information dialog box shows all the information concerning environmental data, patient data and some data about the test

View the Information

Choose **Information** from the **View** menu.

Modify the information

1. Press the **Modify** button on the **Information** dialog box.
2. Change the values you want to modify and press **OK** to confirm.

The software allows to assess the energy expenditure and metabolism substratum. In order to measure FAT and CHO, type the UN (Ureic Nitrogen) value into the field. All the nutritional parameter will be recalculate considering the UN value.

Summary

The summary feature allows to summarise test results according to the workload and phase during the test.

View the summary

1. Choose **Summary** from the **View** menu.
2. The summary of the current test (active window) will be displayed.

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*Tip: double-clicking on the Summary window the function **Options/Summary** is activated by which you may configure the structure of the data.*

Print the data

It is possible to print graphs and data by means of two functions: **Print report** and **Print current window**. The last one is active only if the active window is a graph or a data report.

Print the current window

1. Be sure that the current active window is the graph or the report you desire to print.
2. Select **Print current window** from **File** menu.
3. Press **OK** to print, or **Setup** to customise the print.

Print the report

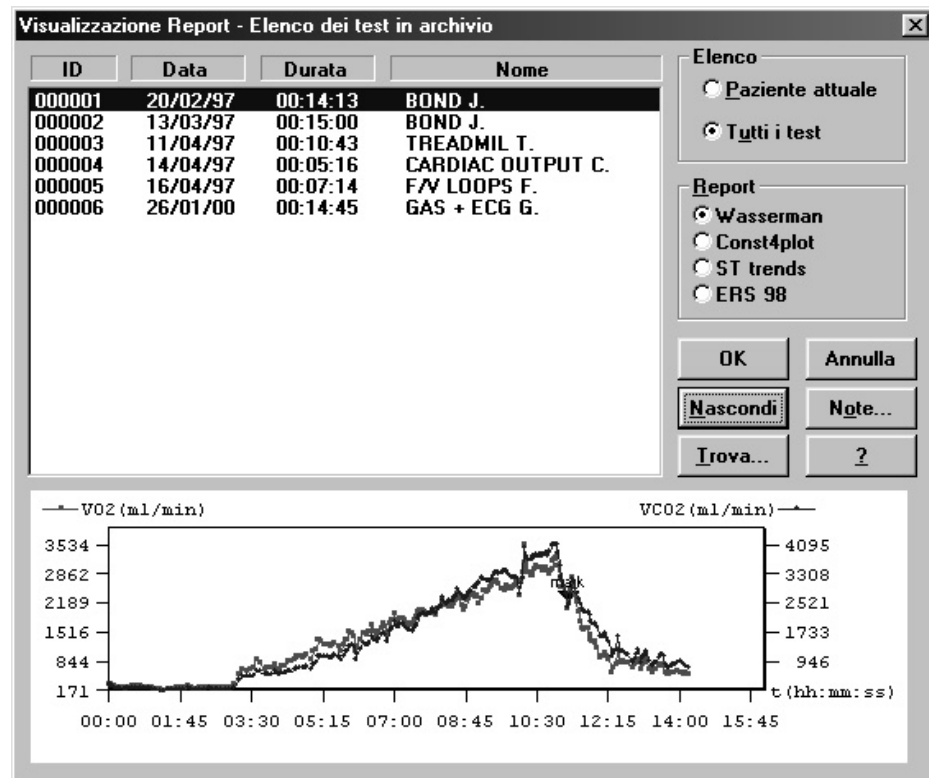1. Select the report to be printed from **File** menu.
2. Press **OK** to print, or **Setup** to customise the print.
3. To only view the report, without printing it, press Shift during the selection.

View the report

This function allows to show a preview of a selected report.

1. Select **Report** from the **View** menu.
2. Select the test and the report to visualise and press **OK** to confirm**.**

Data Editing

The software allows the user to edit the data acquired during the test in the following ways:

- deleting one or more steps
- editing row data
- input new parameters
- data filtering (averaging or smoothing)
- advanced data elaboration

After data elaboration it is always possible to restore the original data file by pressing the **Restore** button .

