CACYVO for WINDOWS

Introduction & first steps

Main Menu

Technical reference
Possible errors
Ordering information

Important
When *CACYVO* is started, the symbol "Graphics Server " appears on the bottom of your screen. Do not close this application as *CACYVO* needs it   for exchangeing graphics via the clipboard .

Open CV
Overlay CV
Delete CV(RAM)
Save CV
Save CV as

Import CV
Export CV

Print CV
Printer Setup...

Exit

Zoom
Normal Size

Data Cursor
Partial CV

Shift CV
Add/substract CV

Copy to clipboard
Save graphic

Function generator
Experimental conditions
Preferences

Data acquisition

CV-Filters
Reduce Data

Spreadsheet

2-Dim-Settings
i-normalization
Mouse coordinates

3-Dim Parameters
Show 3-D

ip, Ep -Evaluation
Q-Evaluation
Assign Peaks
Delete evaluation
Peak auto detect

Single CV mechanism
Show kinetic data
Analyse serie of CV

<u>Contents</u>
<u>Search for...</u>

<u>Registration...</u>
<u>Info</u>

Open CV (Menu File)

Loads a CV from disk. If you have not saved the current CV, all changes will be lost.

Shortcut
<Ctrl> + <O> or "open file" button in the <u>button bar</u> .

🗁 "open file" button
_____
Dialog Box Options

File Name

Select the file you want to open. Either type the name of the file or select it from the list.

Drives

Select the drive in which the file you want to open is stored.

Directories

Select the directory in which the file you want to open is stored.

List of file types

Select the type of file (BIN, CVW or CVD) you want to open.

Related topics:
<u>Overlay CV</u>
<u>Save CV (as)</u>
<u>Import CV</u>

(c) 1995 by L.Walder and B.Flückiger

Overlay CV (Menu File)

Loads a CV file onto yet displayed CV(s). Overlaid CV's can only be saved in single files.

Shortcut
<Ctrl> + <V> or "overlay file" button in the button bar .

 "overlay file" button

3-dimensional representations are possible from overlaid CV's. The Add/subtract option is only available if two CV's are overlaid.

_____
Dialog Box Options

File Name

Use to select the file you want to overlay. Either type the name of the file or select it from the list.

Drives

Use to select the drive in which the file you want to open is stored.

Directories

Use to select the directory in which the file you want to open is stored.

List of file types

Select the type of file (BIN, CVW or CVD) you want to open.

Related topics:
Open CV
Add/subtract CV

Delete CV (Menu File)

Deletes one CV from memory. Enter the number of the CV you want to be deleted in the input box. The option is only available, if more than one CV is loaded. Any modifications and evaluations made and not stored will be lost.

Related topics:
Overlay CV

Save CV (Menu File)

Saves the current CV under the name displayed in the title bar. Only a single CV can be saved per file. Having more than one CV loaded, you have to specify it in the drop down box at the bottom of the main window before saving.
If a CV has been imported you will be asked for a new filename.
If you are altering an existing CV but you do not want to overwrite the original version use the command "save as".

Shortcut
<Ctrl> + <S> or "save file" button in the button bar .
🖫 "save file" button

CACYVO knows two modes of saving:

binary-files
text-files

The CV is saved together with the following settings/parameters:

- CV filtered? → true or false
- experimental conditions
- kinetic analysis (only one analysis per CV!)
- evaluated peak currents and peak integrals

You can check or change these values with any text editor (e.g. notepad).

Related topics
Save CV as

(c) 1995 by L.Walder and B.Flückiger

Save CV as (Menu File)

Saves an acquired CV, a new version of an existing CV or an imported CV.

Shortcut
<Ctrl> + <A>

_____
Dialog Box Options

File Name

Type a name for the new file. You may overwrite an existing file by selecting its name from the list.
The filename can contain up to eight characters and precedes the three character extension. ASCII files
saved from CACYVO have the extension „cvd", binary files „bin".

Drives

Select the drive in which you want the file stored.

Directories

Select the directory in which you want the files stored.

List Files of Type

Select the type of file to be saved, either binary or text.

binary-files
text-files

free disk space on drive [kB]

free disk space
on drive [kbyte]:
189'227

It informs you about the free space on your actual drive. When it is less than 20kB the numbers will turn
red and flash. It is suggested to change the floppy disk or to remove files from the hard disk.

used disk space on drive [%]

42.2

This status bar informs you about the available place on the actual drive.

Related Topics:
Save CV

(c) 1995 by L.Walder and B.Flückiger

Import CV (Menu File)

Allows you to import CV's from other electrochemistry programs into *CACYVO*.

Shortcut
<Ctrl> + <I>
_____
Dialog Box Options
File Name

Type the name of the file you want to import, or select it from the list. To list a different type of file, choose the type from the file type box

Directories

Select the directory in which the file you want to import is stored.

Drives

Select the drive in which the file you want to open is stored.

List Files of Type

• PAR, Princeton Applied Research: these files commonly have the extension "dat" (The program recognizes binary and ASCII files)
• Metrohm VESUV files, these files normally have the extension ".cv"
• Autolab files with the extension ".icv"
• ASCII (*.*): any extension is possible.

For overlaying CV's from imported files you first have to save them in *CACYVO*-format.

Importing ASCII:
Select the file you want to import. You will then be asked how the E and i-values are stored, the conversion factors for i and E as well as for the row sequence of E and i.

Related topics:
Export CV
Overlay CV

(c) 1995 by L.Walder and B.Flückiger

Export CV   (Menu File)

The option creates an ASCII -file of the current CV in memory (E- and i-values) or a HPGL file of all loaded CV's (including ip, Ep-evaluations).

The HPGL -Format (*.plt or *.hgl) is a vector graphic format used for plotters.

(c) 1995 by L.Walder and B.Flückiger

Print CV (Menu File)

Shortcut
<Ctrl> + <P> or "Print button" in the button bar .

🖨️ "Print button"

Prints the current screen contents on your default printer in **landscape orientation** (see <u>Printer Setup</u>)

(c) 1995 by L.Walder and B.Flückiger

Printer Setup (Menu File)

Use this command to select the printer and printer options you want to use to print your drawing.

Printer

Selects the default printer or a printer listed in the box under Specific Printer.
Only installed printers appear in the list. You install printers through the Windows Control Panel.

Orientation

The command has no affect on printing in *CACYVO (CACYVO* always prints in landscape).

Paper

Selects the paper size and source. Click on the arrows on the right of the Size and Source boxes to see a list of options you can choose.

Options

Displays a dialog box where you can choose default options for the printer you select.

Exit (Menu File)

Ends the current *CACYVO* session.

Shortcuts
<Alt> + <F4> or <Ctrl> + <X>.

Caution: any changes since the last saving will be lost!

The next time you run CACYVO, the program will use the same settings as in the last session, i.e.:

• Window size and origin
• All settings in Display → 2-Dim settings
• Function generator setup (Potentials, current amplification, scan rate)
• RS 232 settings and <u>DAP</u> -A/D-settings
• Maximal Number of points to acquire

(c) 1995 by L.Walder and B.Flückiger

CV-Filters (Menu Filters)

The filters can be used to reduce any high frequency noise (as compared to the CV scan rate). It is recommended to filter your CV
1. if "peak autodetect" is on.
2. before data reduction

Note: In case of overlaid CV's, all CV's will be smoothed!

There are two types of filters available:

1. Golay Sawitzki
 "Golay Sawitzky" filter button

The filtering process is according to the formula:

$$i_n = \frac{\sum\limits_{a=0}^{f} (2a+1)i_{n-f+a} + \sum\limits_{a=1}^{f} (2a-1)i_{n+f-a}}{f^2 + (f-1)^2}$$

where
in is the current value of the point to be smoothed.
n is the index of the actual smoothed point (only currents are smoothed!)
f is the filter constant you have to enter in the input box.
This filter does not effect peak values severely.

2. Sliding average
 "sliding average" filter button

The filtering process is according to the formula:

$$i_n = \frac{\sum\limits_{a=0}^{2 \cdot f+1} i_{n-f+a}}{2 \cdot f+1}$$

in is the current value of the point to be smoothed
n is the index of the actual smoothed point (only currents are smoothed!)
f is the filter constant you have to enter in the input box.
The sliding average filter may reduce peak heights.

Note: In case of a sharp spark use the spreadsheet to eliminate the noise manually.

(c) 1995 by L.Walder and B.Flückiger

Reduce data (Menu Filters)

This option is used to reduce the data points. It is recommended to <u>filter</u> your data before reducing them.
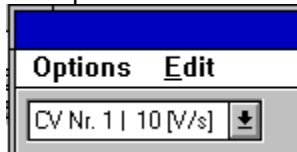
Note: All loaded CV's will be reduced!

Recommended for copying CV's to <u>clipboard</u> .
Do not evaluate peak data on reduced CV's.

Spreadsheet (Menu Filters)

The spreadsheet has an own menu with several options:

Options **Edit**

CV Nr. 1 | 10 [V/s]

How to mark an area:
1. Set the mouse cursor to the first cell you want to mark and click
2. scroll to the last cell you want to mark
3. Press the <Shift> key and click on the cell.

How to edit a cell value:
- Double click on the cell to be edited and enter the desired value or
- Click on the cell and enter any number
After editing press Enter to confirm.
CV data points can be edited, evaluated peak heights and integrals can not be edited.

Zoom (Menu Edit)

Zoomes a portion of the screen.

Shortcut
<Ctrl> + <Z> or "zoom" button in the button bar .

 "zoom" button

Click with the left mouse button on an edge of the region to zoom. Draw the mouse to the opposite corner of the rectangle to define the zoomed region and click.

On the right and lower side of the window two scroll bars appear. You can scroll through the CV by clicking the arrows on the scroll bar, by clicking on the scroll bar itself or by dragging the scroll bar square.

Related Topic
Normal size

Normal Size (Menu Edit)

Displays the CV's in the memory in the original size.

Shortcut
<Ctrl> + <N> or "normal size" button in the button bar .

"normal size" button

Use this button also to redraw the CV's if they are not properly displayed.

Related topic
Zoom

(c) 1995 by L.Walder and B.Flückiger

Data Cursor (Menu Edit)

A cursor is placed on the first point of the CV (the first CV in case of overlaid CV's). The coordinates are displayed in the <u>button bar</u>. It can be moved along the data points of the CV.

velocity of the cursor:

Slow:
press <←> or <→> key
Intermediate:
press <Shift> and <←> or <→> key simultaneously.
Fast:
press <Ctrl>, <Shift> and <←> or <→> key simultaneously.

Jump to next CV (in case of overlaid CV's):
press <> key
 Jump to previous CV (in case of overlaid CV's):
press <↓> key

Use cursor for marking and cut a part of a CV
1. Move the cursor to the first limit.
2. Press the space bar.
3. Move the cursor to the second limit. The selected partial CV is displayed in a different color.
4. Press the space bar

You can display the whole CV again by disabling "partial CV" in the "Edit" menu.

When you overlay a CV while "Partial CV" is active, the "Partial CV"-option is deactivated.

Related topic
<u>Partial CV</u>

(c) 1995 by L.Walder and B.Flückiger

Partial CV (Menu Edit)

This option is only available if you have set two limits on a CV. You can toggle between "Partial CV" and full CV by clicking the "Partial CV" option.

Related topic
Data Cursor

Shift CV (Menu Edit)

This option lets you shift the latest loaded CV horizontally and/or vertically.

It is used to display several CV's on a single screen with the "reference i" option (Menu "2-dimensional options").

(c) 1995 by L.Walder and B.Flückiger

Add/subtract CV (Menu Edit)

This option is only available if **two** CV's are loaded. Both CV's must have the same scan rate, number of points and potential limits.
You have the following options:

CV Nr 1 - CV Nr 2
This will subtract each current value of CV number 2 (the latest loaded CV) from the corresponding value of CV number 1 (the prior loaded CV).

CV Nr 1 + CV Nr 2
This will add each current value of CV number 2 to the corresponding value of CV number 1.

(c) 1995 by L.Walder and B.Flückiger

Copy to clipboard (Menu Edit)

Shortcut
<Ctrl> + <Ins>.

This option lets you copy the graphic to <u>clipboard</u> and insert it in any *Windows* application that supports graphics, such as *Word for Windows, Corel Draw, Write* etc.
In Word and Corel Draw the graphic is copied as *Windows* <u>metafile</u>, in Write it is copied as <u>bitmap</u>.
You can edit the graphics in *Corel Draw* (after „ungrouping") or in *Word* (double click the graphic).

Known bugs
Grid lines are not displayed properly in *Corel Draw*. However, you can define the shape of the grid lines as follows:
Ungroup the graph in *Corel Draw* then select the appropriate line type for the grid lines.
Mark the grid lines and click "apply" in the line combo box of *Corel Draw*.

CACYVO may copy the graph not properly to Clipboard, e.g. only the axis are displayed when you insert the graphic in *Word* or *Corel Draw*. This is a bug of <u>*Graphics Server*</u>.
In this case you have to exit from *CACYVO* and start it again. If that doesn't help, exit Windows and restart it.

Related topic
<u>Save graphic</u>

(c) 1995 by L.Walder and B.Flückiger

Save graphic (Menu Edit)

The option lets you save all loaded CV's in the metafile format. Many other Windows applications recognize this format, e.g.*Word for Windows, Corel Draw.*

Known bug
CACYVO may save the graph not properly to disk, e.g. only the axis are displayed when you import the graphic in *Word* or *Corel Draw*. This is a bug of *Graphics Server* .
In this case you have to exit from *CACYVO* and start it again. If that doesn't help, exit Windows and restart it.

Related topic
Copy to clipboard

(c) 1995 by L.Walder and B.Flückiger

2-Dim-Settings (Menu Display)

This dialog box allows you to control the 2-dim-display of the CV's.

Shortcut
<Ctrl> + <D> or "2-Dim-Settings" button in the button bar .
[D] "2-Dim-Settings" button

_____
Dialog Box Options

Line styles / colors

Different line styles
If this check box is in the case of overlaid CV's, the CV's are shown in different line styles.
 Different colors
If the check box is enabled, overlaid CV's are displayed   and printed in different colors.
Symbols only
If the check box is enabled the CV's will be represented by different <u>symbols</u>   without connecting lines.
Display peak evaluation
Only if this check box is enabled, evaluated data are displayed.

E- and i-direction
Gives you complete control over the direction of the current and voltage axes.

Font
The two options are Arial and Times New Roman (Font size: 10 to 20 points). Further font types and sizes can be used after importing the graph into Corel Draw or Word.

Axes position/height

default settings
If the option is enabled, the origin of the axes is moved to the left down corner.
E-axis intersects i-axis at [μA]
You can position the E-axis at any current within the limits indicated in the gray field below.
 i-axis intersects E-axis at [V]
You can position the i-axis at any current within the limits indicated in the gray field below.
 Grid
Selecting this field will display a grid, with a frequency determined by the major tick settings.
Notes: The "**reference i**" check box is not enabled if the "**Grid**" check box is selected! The grid is not displayed properly in *Corel Draw.* See also <u>Copy to clipboard</u>.
reference i
You can change the origin and length of the reference current by the settings in the corresponding boxes.
Note: The "**Grid**" check box is not enabled if the "**reference i**" check box is selected!

PREVIEW
A preview of the CV is displayed upon clicking according to your settings.

ticks/line/caption settings
default caption
The default caption of the axis are displayed.
ticks outside
The ticks are displayed outside of the axes if selected, otherwise inside.
E-axis resp. i-axis:
        caption

Only available if "default caption" is not selected. Lets you annotate the E and I axes.

#maj. ticks

Select the number of major ticks and the frequency of the grid.

#min. ticks

Select the number of ticks between the major ticks.

line thickness

Determines the thickness of the lines of the axis and the CV's. Values between 1 and 4 are accepted.

i-normalization (Menu Display)

You can toggle between the following current normalizations:

- 1 (no normalization with sweep rate)
- 1/
$$\sqrt{\text{sweep rate}}$$
- 1/sweep rate

Dependent of the above normalization you can toggle between current and current density.

Note:
If you evaluate currents the program uses always non-normalized values.

- Charge calculation is only possible if no normalization is selected.
- The program only displays a reference i, if no normalization is selected (see 2-Dim-Settings).

(c) 1995 by L.Walder and B.Flückiger

Mouse coordinates (Menu Display)

Enables or disables the indication of the mouse coordinates.

(c) 1995 by L.Walder and B.Flückiger

3-Dim Parameters (Menu Display)

CACYVO lets you display overlaid CV's in a perspective 3-Dim fashion. The 3rd dimension is any of the parameters shown below.

_____
Dialog Box Options

3rd Dimension:
Any of the following parameters can be chosen for the 3rd dimension:
- *Number of CV*
- *Sweep rate*
- *El.act. sp.*
- *Electrolyte*
- *Other add.*
- *Temperature*
- *Time*

z-axes scale:
linear or logarithmic.

Angle:
Any value from 0 to 90° is allowed. It may be changed via the text box or via the scroll bar.

Rel. length of z-axis:
You can change the rel. length from 0% to 100%. For 2 to 5 loaded CV's a value from 20% to 40% is recommended, for 6 to 10 loaded CV's, a value from 40% to 100%.

The above selections show up if Show 3-D option is on.

(c) 1995 by L.Walder and B.Flückiger

Show 3-D (Menu Display)

Displays the CV's in three dimensions according to the settings in the <u>3-Dim Parameters</u>. This option is only active if several CV's are overlaid (see <u>Overlay CV</u>).

Function generator (Menu Acquisition)

This option lets you program the function generator.

Shortcut
<Ctrl> + <F> or "function generator" button in the button bar .

🔣 "function generator" button

Note:
If you have an AMEL 568, connected with a serial cable (RS232) to the computer, the program programs the function generator.
Even with a manually set function generator you have to define the function generator settings here, in order the program knows how the set the A/D converter.
_____
Dialog Box Options

Potentials (1-14)
Enter the starting potential, the switching potential(s) and the final potential in Volts. You can enter up to 14 and at least two potentials.

Scan rate
Enter the scan rate. Integer values from 1 to 1024 are accepted. You can toggle between "V/s" and "mV/s". The DAP 800/3 can handle scan rates from 20mV/s up to 500V/s.

Current amplification
Enter the current amplification (1 Volt corresponds to xx Ampères). You can toggle between "A", "mA" , "mA" and "nA". If the current amplification is too low the program indicates that after acquisition.

Initial / Final delay
Enter the equilibration (closed circuit) time for the experiment. Integer values from 1 to 1024 are accepted. You can toggle between   "min", "sec", "msec" and "msec". For continuos acquisition a low value of 20ms is recommended.

OK
Closes the function generator window.

continuous scans...
Shows an additional dialog box option for the specification of the continuos acquisition. Continuos acquisition is possible from few minutes to several hours. You can define how many CV you like to store on disk (a few up to several hundreds).