If you want to save permanently all the changes, press **Overwrite**; being aware this function replaces the original test definitely.

Editing values and input numerical values

1. Choose **Edit test** from the **Test** menu.
2. Select the cell containing the value you want to replace with others values and press **OK** to confirm the editing.

The software will recompute all the parameters. Both the tables and the graphs will be automatically updated.

Edit Test						
Time	**Ti**	**Te**	**IV**	**VT**	**O2exp**	
00:00:03	1.23	2.35	0.69	0.912	154.4	
00:00:06	1.40	2.22	0.93	1.133	192.0	
00:00:11	1.39	2.49	0.90	1.121	190.5	
00:00:15	1.41	2.40	0.86	1.018	172.8	
00:00:19	1.40	2.54	0.87	1.020	172.9	
00:00:23	1.48	2.57	0.90	1.041	176.3	
00:00:27	1.41	2.61	0.84	0.935	159.0	
00:00:30	1.44	2.43	0.82	0.919	156.5	
00:00:34	1.43	2.46	0.84	0.947	161.6	
00:00:38	1.46	2.29	0.83	0.960	164.5	
00:00:41	1.40	2.25	0.80	0.936	160.7	
00:00:45	1.44	2.25	0.78	0.956	163.6	
00:00:49	1.39	2.27	0.77	0.921	157.4	

Phase
- 0 = -------
- 1 = Rest
- 2 = Warm-up
- 3 = Exercise
- 4 = Recovery
- Marker: +10

OK / Cancel / Preview / Filtering... / Delete step / Advanced... / Restore... / Overwrite... / ?

Test n. 21   Step n. 1 / 230   Duration: 00:16:15

Data filtering

Select Filter Type

Filter
- Discard invalid steps — Details...
- Averaging — 00:24
- Smoothing — Points: 3

FILTER / OK / Cancel / ?

1. Choose **Edit test** from the **Test** menu.
2. Press the button **Filtering** and choose the option **Discard invalid steps** to automatically eliminate all the invalid steps
3. Press the button **Filtering** and choose the option **Averaging** and type the desired value for points Ave/smooth to perform an averaging of the all acquired steps. This feature reduces the size of the original test.
4. Press the button **Filtering**, select the option **Smoothing** and type the desired value for **points**. This feature doesn't reduce the size of the original test, although it smoothes the fluctuation of data.

Using the User fields

The software is provided with three free fields in which the user may enter values coming from others devices such as lactate, blood pressure etc.

To define the user fields:

1. Choose **User Fields** from the **Options** menu
2. Type the desired text in the input fields and press **OK**.

To enter values in the user fields:

1. Choose **Edit test** from the **Test** menu.
2. Scroll horizontally until the fields USER 1, 2 and 3.
3. Enter the desired values and press **OK** to confirm.
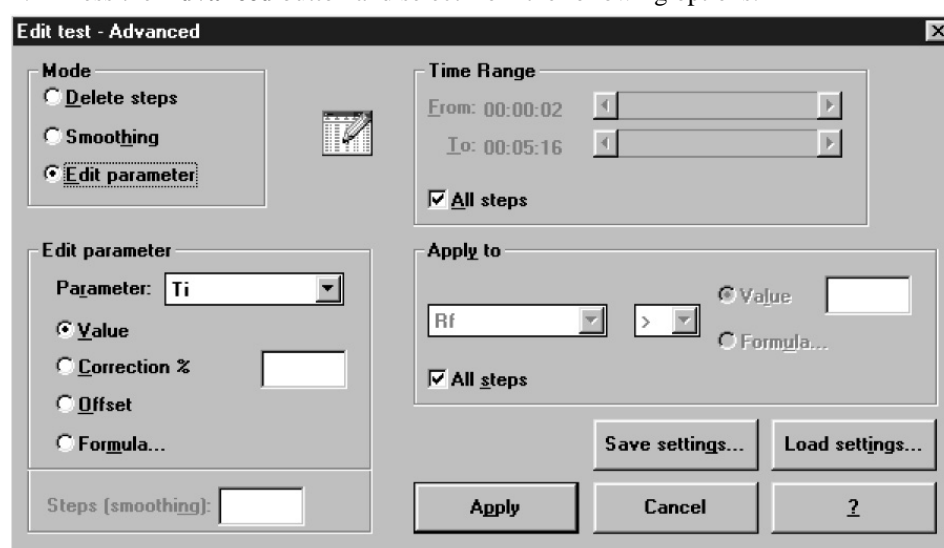
Deleting steps