_____
Additional Dialog Box Options

target path
Lets you select the target path of the continuous acquisition files in the directory list below.

drives (HDD only)
Lets you select the target drive of the continuous acquisition files in the drive list below. Only the hard disk is allowed for continuos acquisition.

reset
resets the "#cycles" and "save every" value to "1"

autosave parameters
  filename (4 lets.)
Lets you enter the common filename of the files. Only 4 letters are allowed. The program adds the second part of the filename as a number from 0001 to 9999.
  #cycles
Lets you enter the number of cycles the function generator has to do. Depending on the computer you are using and the scan rate the program may not count all CV's executed by AMEL.
  #save every
Lets you determine how many CV's you want to save during acquisition. The program saves the first and then every x-th file (x in this box).

available/needed place [kB]
Shows the needed and available place for the continuos acquisition experiment on your hard disk. If the needed place is larger than the available place, it turns from green to red. . It is recommended to reduce #cycles and/or to increase #save every.

Continuos scans limitations:
The continuos scans option was tested with an 486-DX2/66 PC and an DAP 800/3 A/D-board. With this equipment a maximum scan rate of 200mV/s is suggested. Higher scan rates may cause data loss.

Note:
CACYVO disables the windows screen saver during data acquisition to prevent information loss. Third party screen savers should be disabled manually before working with CACYVO.

(c) 1995 by L.Walder and B.Flückiger

Experimental conditions (Menu Acquisition)

Shortcut
<Ctrl> + <E> or "Experimental conditions" button in the button bar .

"Experimental conditions" button

Lets you define the experimental (chemical) conditions related to the actual CV. Date and time is updated by the program.

Abbreviations:

w.e.	working electrode (string)
surf. w.e. [cm^2]	surface of the working electrode (num. var.)
r.e.	reference electrode (string)
r.e. vs NHE [V]	reference electrode as compared to NHE (num. var.)
a.e.	auxiliary electrode (string)
elyt	electrolyte (string)
[elyt][mol/l]	concentration of the electrolyte in mol/liter (num. var.)
elact.sp.	name of the electroactive species (string)
[elact.sp.][mol/l]	concentration of the electroactive species (num. var).
surf. confined	surface confined or homogenous (string, "h" or "s")
temp [°C]	temperature (num. var.)

Preferences (Menu Acquisition)

_____

Dialog box options

Serial Port:
Define the settings of the serial port (important only if you use the AMEL 568).

Additional options:
Amel 568 function generator
Make sure that this check box is marked if you use the AMEL 568.
Microstar simultan board
Make sure that this check box is marked if you use the microstar simultan board.

Number of points/CV to acquire
You can define the resolution of the CV. Values from 800-1000 data points are recommended for a single CV. For two scans use 1500 points. At very high scan rates the program reduces the number of data points.

DAP Performance [cycles/s*channel]
This value is determined by the performance and configuration of you DAP board. Use the values indicated in the DAP performance settings.

(c) 1995 by L.Walder and B.Flückiger

Data acquisition (Menu Acquisition)

Shortcut
<F9> or "Data acquisition" button in the button bar .

 "Data acquisition" button

_____
dialog box options

OK
Starts the acquisition. Previously loaded or acquired CV('s) will be lost.

cancel
Escapes the acquisition. Previously loaded or acquired CV('s) are not lost.

Note:
CACYVO disables the windows screen saver during data acquisition to prevent information loss. Third party screen savers should be disabled manually before working with CACYVO.

(c) 1995 by L.Walder and B.Flückiger

ip, Ep -Evaluation (Menu Analysis)

This option lets you evaluate peak heights and potentials (follow the messages in the information bar at the bottom of the window).

Shortcut
<Ctrl> + <i> or "ip, Ep -Evaluation" button in the button bar .

🔼 "ip, Ep -Evaluation" button

1. set the turning point of the tangent:
Move the mouse cursor to the turning point of the wave to be evaluated and click.

2. set the slope of the tangent:
Move the mouse until the slope corresponds and click.

3. position tangent:
Move the tangent without changing its slope for a best fit. Click if done.

4. set peak:
◉ Auto detect on: Move the mouse cursor close to the peak and click (the program will position it at the accurate peak position).
◉ Auto detect off: Position the mouse cursor exactly onto the peak and click.

Note:
Evaluation of peak values is only displayed, if "**Display peak evaluation**" in the "2-dim-settings" menu is selected!

(c) 1995 by L.Walder and B.Flückiger

Q-Evaluation (Menu Analysis)

Lets you evaluate the faradayc charge (i.e. the area between the CV-trace and the capacitive contribution). Follow the messages displayed in the information bar at the bottom of the window.

Shortcut
<Ctrl> + <q> or "Q-Evaluation" button in the button bar .

"Q -Evaluation" button

1. set the turning point of the tangent:
Move the mouse cursor to the turning point of the wave to be evaluated and click.

2. set the slope of the tangent:
Move the mouse until the slope corresponds and click.

3. position tangent:
Move the tangent without changing its slope for a best fit. Click if done.

4. Set left and right limit of integration:
Position the cursor at the left integration limit and click. (+) will appear at this position. Now position the cursor at the right integration limit and click.
The result of integration is displayed μC.

Note:
The charge is only displayed, if "**Display peak evaluation**" in the "2-dim-settings" menu is selected!

(c) 1995 by L.Walder and B.Flückiger

Assign Peaks (Menu Analysis)

An anodic and a cathodic peak can be assigned to each other, if they are evaluated (See <u>ip, Ep Evaluation</u>). Certain <u>single CV mechanisms</u>, e.g. Erev-Cirrev, can only be evaluated if two peaks have been assigned.

1. Position the mouse cursor next to the cathodic peak to be assigned. Upon recognition, the peak is marked with a red circle. Click the left mouse button to confirm.
2. Position the mouse cursor next to the corresponding anodic peak   and click. Upon recognition, the peak is marked with a red circle and the two assigned peaks with the same blue number. Assigned peak are stored as pairs to the file upon saving the CV.

The program assigns the peaks and displays a blue number next to the Ep-value of the peaks. (See important note!) Corresponding peaks have corresponding numbers.
Assigned peaks are also stored to file.

Important note:
Assigned peaks are only marked, if 'Display integral/peak' in the <u>2-dim-settings</u> menu is selected.

(c) 1995 by L.Walder and B.Flückiger

Delete evaluation (Menu Analysis)

Evaluated data (ip, Ep, Q, assigned peaks) of all loaded CV's are deleted.

Peak auto detect (Menu Analysis)

If selected, the mouse cursor jumps automatically onto the closest peak upon mouse click during <u>ip, Ep evaluation</u>. If disabled, the effective mouse cursor position at the click is read as peak position during ip, Ep evaluation.
Note: Use auto-detect only on reasonably smooth CV's

(c) 1995 by L.Walder and B.Flückiger

Single CV mechanism (Menu Analysis)

The following mechanistic cases are curently available:

E (rev)   assigned couple only
E (rev2)
E (q-rev)   assigned couple only
E (irrev)
E (rev) - C (irrev)   assigned couple only
E (rev) - C (cat)

E (rev2), E (irrev) and E (rev) - C (cat are active if at least one peak (anodic or cathodic) has been evaluated (see ip, Ep-Evaluation).
E(rev), E (q-rev) and E (rev) - C (irrev) are available only if a pair of waves have been evaluated and assigned (see Assign Peaks).

Important note: Only one mechanistic case per CV can be stored on disc.

Show kinetic data (Menu Analysis)

Displays a window with the evaluated kinetic data that can be copied to clipboard .
Mark the area to copy, then press <Ctrl> + <Insert>.
You can switch between different evaluated CV's by selecting it in the dropdown box.

(c) 1995 by L.Walder and B.Flückiger

E (rev) (Menu Single CV mechanism)

Criteria: peak separation must be 60/n [mV].
Needs an assigned pair. The program calculates n, D or [el.act.sp] according to [1]:

$$E^0 - \frac{E_{pa} + E_{pc}}{2}$$ is solved vor E°

$$Ep_a - Ep_c = \frac{2.303RT}{nF}$$ is solved for n

$$ipc = 0.4463nFAC_o^{'}\sqrt{\frac{nF}{RT}nD_o}$$ is solved for Do resp. DR

Note: A warning message will appear, if the program is forced to make a division by zero. In this case check the corresponding fields for their values. If Do or DR is known, the program can calculate the concentration of the electroact. species (click the selection box).
Calculated values are displayed in red.

(c) 1995 by L.Walder and B.Flückiger

E (rev2) (Menu Single CV mechanism)

Criteria: peak separation must be 60/n [mV].
The program calculates D and E1/2 according to [1]:

$$E_{1/2} = E_{p/2} - \frac{1.09RT}{nF}$$ solved for E1/2

$$i_{pc} = 0.4463nFAC_o^{*}\sqrt{\frac{nF}{RT}nD_o}$$ solved for D

Note: A warning message will appear, if the program is forced to make a division by zero. In this case check the corresponding fields for their values.
Calculated values are displayed in red.

(c) 1995 by L.Walder and B.Flückiger

E (q-rev) (Menu Single CV mechanism)

Criteria: peak separation must be 64 < ΔEp < 200[mV].
Needs an assigned pair. The program calculates k° from the peak separation according to [1]:

$$Y = \frac{\frac{aD_O}{cD_R} \cdot \frac{\delta^{a/2}}{\varnothing} + k^0}{\sqrt{\frac{D_O p n n F}{RT}}}$$

$Y = f(DE_P)$ is solved for k°

Note: A warning message will appear if the program is forced to make a division by zero. In this case check the corresponding fields for their values. α influences the calculation only if DR is not equal DO. IR-compensation is just a reminder for the operator, it does not influence the calculation.
The value of Ψ is calculated according Table 6.5.2 (p. 231) in A.J.Bard, L.R.Faulkner, Electrochemical Methods, Wiley & Sons (1980).
Calculated values are displayed in red.

(c) 1995 by L.Walder and B.Flückiger

E (irrev) (Menu Single CV mechanism)

Criteria: $\Delta Ep > 200[mV]$
The program calculates k° (if E° is known), α and D according to [1, 2]:

$$E_p = E^{0'} - \frac{RT}{a \, n_a F}\left[0.78 + \ln\frac{\sqrt{D_o}}{k^o} + \ln\sqrt{\frac{a \, n_a F n}{RT}}\right] \quad \text{solved for k°}$$

$$i_p = 2..99 \cdot 10^5 n C_o^* A \sqrt{D_o n a \, n_a} \quad \text{solved for D}$$

$$\left| E_p - E_{p/2} \right| = \frac{1.857 RT}{a \, n_a F} \quad \text{solved for } \alpha$$

Note: A warning message will appear, if the program is forced to make a division by zero. In this case check the corresponding fields for their values. If not specified differently, default value (E°=0) is used for ko calculations.

Lit:
R.S.Nicholson, I.Shain, *Anal. chem.*, **36**, 706, (1964)
H.Matsuda, Y.Ayabe, *Z. Elektrochem.*, **59**, 494 (1955)
Calculated values are displayed in red.

(c) 1995 by L.Walder and B.Flückiger

E (rev) - C (irrev) (Menu Single CV mechanism)

Criteria: ipc/ipa < 0.8 or ipc/ipa > 1.2.
1.   Ox + e- ↔ Red
2a   Red → Red'   (k)
2b.   Red + Additive → Red' + Additive'   (k2nd)
The program calculates kf or k2nd accordingg to [2]:
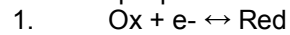
$$\frac{i_{pa}}{i_{pc}} = f(k_f t)$$

solved for kf and k2nd

Note: A warning message will appear, if the program is forced to make a division by zero. In this case check the corresponding fields for their values. The program assumes in case of a second order reaction no depletion of Additive in the reaction layer, *i.e.* (Additive) >= 10*(Ox)

The kfτ-value is calculated according to Table XI, p. 719 in Lit [2]

(c) 1995 by L.Walder and B.Flückiger

E (rev) - C (cat) (Menu Single CV mechanism)

Criteria: iplateau is independent of *v*.
1.   Ox + e- ↔ Red
2.   Red + Additive → Ox + Additive (oxidé) kcat
The program calculates kcat from [2, 4]:

$$i_{\&} = nFAC_O \sqrt{D_{additive}k_{cat}C_{additive}}$$ solved for kcat

Note: A warning message will appear, if the program is forced to make a division by zero. In this case check the corresponding fields for their values. The calculation assumes that the 'peak current' is measured at the plateau of the steady state current and that (additive) >> (el.act.species).

Lit:
R.S.Nicholson, I.Shain, *Anal. chem*., **36**, 706, (1964)
J.M.Saveant, E.Vianello, "Advances in Polarography", I.S. Longmuir, ed., **Vol. I**, p. 367, Pergamon Press, New York, 1960

Calculated values are displayed in red.

(c) 1995 by L.Walder and B.Flückiger

Contents

Loads the main window of the *CACYVO* help file.

(c) 1995 by L.Walder and B.Flückiger

Search for...

Loads the *CACYVO* help file and shows a window for context search.

The bar along the top of a Windows application that contains the control menu box, the Maximize and Minimize buttons. In CACYVO it also contains the name of the current CV.

Mouse coordinates

In this two fields *CACYVO* displays the actual coordinates of the mouse. You can switch them off by clicking on "Mouse coordinates" in the Display Menu.

CV number box

The CV number box lets you select a specific CV, if several CV's are overlaid. It is displayed in different Menus, such as the Main Menu (in addition there's the scan rate of the CV's), the experimental conditions, the spreadsheet etc.

information bar

The information bar is part of the status bar. The program informs the user about the following things:
- successful file saving
- step to do if evaluating i_p or Q_p
- actual calculations (filtering, reducing)

Analyse series of CV (Menu Analysis)

Available only if more than two evaluated CV's are overlaid (see <u>overlay CV</u> for more information).

▭	
Options	Edit

_____
Other dialog box options

Title
 You can annotate the top of the graph.

y-axis settings
>**Variable**
>Select the peak value for y-variable presentation from the drop down box.
>**Cath. or Anod. peak:**
>Select the current direction to be correlated. (Rest weglassen)
>**Y-axes caption:**
>You can annotate the y-axis. Press 'actualize graph' afterwards.

x-axis settings
>**Variable**
>Select the X-axis variable from the list:
>
>| v | scan rate |
>|---|---|
>| $(v)^{0.5}$ | $(scan\ rate)^{0.5}$ |
>| [additive] | conc. of additive |
>| [elact. sp.] | conc. of the electroactive species |
>| t (exper.) | time (continuous scans) |
>| T [K] | Temperature |
>
>**scale:**
>Chose linear or logarithmic (base 10) for the x-values
>**x-axes caption:**
>You can annotate the y-axis. Press 'actualize graph' afterwards.

actualize graph (command button)
Actualize the graph manually by pressing the button, if the changes do not show up on the graph.

drop down box
Lets you troggle between the graph and the worksheet.

calc. + show linear fit
Calculates the linear fit of the marked x-y data (third row 1=marked, 0=not marked). Edit the third row to define the limits of the linear fit.

Spreadsheet options:
Changing a value:
click or double click on the cell (as in the spreadsheet) and enter the new value.

Values not to be taken:
Enter a "0" in the "display"-row, if the values in the corresponding column

technical reference

System requirements

The program needs Windows 3.1 or 3.11, it does not run under Windows 3.0 and Windows NT.
The program was tested with a 386DX-25 with 4MB Ram, a 486DX-50 and a 486DX/2-66 both with 8MB Ram.
For easy and fast working a system with a 486DX-33 processor, 8MB Ram, a fast Hard Disk and a Windows graphic accelerator card is recommended.
The program approximately needs 1.5MB on your Hard Disk.
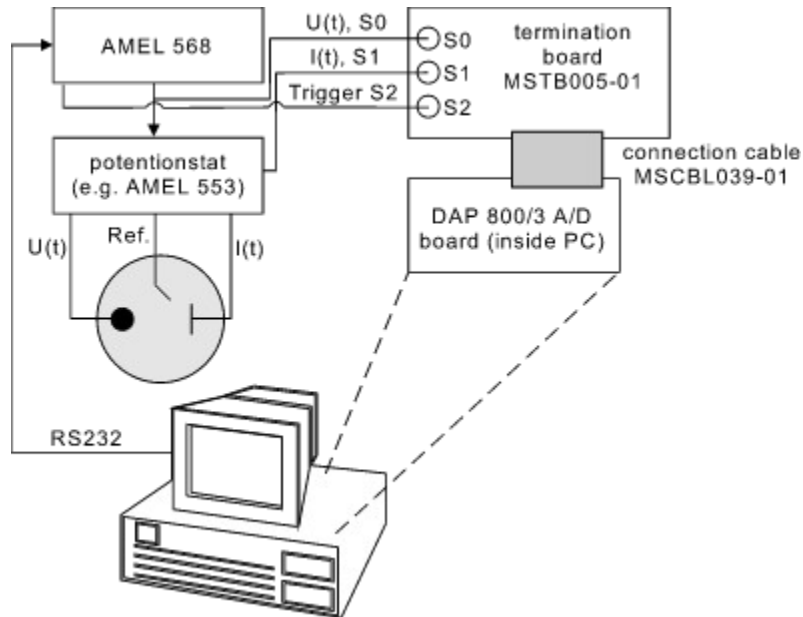
For the DAP -A/D-Converting board, a A/D rate of at least 100kcycles is recommended.

(c) 1995 by L.Walder and B.Flückiger

DAP-Board

DAP -Hardware & Jumper settings

The range of the A/D-Conversion has to be set from -5Volts to +5Volts. Make sure, that the jumpers on your board are correctly set (read your DAP-Manuals for more information).