This feature is useful whenever some steps acquired during the test are to be discarded (steps acquired before the start of the test, patient disconnected from the face mask....).

1. Choose **Edit tests** from the **Test** menu.
2. Position the cursor on the step you want to delete and press the button **Delete step**.

Advanced Editing

This feature allows to perform some advanced editing of the data stored in the software.

1. Choose **Edit test** from the **Test** menu.
2. Press the **Advanced** button and select from the following options:

Option	Function
Delete steps	deletes the steps meeting the selection criteria
Smoothing	applies a moving average to the selected parameter
Edit parameter	edits a parameter according to the selected criteria

Edit parameter	Specifications
Value	replaces the value of the selected parameter with a new one.
Correction %	applies a percentage correction to the value of the selected parameter.
Offset	adds an offset to the value of the selected parameter.
Formula...	replaces the value of the selected parameter with a mathematical function.

Time range	Specifications
From, To	specifies the time range.
All steps	applies the editing from the beginning to the end of the test.

Apply to	Specifications
Parameter	specifies the reference parameter
>, >=, =, <, <=, <>	higher than, higher or equal, equal to, lower than, lower or equal, different
Value/Formula…	specifies the value (mathematical expression) compared with the value of the specified parameter.
All steps	do not use any selection criteria.

Restore the original test

To cancel all the editing, in the "Edit Test" dialog box press the **Restore** button, confirm your choice by pressing **yes**.

Overwrite the original test

To save all the editing, replacing the original test with the modified one, in the "Edit Test" dialog box press the **Overwrite** button, confirm your choice by pressing **yes**.

Customise the desktop

Customise the display colours

1. Select **Colors** from **Options** menu.
2. Select the item to be modified.
3. Press **Change** and select the desired colour.

Smart edit

This function is useful to correct data from artefacts; the noise affecting the measured data can be reduced in 2 different ways:

Graphical noise suppression	using the mouse
Threshold noise suppression	applying a filter to the measured data
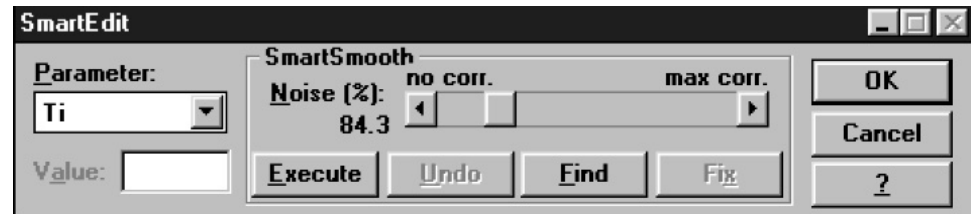
Apply the graphical noise suppression

1. Make active a graph or a data window corresponding to the test that you want to modify.
2. Press the **right key** of the mouse and select **Smart Edit**.
3. Select the parameter that you want to modify.
4. Point the mouse on the position where the graph presents the artefacts, click the **Right key** and, keeping pressed the key, drag the point on the desired place.
5. If you want to cancel the edit press the **Left key** of the mouse.
6. Repeat the above mentioned procedure for the all parameters and press **OK**.