DAP-connections & AMEL 568

DAP-connections without simultanboard & a custom Function generator
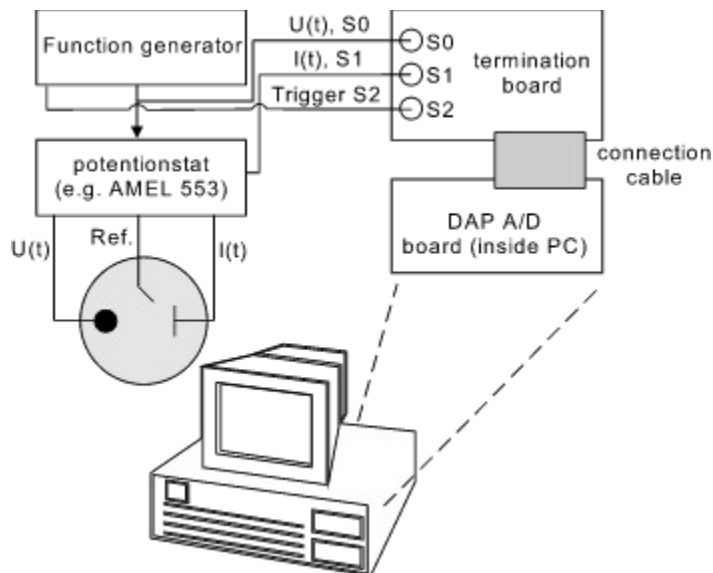
Serial cable (RS232)

The connections PC-AMEL 568 are as follows (only the 25 pin plug is shown):
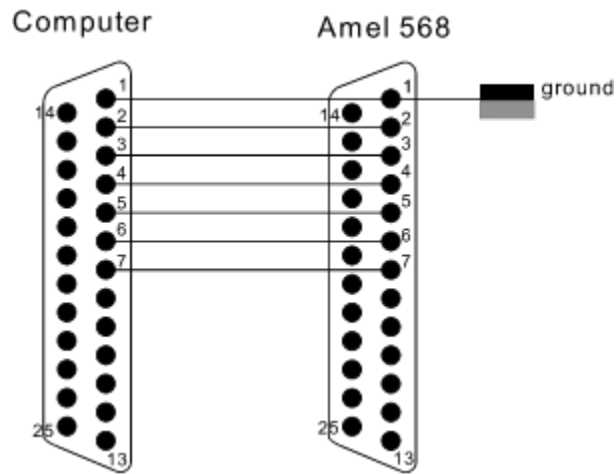
Check if the settings for RS232 communications are the same at the AMEL 568 and the PC (See also Preferences)

DAP Performance settings

Table of DAP board settings to be used in the "preferences" dialog box. (Menu Acquisition):

DAP-Board	A/D-conversion rate [kHz]	setting in CACYVO with sim.board	setting in CACYVO without sim.board
1200/4	156	26300	35000
1200/2/3	50	8429	11218
2400/4	156	26300	35000
2400/5/6	235	39619	52724
800/1	75	12644	16827
800/2/3	105	26300	35100
801/1	60	14857	20057
1200e/4	166	41105	55491
1200e/6	312	77257	104297
2400e/4	166	41105	55491
2400e/5	250	61905	83571
2400e/6	312	77257	104297
3200e/101	312	77257	104297
3200e/102	312	77257	104297
1216e/4	100	24762	33429
2416e/4	100	24762	33429
2416e/6	100	24762	33429

Note:
The red values are calculated and not experimentally verified. You have to check the display of your CV's:

Case 1: The CV is not complete.
-> Increase the value entered in the "DAP Performance" box.

Case 2: Data acquisition continues after the final potential is reached.
-> Decrease the value entered in the "DAP Performance" box.

(c) 1995 by L.Walder and B.Flückiger

SPOptions

Quit spreadsheet

(c) 1995 by L.Walder and B.Flückiger

SPEdit

E/i data points
ip, Ep values
Q-values

Select all
Selected area to clipboard

Options

Exit analysis

(c) 1995 by L.Walder and B.Flückiger

Edit

<u>Copy to</u> <u>clipboard</u>
<u>Save to disk</u>
<u>Print graphic</u>

Info

Shows a window with the copyright notice and the names of the authors as well as some system information and the registered user's name.

(c) 1995 by L.Walder and B.Flückiger

Possible errors

Error: display not actualized
-> press "Normal size" button:

Error: graphic not copied properly
-> leave *CACYVO*

Error: line not deleted when evaluating ip, or Q
-> do not switch between applications during evaluation

Error: Data acquisition not possible
-> Exit windows, reboot the PC and start Dapview (DV.exe) in your <u>DAP</u> directory.

Error: cross not deleted when marking a CV
-> do not switch between applications while marking

Registration...

Click on "print" for printing registration form!

CACYVO V2.0
Ordering Form

Name: _____

Address: _____

ZIP Code: _____   City: _____

Country: _____

University or company: _____

Phone: _____Fax: _____

E-Mail address: _____@_____

Signature: _____

I remit

        200 US$ for Industrial Customers
        80 US$ for Academics

to banking account:

        Schweizerischer Bankverein, SK 90-237.830.0
        PD Dr. L. Walder
        Institut für organische Chemie
        Universität Bern, CH-3012 Bern, Switzerland

The registration code (transforming the demo version into a full version) will be mailed upon confirmation of your money transfer.

Please send this form to:

L. Walder/ B. Flueckiger, Freiestrasse 3, University of Berne, CH-3012 Berne, Switzerland

Fax: ++ 41 (0)31 631 44 99

Note: reports on major bugs or important modifications of CACYVO 2.0 will be honored with a free

upgrade.

Literature

[1] A.J.Bard, L.R.Faulkner, Electrochemical Methods, Wiley & Sons (1980)
[2] R.Nicholson, I.Shain, Anal.chem., 36, 706, (1964)
[3] H.Matsuda, Y.Ayabe, Z.Elektrochem., 59, 494 (1955)
[4] J.M.Saveant, E.Vianello, „Advances in Polarography", I.S.Longmuir, ed., Vol I, 367, Pergamon Press, New York 1960

Introduction & first steps

- Copyright
- Introduction
- Representation of a single CV
- 2-dim representation of a series of CV's
- 3-dim representation of CV's
- Evaluation of cyclic voltammograms
- Interpretation of cyclic voltammograms
- How to use CACYVO in combination with the AMEL 568 and te Microstar DAP 800/3 A/D-Converter
- How to use CACYVO in combination with other electrochemical hardware and Microstar DAP A/D-Converters
- How to acquire data

How to use CACYVO in combination with the AMEL 568 and the Microstar DAP 800/3 A/D-Converter

CACYVO has been originally written for the <u>DAP</u> 1200/4 A/D converter from Microstar. The more recent DAP 800/3 is also supported by our software. We recommend to purchase the DAP 800/3 from:

2265 116th Avenue N.E.
Bellevue, WA 98004
USA
Sales & Customer support: (206) 453-2345
Finance & Administration: (206) 453-9489
Fax: (206) 453-3199

The DAP 800/3 is an A/D and D/A converter. The latter is not used by the current *CACYVO* version 2.0. However, future *CACYVO* versions will make use of the D/A abilities of   DAP 800/3, i.e. the excitation signal will be generated on board.

DAP-Jumper settings for the DAP 800/3
The range of the A/D-Conversion has to be set from -5Volts to +5Volts. Make sure, that the jumper J9 on your board is correctly set (read your DAP-Manuals for more information).   The factory configuration is bipolar (-5V to +5V) so you usually don't need to change any jumpers.

Connect the DAP, the AMEL 568 and the PC as showed in the following illustration:
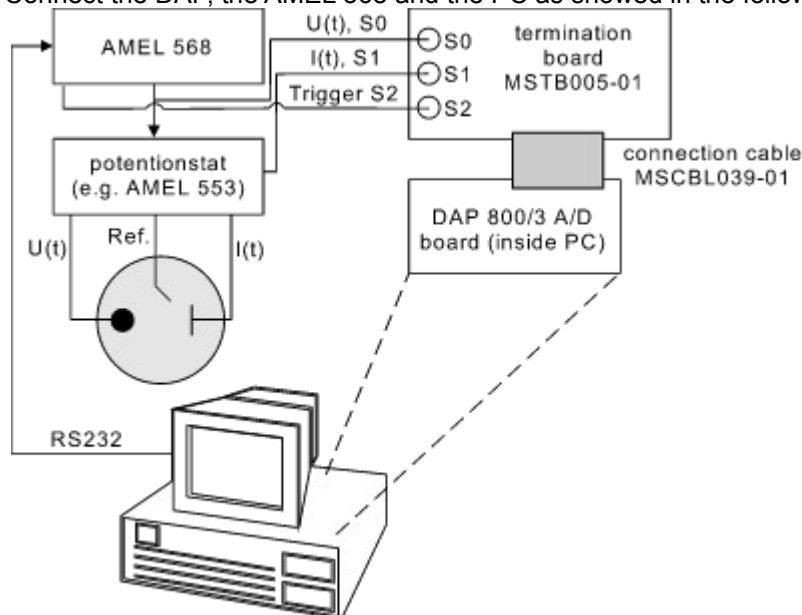
A scheme of the RS 232 cable is shown in the <u>technical reference</u> at the end of this document.

How to use CACYVO in combination with other electrochemical hardware and a custom Microstar DAP A/D-Converter

DAP -Jumper settings
The range of the A/D-Conversion has to be set from -5Volts to +5Volts. Make sure, that the jumpers on your board are correctly set (read your DAP-Manuals for more information).

DAP-tuning with CACYVO
If you use a different DAP board you have to enter an A/D conversion rate in the Preferences (Field „DAP Performance") dialog box (Menu Acquisition). A table with the DAP-boards an the corresponding values is shown in the technical reference. Tune your card as indicated after the table.

Note:
If you don't have a AMEL 568 you have to enter the potentials and scan rate settings in the function generator dialog box (Menu Acquisition). Your function generator must be equipped with a trigger. Connect the DAP, the AMEL 568 and the PC as showed in the following illustration:
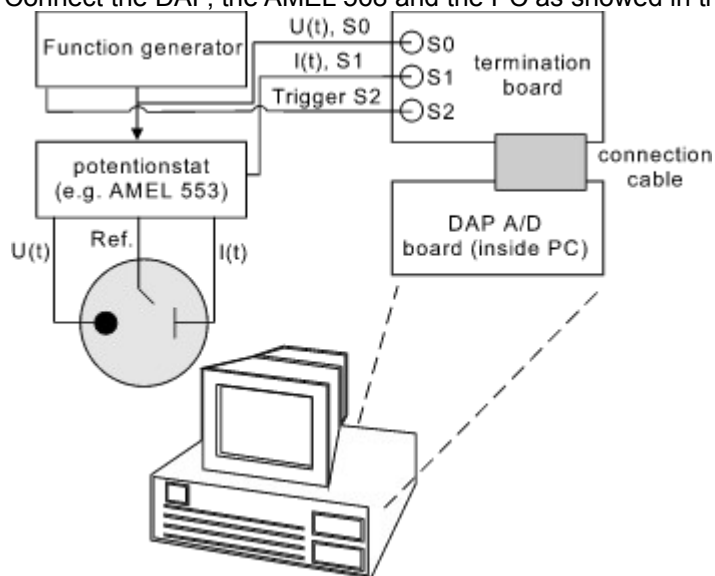
Introduction

The **C**omputer **A**ssisted **CY**clic **VO**ltammetry software, *CACYVO*, runs under Windows and manages CV-representation, evaluation and interpretation including so far unknown features as:

- Specific import filters for PAR 270/250 (ASCII and binary format), Metrohm VESUV files, and Autolab
- GPES; a general import filter for any two column representation of current/potential values;
- software -assisted peak value evaluation, i.e. ip, Ep, Q;
- mechanistic analysis on single CV's using different models, e.g. Eirrev, Erev-Cirrev, Erev-Ccat;
- graphic correlation of peak values from a series of CV's with experimental parameters, e.g. ip vs v^0.5, Ep vs log{additive};
- spreadsheet representation of the CV data points including editing options;
- filter, zoom and add or subtract a constant current or voltage value;
- add- and subtract entire CV's from each other;
- normalization of CV's with respect to electrode surface, scan rate (n) or n^0.5;
- multiple CV representation in two and three dimensions, using different experimental parameters as the third axis, e.g. v, log{additive}, temperature;
- Different representation options, e.g. axes, boxes with ticks in or out; direct export of any representation into other Windows programs, e.g. Word, Corel Draw, via <u>clipboard</u> (copy - shift insert);

In combination with the A/D-converter board 800/3 (not included), and interfaced with a function generator and a potentiostat, CACYVO can also be used for CV data acquisition in the range of 0.02 to 500 V/s. The current CACYVO version communicates well with the function generator AMEL 568. Any other programmer can be used, provided that it generates a trigger output. However, in such a case data acquisition is less comfortable (a). CACYVO acquisition options includes:

- single and multiple scan data acquisition;
- continuous scan data acquisition;

a)   Future versions of CACYVO will take advantage of the A/D and D/A
      abilities of the Microstar 800/3 board.

<u>CACYVO may be of interest for you:</u>

1. If you are equipped with any of the following digital CV data acquisition instruments and software:
      PAR 270 (and compatibles)
      Metrohm VESUV
      Autolab General Purpose Electrochemical System GPES
You will continue to use your equipment for data acquisition, but you can import the CV's stored on a DOS-disc into *CACYVO* using the specific import filter to evaluate, interpret and represent them under the *Windows* environment. Read chapter 2 and 3 of the manual and refer to chapter 7 for specific questions.

2. If you use any other digital CV data acquisition instrument, that stores CV's on a DOS disc in a two column representation of current and potential, you can import the data directly into *CACYVO* using the general import filter to evaluate, interpret and represent them under the *Windows* environment.
      Read chapter 2 and 3 of the manual and refer to chapter 7 for specific questions.

3. If you use the AMEL 568 programmer possibly in combination with the AMEL 553 potentiostat, we recommend to purchase the A/D conversion board 800/3 from Microstar. *CACYVO* will develop its full power, i.e. control of data acquisition and evaluation, interpretation and representation of the results under the *Windows* environment.
      Read chapter 2, 3, 4 and 6 of the manual and refer to chapter 7 for specific questions.

4. If you use any other analog function generator with a trigger output and potentiostat such as PAR 173/175, we recommend you to purchase the A/D conversion board 800/3 from Microstar. Data acquisition with *CACYVO* is then possible - however with less comfort then in case 3. Full power in evaluation, interpretation and representation of the results under the *Windows* environment is available.
Read chapter 2, 3, 5 and 6 of the manual and refer to chapter 7 for specific questions.

5. If you have a potentiostat with a modulation input, but no fast function generator, wait for the next version of *CACYVO*. It will make use of the function generator build-in on the Microstar 800/3 A/D D/A conversion board. Inform the authors about your interest in the new version of *CACYVO*.

Representation of a single CV

1.Load a CV from disc (or produce one by acquisition, see chapter 6, and go to step 2) choose <u>open CV</u> from the main menu <u>File</u>; choose the **drive**, the **directory**, the **type of file** and the **file name** in the box.

2. If the CV is noisy, either chose *Filters, Smooth Curve*, <u>Golay Sawitzki</u>. If it is not noisy go to step 3.

3. From the Display / <u>2-dim settings</u> menu disable the **Display integral/peak** switch to suppress the display of evaluated peak values.

4. From the *Display / 2-dim settings* menu choose
·**i-direction and E-direction**
·**Font and Font size**
·**axes position and grid option**
·**ticks/line/caption settings**
Check your settings in the Display / *2-dim settings* with the **OK-**button.
These settings will be stored if you quit the program and will be active when you start *CACYVO* next time.

5. If you want to normalize the current, choose **v** or **v^0.5**, and/or **surf. w.e**. (for current densities) from the menu Display <u>misc. options</u>.
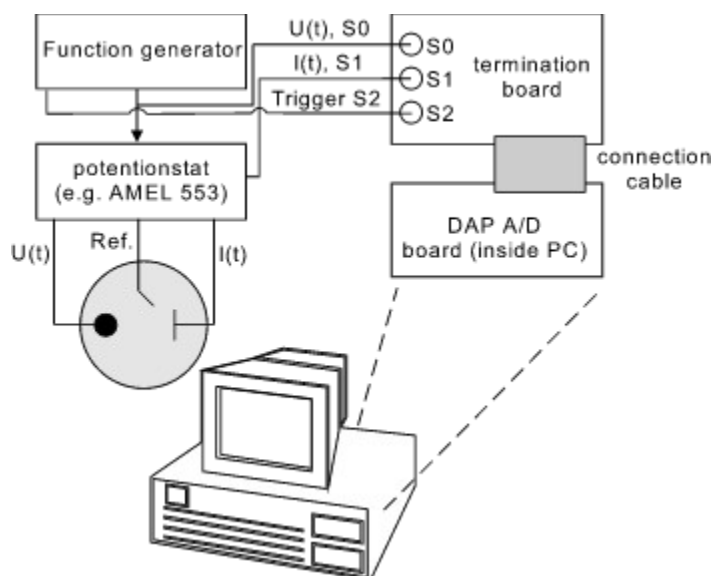

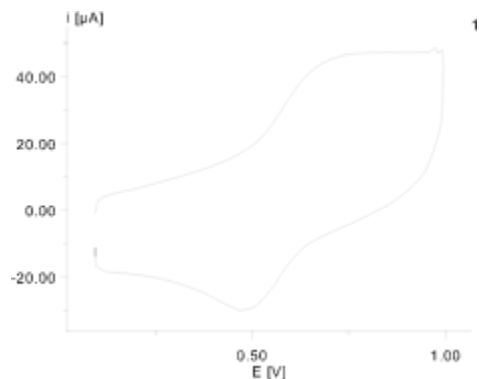Fig. 1: a voltammogram before filtering

Fig 2: same voltammogram as in Fig. 1 after filtering

2-dim representation of a series of CV's

Load the first CV of a series according to steps 1-5 in representation of a single CV

6. Select Overlay from the main menu *File* and choose the **drive**, the **directory**, the **type of file** and the **file name** in the box.
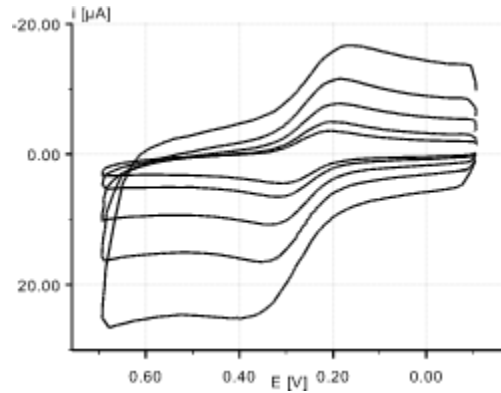7. For an offset representation without common i-axis select Shift CV in the main menu Edit

Fig. 3
series of overlaid CV's prepared in *CACYVO* and copied directly into *Word* (larger line thickness and font size for representation purpose used).
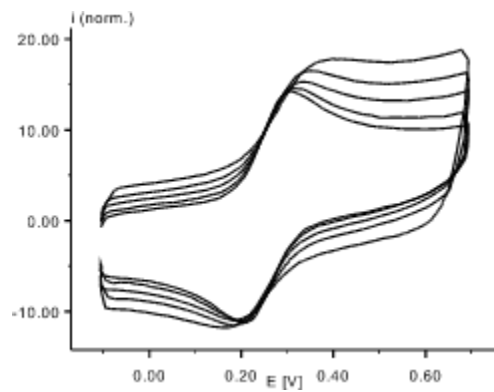

Fig. 4
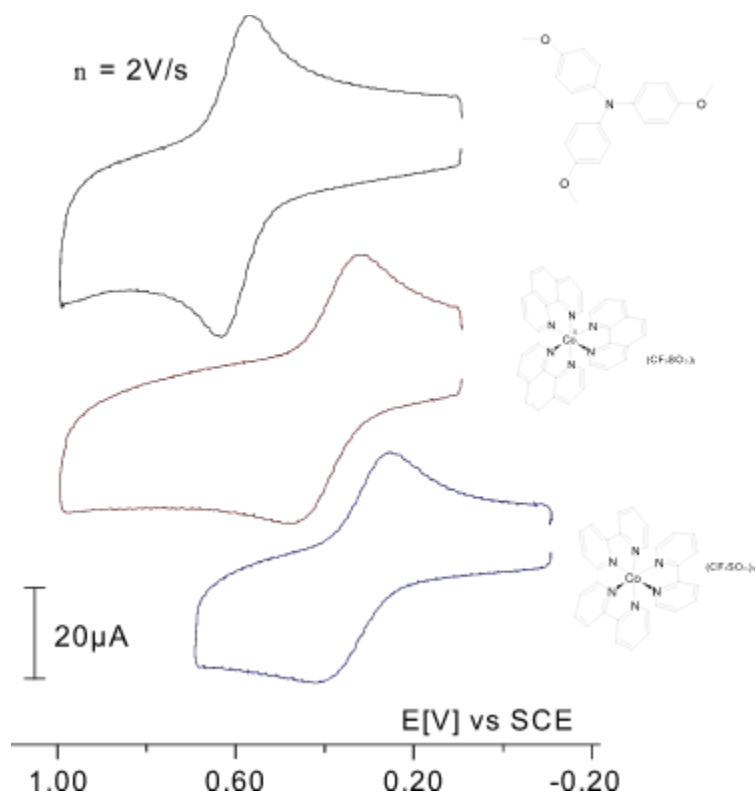same series of overlaid CV's prepared with *CACYVO* using **v^0.5** normalization and inverted axes.