Apply the threshold noise suppression

1. Make active a graph or data window corresponding to the test that you want to modify.
2. Press the **Right key** of the mouse and select **Smart Edit.**
3. Select the parameter that you want to modify.
4. Set a **Noise(%) Threshold** (as a percentage of the parameter value) above which any peak will be considered an artefact.
5. Press **Execute** and eventually **Undo** if you are not satisfied.
6. Press **OK** to confirm.

Customise the parameters

The software allows the user to create customised parameters and predicted values, derived from the standard parameters (the ones that are calculated by default) through any mathematical formula.

All the customised parameters can be used freely for viewing and printing purposes.
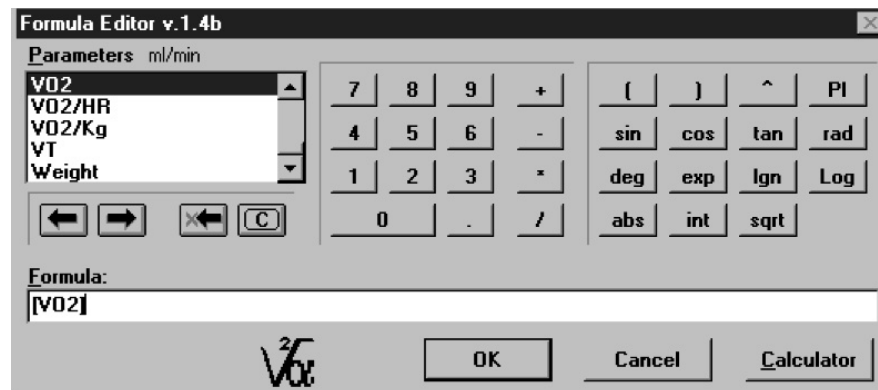

Create a new parameter

1. Choose **Customise parameters** from the **Options** menu.
2. Press the **New** button if you want to create a new parameter or **Modify** if you want to modify an existing one
3. Type the desired value in the fields "Name", "unit of meas", "integers", "decimals" and "summary" (to present the parameter in the summary) and press the **Formula** button.
4. Insert the mathematical formula by using the appropriate tools and press **OK** twice to confirm.

Create a new predicted parameter

1. Choose **Customise predicted** from the **Options** menu
2. Press the **New** button if you want to create a new parameter or **Modify** if you intend to modify an existing one
3. Type the desired value in the fields "Name", "unit of meas", "integers", "decimals".
4. Select the group of the predicted values from the options boxes.
5. Select the reference parameter in the "Compared to" list box.
6. Press the buttons in the calculation group and insert the mathematical formulas for men and women, adults and paediatrics. Press **OK** twice to confirm.

Once you create the new predicted you can see it in the predicted window.
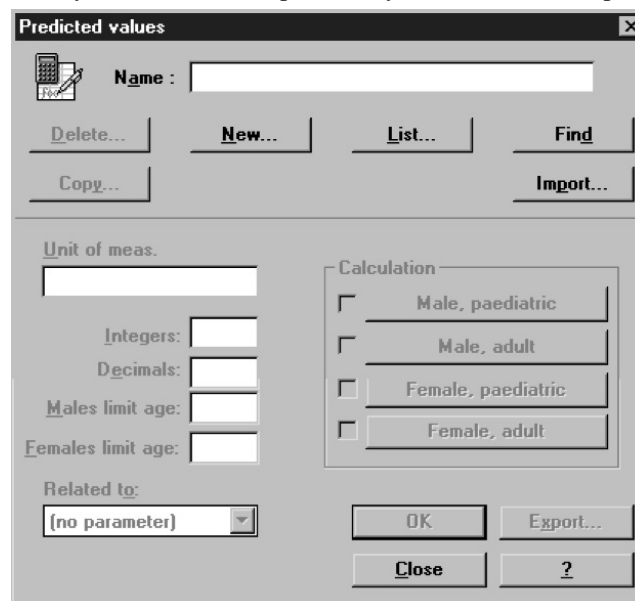
Exporting data