Fig. 12
A series of three overlaid CV's has been prepaired in CACYVO using the shift CV option. They were copied to clipboard and inserted in Corel Draw. Molecular formula were drawn in Chem Window and added, the carachter size of the potential axis was adjusted and the current axis was replaced by a current scale indicator.

 2-dim representation of a series of partial CV's

Load and overlay the CV's according to steps 1-5 in and step 6 in; use the shift CV option (step 7), if necessary:
8. Select Data Cursor in the Edit menu and define the limits of the partial CV.
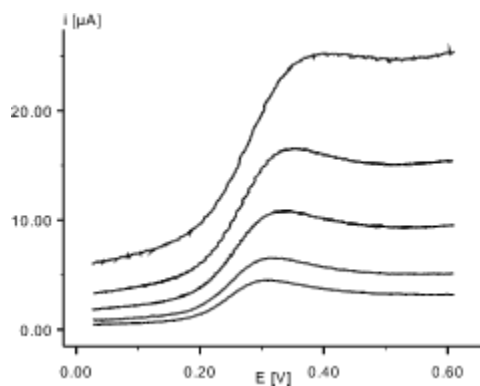9. Switch Partial CV on in the Edit menu.

Fig. 5: series of overlaid partial CV's prepared in CACYVO using the shift CV option

3-dim representation of CV's

Load and overlay the CV's according to steps 1-5 in and step 6.
10. Select 3-dim Parameters in the *Display* menu and define the z-axis settings.
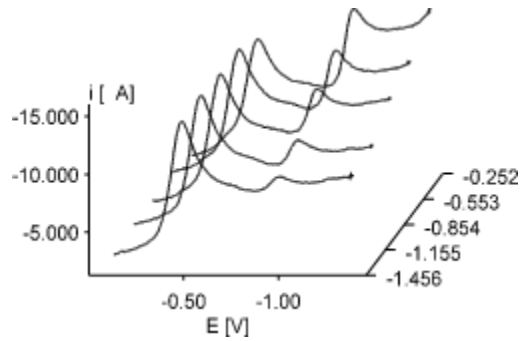11. Enable Show 3-D in the *Display* menu.

Fig. 6: series of overlaid CV's in 3-dimensional representation.
The z-axis unit is log[additive]. (cobalt-corrinoid system, additive = n-Butyliodide)

Evaluation of cyclic voltammograms

1. Load a CV from disc (or produce one by acquisition, see chapter 6, and go to step 2)
2. If the CV is noisy, either chose *Filters, Smooth Curve*, Golay-Sawitzki or disable peak autodetect in the menu *Analysis*. If it is not noisy go to step 3
3. Enable the **Display integral/peak** switch in the *Display* / 2-dim settings / **line styles/colors menu**.
4. Choose Ep, ip Evaluation in the menu *Analysis*, set the tangent and then the peak current according to the bottom line instructions. Finish the evaluation of the first peak (tangent and peak) before proceeding to the next peak. If you are interested in the faradayic charge under the CV trace for surface confined, electroactive species, choose Q-Evaluation in the menu *Analysis*, set the tangent and then the limits of integration according to the bottom line instructions. If you want to correct any evaluation, chose Delete Evaluation in the Analysis menu. All evaluations of the current CV will be lost and you have to start again from zero with evaluation.
5. Choose Assign Peaks in order to link the cathodic and anodic waves of a simple redox couple. Such an assignment is compulsory for the subsequent determination of E° (reversible couple), of kos (heterogeneous e.t. rate constant, quasi reversible couple), or of k (first or second order chemical rate constant, Erev-Cirrev).
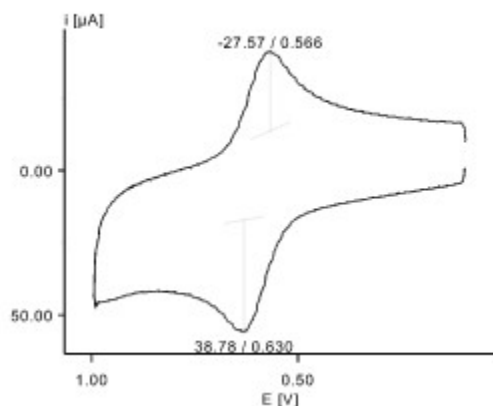

Fig. 7: CV with evaluated peak heights and Ep-values

Interpretation of cyclic voltammograms

Single CV's:
If steps 3.1.1-5 have been executed on a single CV, choose Single CV mechanism in the menu *Analysis* and decide for one of the models to be applied. *CACAVO* 2.0 includes the following 5 mechanistic models and will calculate the corresponding parameters:

- Erev: E°, n, D
- Eq-rev: E°, ko
- Eirrev: k°, a, D
- Erev-Cirrev: kf, k2. order
- Erev-Ccat.:   kcat

Note: It's up to the operator to choose the appropriate model according to the criteria discussed in the original literature and presented in a simplified version in the **Single CV mechanism Help File**. Application of the wrong model forces *CACYVO* to produce wrong results without notification.

Series of CV's:
Interpretation of a series of CV's in *CACYVO* is based on the influence of a single experimental parameter (e.g. scan rate, temperature, time) on an electrochemical observable (e.g. ip, Ep). The corresponding dependence is plotted in a x-y graph; for its interpretation the operator is refereed to the literature [1].
1. Overlay(see section 8.2) a series of evaluated CV's (see section 3.1.1-5) with one experimental parameter changing.
2. Choose Analyze series of CV's from the main menu Analysis.
3. Choose observable (current, potential or charge (**y-axis settings, Variable**)) and select the wave
4. Choose the changing experimental parameter (**x-axes settings, Variable**) and select the scale (linear or logarithmic).
5. Choose **graph** and **actualize graph** to see the graphic representation.
6. Choose again **grid** and edit the column **display** in order to eliminate a data point
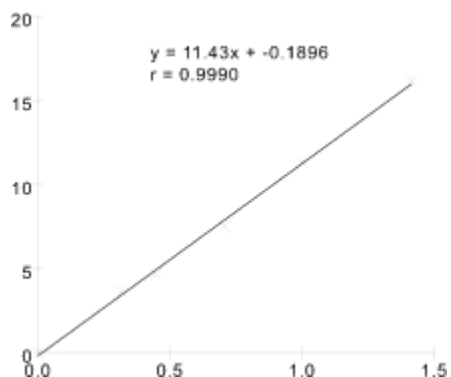7. Choose **show linear** fit for a best fit.

y = 11.43x + -0.1896
r = 0.9990

Fig. 10: Currents (y-axis) plotted against v^0.5 (x-axis) and corresponding linear regression. The point (0,0) is not an experimental value, it was manually added to the spreadsheet.

Copyright

Demo version

The demo version without save file, import and acquisition abilities is freeware and may be distributed freely.

Full version: (The demo version is transferred into the full version with the registration code)

Copyright:
This program is owned by Licensor an is protected by international copyright laws. You must treat the Software like any other copyrighted materials except that you may either (a) make copies of the Software solely for backup purposes or (b) transfer the Software to one or more PC's under the restriction that only one copy of the Software runs at the same time.

Grand of License:
This license agreement is a non-exclusive license which permits you to use the software ("Software") with Licensor products on one or several computers with the restriction, that only one copy is in "use" at the same time. The Software is in "use" on a computer, when it is loaded into temporary memory (RAM).

Disclaimer of software warranties and liabilities
Licensor licenses the software "as is" without warranty of any kind, either express or implied, including but not limited to the implied warranties of merchantability and fitness for a particular purpose. You have the responsibility to determine whether the software meets your needs. You are responsible for its use and for the results of its use.
You assume the risk as to the quality and performance of the software. Should the software prove to be defective, you assume the entire cost of all necessary repair, servicing or corrections. Licensor does not warrant that the software will run without defects. In no event shall Licensor be liable to you for any damages, including lost profits, lost savings, or other incidental or consequential damages arising out of the use of, or the inability to use the software, even if Licensor or an authorized dealer has been notified of the possibility of damages. Licensor will not be liable for any claim by other party.