With this function you can export the tests data and parameters in different file formats:

- *.xpo (Cosmed proprietary file format)
- *.txt (ASCII)
- *.xls (Microsoft Excel)
- *.wk1 (Lotus 123)

Export a test

1. Choose **Export Tests** from the **Test** menu.
2. Select the test to export from the list box and press **OK** to confirm.
3. Select the file output format from the list box, click on ***.xpo, *.txt, *.xls** or ***. wk1.** If you selected ASCII format, by clicking on **Text** button you can then select the **Thousands sep.** and **Column sep.** according to the program you want to use. With the **xpo Cosmed format** you can import/export the tests performed on another K4 b² equipment.
4. Select the folder, type the file name and press **OK** to confirm.
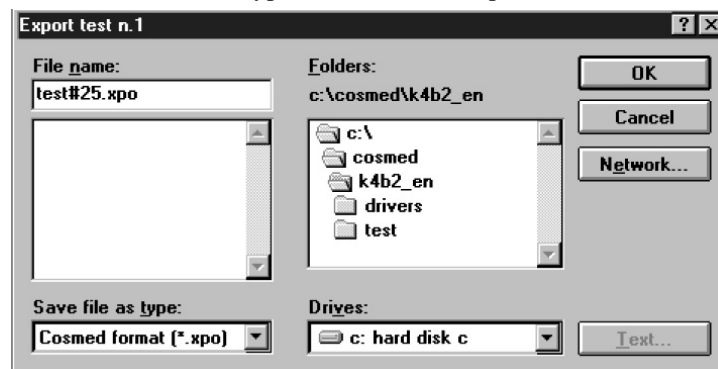
DDE with Excel

If Microsoft Excel is installed on your PC, you can export a test simply pressing a button on the toolbar.

To send a test to Excel, select **Send to Excel** from the **Test** menu.

The program will show a status bar indicating the data transmission to Excel. At the end of the process a new sheet with all test data will be opened ready to be edited with the powerful functions of Microsoft Excel.

Creating Test Protocols

The software allows to create different exercise protocols to use during the test. The load of the ergometer is automatically controlled by the software that change it according to the defined protocol.

Create a new protocol

1. Choose **Real Time > Ergom. Tests Protocols** from the **Options** menu.
2. Press **New** and enter a name for the protocol.
3. In the field "Message Time" type a number that means to get a message to advise when switching to the next load.
4. Enable the "Drive Ergometer" check box to let the software control the ergometer. Select the "Initial Command" if the ergometer need it.
5. Enabling the option "Relative Increments", the loads refer to the previous step.
6. Press **Generate** and enter the values to generate a protocol from only one load (i.e. 30 Watt each minute for a total of 20 steps) and press **OK** to confirm.
7. Press **Add** if you want to add a new step.
8. To edit a step, select it from the list and change the relative values in the **Edit** boxes below the list. Press the Tab button to save changes.
9. To delete a step, highlight the step and press **Delete**.

Software configuration

The software can be customised as you wish. Most of the feature are easily editable to be tailored according to different purposes.

Data viewing

The software allows to calculate a huge number of parameters; it is advisable, in order to simplify the analysis of the results, view in the data window the only desired parameters.

Select the parameters to view
1. Choose **Parameters to view/Test visualisation…** from the **Options** menu.
2. Select the parameters you require to view.
3. Press **OK** to confirm the selected configuration.

Select the parameters to view during the test
1. Choose **Parameters to view/Test execution…** from the **Options** menu.
2. Select the parameters you require to view.
3. Press **OK** to confirm the selected configuration.

Sort the parameters
It is possible to sort the parameters (both for viewing and printing purposes) according to the desired order.
1. Select **Sorting parameters** from the **Options** menu.
2. Move the parameters in the order you want by pressing and holding the left mouse button.
3. Press **OK** to maintain the current configuration.

Steady State

The program has an algorithm to tag sets of steps as Steady State.

The algorithm considers belonging to the Steady State the only consecutive steps that meet the following conditions:

- The value of VO2, VE and R do not vary from their mean values more than **Threshold (%)**;
- The number of consecutive steps that met the preceding criteria are at least **Minimum number of steps**.
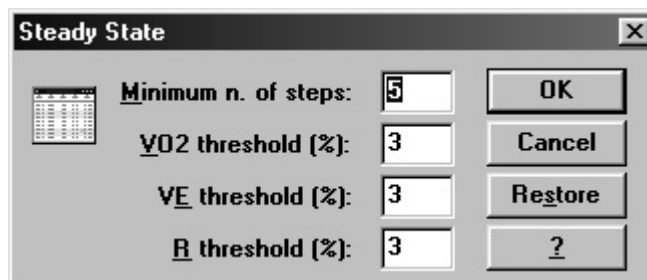
Customise the Steady State detection criteria
1. Choose **Steady State** from the **Options** menu
2. Type the desired values for **Minimum number of steps**, **VO$_2$ threshold (%)**, **VE threshold (%)** and **R threshold**.

The steps which satisfy these conditions will be highlighted with a yellow bar.

Printout reports

The software allows the user to printout data and graphics according to 4 customisable reports. Further it allows the user to customise a printout header that will be printed in each page.

Set up the printout

1. Choose **Reports** from the **Options** menu.
2. Define the desired features of the report and confirm. Enabling the option "Graphs in one page" all the graphs selected in the report will be printed in one page.
3. Type the name you want apply to the report and press **OK** to save changes.

Reports Configuration				
Report n. ⦿ 1 ○ 2 ○ 3 ○ 4		**Printed pages** ☐ Test data ☑ Predicted values ☑ Lactate threshold ☐ Test summary		
Name: Wasserman ☑ Graphs in one page		Parameters... ☐ Comments		

Graphs

Print	Y1 Axis	Y2 Axis	X Axis	
N.1 ☑	VE	Load1	t	More...
N.2 ☑	HR	VO2/HR	t	More...
N.3 ☑	VO2	VCO2	t	More...
N.4 ☑	VE	(no graph)	VCO2	More...
N.5 ☑	HR	VCO2	VO2	More...
N.6 ☑	VE/VO2	VE/VCO2	t	More...
N.7 ☑	VT	(no graph)	VE	More...
N.8 ☑	R	(no graph)	t	More...
N.9 ☑	PetO2	PetCO2	t	More...
N.10 ☐	Rf	(no graph)	t	More...
N.11 ☐	Rf	(no graph)	t	More...
N.12 ☐	Rf	(no graph)	t	More...

OK   Cancel   Restore   ?

Select parameters to be printed

K4 b^2 allows to print a large number of parameters; it is advisable, in order to simplify the analysis of the results, to printout desired parameters only.

1. In the report configuration window select **Parameters**.
2. Select the parameters you require to be printed in the data printout. The number of parameters which can be printed depends upon the size of the paper in use (see Printer Layout) and from the orientation of the sheet.
3. Press **OK** to confirm the selected configuration.
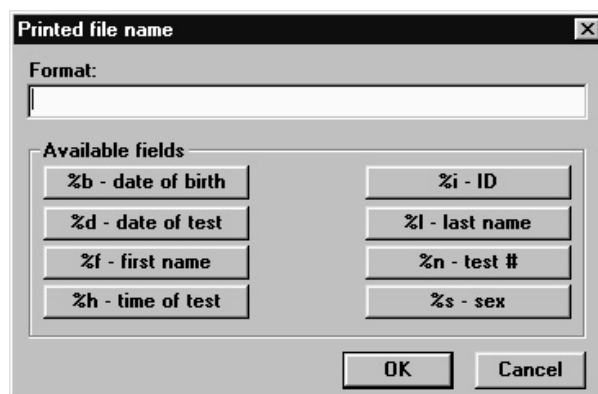
Customise the printout header

1. Choose **Printout header** from the **Options** menu.
2. On the "Report Header" dialog box type the text of the header.
3. To insert an image click the **Logo** button. An image editor will be opened, draw the own logo and close the image editor to save changes.
4. Press **OK** to save the Printout header.