Main Menu

ba1e0.bin

File Edit Acquisition Filters Display Analysis Help
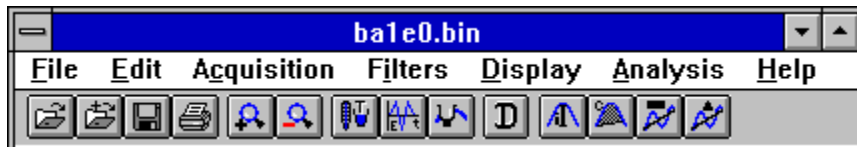
(Menu list and button bar , click for information)

Status Bar

E[V]: 0.235 | i[µA]: -21.095 | CV Nr. 1 | .1 [V/s]   ▼   Open CV-file

How to acquire data

Using the AMEL 568:
1. define experimental parameters in the <u>experimental conditions</u> dialog box (optional) and excitation signal (compulsory) in the <u>function generator</u> dialog box (Menu Acquisition)
2. Adjust the current scale of the potentiostat (it has to fit that of the function generator dialog box)
3. Press <F9> or click <u>Data Acquisition</u> (Menu Acquisition)
4. Switch the cell on, switch purging off
5. Press <Enter> or click the "OK" button →
Data transfer to the function generator
trigger sent to A/D-converter, excitation and acquisition starts
A/D-converter data are displayed on the screen

Using a custom function generator:
1. define experimental parameters in the experimental conditions dialog box (optional) and excitation signal (compulsory) in the function generator dialog box (Menu Acquisition)
2. Define the potentials and the scan rate on your function generator
3. Adjust the current scale of the potentiostat (it has to fit that of the function generator dialog box)
4. Press <F9> or click Data Acquisition (Menu Acquisition)
5. Switch the cell on, switch purging off
6. Press <Enter> or click the "OK" button →
trigger sent to A/D-converter, excitation and acquisition starts
A/D-converter data are displayed on the screen

Important Note:
Sometimes, the <u>DAP</u> -A/D board can not be addressed by the computer. In that case you can not acquire data. We have observed   the following problem with the DAP 1200/4:
DapView (DV.EXE) could not be started from the Windows environment if Windows was loaded by the autoexec.bat file (error message: DAP communication could not be established).
→ start DV.EXE form c:\dap before starting Windows.

Glossary

A
ASCII

B
binary-files
bitmap
button bar

C
clipboard
Copy to
Copyright

D
DAP

E
E/i data points
E/i-ASCII
Error: cross not deleted when marking a CV
Error: Data acquisition not possible
Error: display not actualized
Error: graphic not copied properly
Error: line not deleted when evaluating ip, or Q
Exit analysis

G
Grand of License
Graphics Server

H
HPGL

I
Information bar
ip, Ep values

M
metafile

P
Print graphic

Q
Q-values

binary-files

Files saved in binary mode need approx. 30% less disk space than files, saved in text mode.

The header (containing the experimental conditions and evaluated data) of both, binary and text-files, are saved as ASCII and can be looked at with any text editor available (such as "Notepad", provided with Windows 3.1).

The second part of the file contains the E/i-values.

text-files

Files saved in text mode need approx. 30% more disk space than files, saved in binary mode.
In text files, the complete information is saved in ASCII format.

HPGL

HPGL means "HPGraphics Language", a format almost every graphic program or word processor is able to import.
Note: Character size- and line thickness-settings made in "CACYVO"   do not have any influence in HPGL files.

E/i-ASCII

E/i-ASCII or ASCII files can be read by many programs, such as Excel, Grapher, Word for Windows etc. CACYVO can also import E/i-ASCII files, as long as E and i-values, representing the CV, are stored in two rows.

Title bar.
The bar along the top of a Windows application that contains the control menu box, the Maximize and Minimize buttons. In CACYVO it also contains the name of the current CV.

ASCII

E/i-ASCII or ASCII files can be read by many programs, such as Excel, Grapher, Word for Windows etc. CACYVO can also import E/i-ASCII files, as long as E and i-values, representing the CV, are stored in two rows.

The seperator can be a comma, a space (" ") symbol or a tab (chr$(9)).

clipboard

The clipbard is a program, provided with Windows. It allows applications running under windows to exchange data via memory. These data are either graphics or text. Graphics are mostly copied as metafiles, a windows vector format.

Text, copied with CACYVO is not formatted.

button bar

The button bar contains several buttons and, if the data cursor is activated, the coordinates of the data cursor.

If the mouse is more than 1 second over a specific button, a yellow message box appears, informing you about the buttons task.

Scan rate box

The scan rate box is part of the status bar. It lets you select a specific CV with the scan rate displayed in the drop down box. The CV Number box will automatically be updated.

Information bar

The information bar is part of the status bar. It displays information e.g. about what will happen if a specific button of the button bar is pressed, or what to do if you evaluate a peak.

Status Bar

The status bar is part of the main window and displays useful information such as mouse coordinates, scan rates, CV number and an information bar.

metafile

The metafile (or Windows metafile) is a format which most Windows applications use to exchange data via clipboard. The graphic is represented by succeeding graphic commands, it is a vector format.

bitmap

A bitmap is a point orientated graphic format (see metafile for vector format). Every point of the graphic has its own color. If a bitmap graphic is enlarged, it normally looses resolution. Normally it also needs much more memory than a metafile.

Graphics Server

This is a little symbol that appears on the bottom of your computer screen (if no other application is using this part of the screen). Do absolutely not close this application because CACYVO needs it for exchanging data via clipboard!

symbols
Each CV has its own symbol (a cross, a triangle, a square etc.) when you select "Different line styles" or "Symbols only" in the 2-Dim settings menu. The distance between the symbols is more or less constant.

screen saver
Screen savers do (as their name tell it) save your screen if you are not working with the computer. Anyway, during data acquisition with CACYVO the program disables screen savers for preventing information lost. After acquisition it enables screen savers again.
Note: This does not work with non standart Windows screen savers (e.g. After Dark). You then have to disable this screen savers manually.

E/i data points

(spreadsheets, menu options)

E/i values of the CV are represented in two rows. You can scroll down the spreadsheet clicking on the vertical scroll bar on the right of the rows.

ip, Ep values

(Menu Edit, Spreadsheet)

Evaluated ip, Ep, E° and E½ are represented in the spreadsheet. You can mark the values and copy them to clipboard.

Q-values

(Menu Edit, Spreadsheet)
The charge and the coordinates of the displayed value in the CV are shown. You can mark the values and copy them to clipboard.

Select all
(Menu Edit, Spreadsheet)
Selects all values in the spreadsheet, a usefull option to copy all E/i values to clipboard.

Shortcut
<Ctrl> + <A>

Quit spreadsheet
Quits spreadsheet and goes back to the Main menu

Selected area to
(Menu Edit, Spreadsheet)
Copies the selected area of the spreadsheet to clibpoard.

Exit analysis

(Menu options, Analysis)

Quits analysis and leads to main menu

Copy to

(Menu edit, analysis)

Copies the graphic or the selected area of the spreadsheet to clipboard. The graphic can be copied into any word processor or graphic program.

The content of the spreadsheet can be copied to any word processor.

Save to disk

(Menu edit, analysis)
Saves the graphic (as Windows metafile) or the spreadsheet (as text file) to disk.

Print graphic

(Menu edit, analysis)
Prints the current graphic to your default printer. The graphic is always printed in landscape.

second window help

The second window help is shown above the CACYVO help file.

RS232

The RS232 is a serial cable which lets you connect your PC with different external devices e.g. the AMEL 568. There are two different plugs, one with 25 and another with 9 pins. If you want to connect your PC to the Amel have a look at the Serial cable (RS232) in this help file.

DAP

DAP boards are manufactured by Microstar Laboratories(tm).
Address:
2265 116th Avenue N.E.
Bellevue, WA 98004
USA

Sales & Customer support: (206) 453-2345
Finance & Administration: (206) 453-9489
Fax: (206) 453-3199

Error: graphic not copied properly

Sometimes the graphic is not copied properly to clipboard. This is an error of "Graphics Server" (see also "copy to clipboard".
You then have to exit from CACYVO and start it again. If this still doesn't help, you have to exit windows and restart it.

Error: line not deleted when evaluating ip, or Q
If you switch to another windows application during evaluation (especially if you draw the line), there will be two lines when you switch back to CACYVO.
The program takes the last drawn line for calculations.
Anyway, it is not recommended to switch between applications during evaluation!

Error: Data acquisition not possible

Sometimes, the DAP-A/D board can not be reached by the computer. You will notice this, when you can not acquire data.

We had special problems with the DAP 1200/4:

Starting windows directly with the autoexec.bat caused the following error when we tried to start DapView (DV.exe):

"DAP communication could not be established"

Workaround:

Don't start windows with autoexec.bat. Before starting windows from DOS, change to your DAP directory and start DV.exe. If everything works fine (no error messages), press <F10>, then <Q> (This exits DV.exe).

Then start windows and CACYVO.

Error: cross not deleted when marking a CV

Like in "line not deleted" it is recommended to not switch between windows applications while you are marking a CV.

Copyright

This program is owned by Licensor an is protected by international copyright laws. You must threat the Software like any other copyrighted materials except that you may either (a) make copies of the Software solely for backup purposes or (b) transfer the Software to one or more PC's under the restriction that only one copy of the Software runs at the same time.

Grand of License
This license agreement is a non-exclusive license which permits you to use the software ("Software") with Licensor products on one or several computers with the restriction, that only one copy is in „use" at the same time. The Software is in "use" on a computer, when it is loaded into temporary memory (RAM).

Error: display not actualized

It may be that the graphic of CACYVO is not actualised, e.g. when switching between differnt windows applications.

You can force CACYVO to actualise the graph by pressing the "normal size" button (button bar or Menu Edit).