Electronic reports (*.pdf)

If an Adobe PDF writer "Printer Driver" is installed and set as the default printer, it is possible to store the printout report automatically in any location of the HD or eventually LAN paths according to a customizable filename format.

It is possible to define the created filename format selecting **Options/Printout header...**, and then **Name format…**

Printed file name	☒

Format:

Available fields

%b - date of birth	%i - ID
%d - date of test	%l - last name
%f - first name	%n - test #
%h - time of test	%s - sex

OK	**Cancel**

Print the current window

The print current window function is enabled when the active window is a graph or a data report.

1. Select **Print current window** from **File** menu.
2. Press **OK** to print, or **Setup** to customise the print.

Print the customised report

This function is enabled only after having customised a report.

1. Select the customised report from **File** menu**.**
3. Set the sheet format and press **OK**.

Events management during exercise testing

By using K4 b² in serial mode, beside standard measurements, the software allows also to save some extra "events". They are so called "events" since they are not continuously stored during the test but they can be saved upon user selection.

Flow Volume loops

This test is useful during exercise to detect abnormalities in the mechanics of ventilation in patients with pulmonary/ventilatory limitations to exercise.

The test consists in acquiring some flow/volume loops during exercise at different workloads and overlapping them on the rest maximal flow/volume loop of a Forced Vital Capacity test.

The majors information that you can get from this manoeuvres are the flow reserve (flow distance from the peak flow of the F/V loop during exercise to the corresponding flow on the superimposed F/V loop at rest) and the volume reserve (volume distance from the maximum volume of the F/V loop during exercise to the corresponding volume on the superimposed F/V loop at rest).

The manoeuvre consists in the following phases:

- Acquiring some Flow/Volume loops during the exercise
- Making the patient inspire completely up to TLC level (this is necessary to place the loop correctly into the rest F\V loop of the forced Vital Capacity test)
- Overlapping the F/V loop acquired during exercise and the F/V loop performed at rest.

Flow Volume loop during the test

1. Start with normal Exercise test and begin the memorisation of breath values (**F2**)
2. During a steady state select **F/V loops** form **Test/Event...**
3. As soon as 2 or 3 complete loops have been acquired ask the patient to inspire completely up to TLC level and press **F3** to stop the acquisition.

O2, CO2 vs Time

The O2, CO2 event is useful to check the real-time readings of the O2 and CO2 signals during the test.

O2, CO2 vs Time during the test

1. Start with normal Exercise test and begin the memorisation of breath values (**F2**)
2. During a steady state select **O2, CO2 vs Time** from **Test/Event...**
3. As soon as 5 or 6 complete breaths have been acquired press **F3** to stop the acquisition.
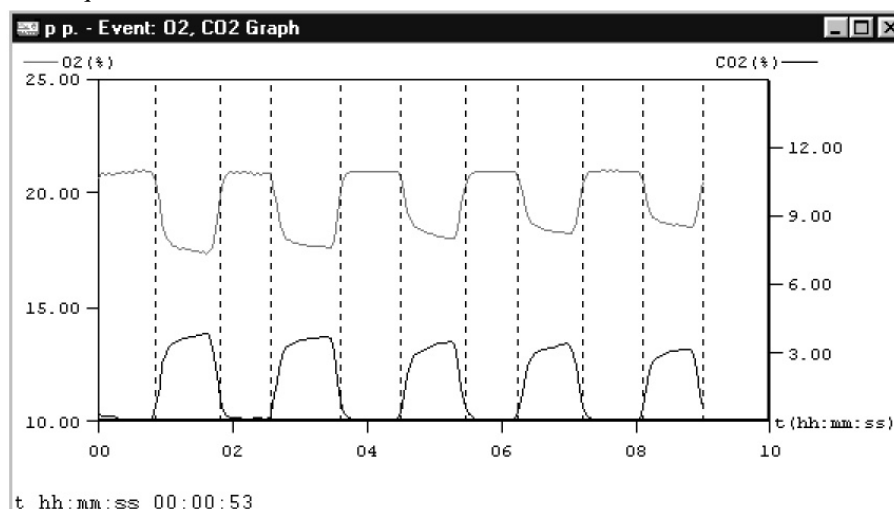
O2 Saturation (optional)

The O_2 Saturation event is useful to check the quality of SpO_2 signal acquired by the on-board Oxymeter (if available) during the test.

O2 Saturation during the test

1. Start with normal Exercise test and begin the memorisation of breath values (**F2**).
2. Select **O_2 Saturation** from **Test/Event...**
3. As soon as 5 or 6 complete pulses have been acquired press **F3** to stop the acquisition.

Spirogram

The spirogram event allows to display and store the volume/time plot.
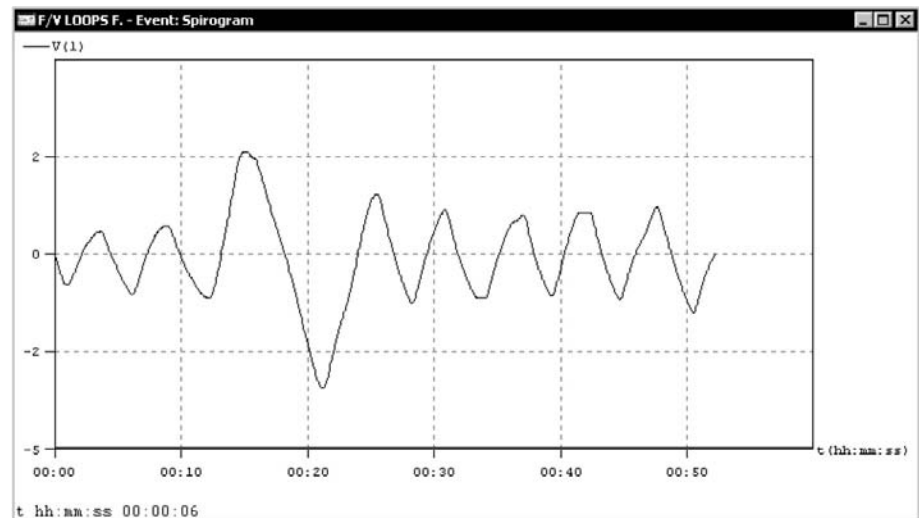
Spirogram during the test

1. Start with normal Exercise test and begin the memorisation of breath values (**F2**).
2. During a steady state select **Spirogram** form **Test/Event...**
3. Acquire volume/time plot until the window is filled and press **F3** to stop the acquisition.

View the events after the test

1. Select **Data...** from the **View** menu
2. Select the test during which spirogram event has been carried out in the list box and press **OK**
3. Select **View...** from the **Events** menu, choose the desired event and press **OK.**
4. Select **Print Current Window...** from the **File** menu to print the F/V curve page.

It is possible to edit the F/V loops event in the following way:

5. Select **Edit...** from the **Event** menu to change the F/V loop at rest (the list contains all the FVC test carried out by the same Patient with the Spirometry software) and press **OK.**

It is possible to edit the Cardiac Output event in the following way:

5. Select **Edit...** from the **Event** menu to change the parameters measured during the steady state before the rebreathing, the CO_2 concentration at the equilibrium and the calculation method.

Raw data

It's a particular feature with which the user can check and save some parameters (CO_2 output, O_2 concentration and volumes) in Ascii file format in a archive apart at a sampling rate of 25 Hz.

Save Raw data

1. During the test choose **Event** from **Events** menu.
2. Select Raw Data from the list.
3. On the save data box give a name to the file and select the destination folder.
4. To stop saving Raw data press the **stop** icon or press **F3** on the keyboard.