CAD

Assemble, Edit, Export Intermediate Graphic Output & Design SCRIPT Resources)

Introduction

A lot of *Zennium* users need more than the standard options of a measuring system like measure, calculate, evaluate and print.

Some users prefer the shortest way picking data from *Zennium* to their own documentation and DTP tools. Generally the *Zennium* supports this by automatically generating text and data table files suitable for use in MS-DOS environments. In contrary to this it is useful in many cases to take the advantages of *Zennium* as a workstation with its powerful analysis software and its graphical and mathematical abilities.

CAD supports this activities in a variety of ways. Most utilities producing standard graphic output, from internal and external sources, are able to send their data to the AMOS-CAD. In this way graphics, similar to the standard hardcopy outputs, are created – with one important difference: They are no longer in a fixed format. All elements, such as curves, text, lines, dots, etc., may be moved, erased, zoomed or rotated. Elements may be edited, completed or changed in color or line type. Arrangement of curves which are not available by standard software become possible, like combinations of measured and literature data yielded by some mathematical treatment. The CAD-editor also provides tools for splining, smoothing, n'th-order-regression, conversion of tables and calculation of mathematical formulas.

The file management supports a. o. overlay of more than one figure. Figures and written text can be combined by the preview function. Files created in this way may be printed by ink- and laser printers or plotted by XY-plotters. Sophisticated drivers allow the positioning of figures in different orientations and fixed or variable scales. Another important feature is the ability of exporting and importing graphics as HPGL-list to and from other environments. So AMOS-CAD forms a powerful link between *Zennium* and different external sources and destinations of numeric and graphic data.

Operating instructions
AMOS-CAD

Piece of advice for the mouse button busying:

> left   RETURN
> middle HOME
> (normally) right   HELP/TOGGLE

The left button in the graphic editor, for example, has the function to change over the step width of the cross hair from rastered to fine.

1. Main Menu

After the program has been started, the main menu "MENU AMOS-CAD" appears first.

It is possible to jump into all sub-menus from this menu. In the end repeated pressing of the "HOME"-button always leads back to the "SHELL"-menu, independent of the sub-program, which is working. In any sub-menu, the HOME -command is followed by the escape to a higher menu level and it does not make any difference if it was given by keyboard or mouse. By this, it is always possible to correct wrong input at once and without much fuss. In the following the sub-menus of the "AMOS-CAD" shall be described.

2. File Operations

The first point of the main menu are the data operations. The functions offered here have to be handled like in the other programs, or as they are described in the corresponding instruction. The only exception hereby is the function "Append". With help of this function it is possible to add a second drawing to one drawing, which has already been drawn up or which has been loaded. If this point is chosen, the input routine of the file compare string appears ("*" loads the whole catalog). The desired drawing can be loaded by choosing. Then the additional drawing (streaked rectangle) is placed with the mouse and the desired position is confirmed with "RETURN". Thereby this combined data is not yet stored.

As far as this example is concerned the graphic in the center of the picture was already in the memory. The file "cadtitel" (symbolized by the streaked rectangle) has been added and can now be placed as desired.

Note:	You can append the second graphic with the same origin as the first by pressing RETURN or clicking the left mouse button at this screen before the streaked rectangle (green) appears. This is very helpful for creating graphic resources for SCRIPT applications.

3. Graphic Output

If the point "Graphic output" is chosen, the drawing in the memory can be printed out on a printer or on a plotter.

The standard configuration is set to the Windows® default printer. The default printer device can be configured by the Windows® control panel.

The plotters "SE 292" and "HP 7550" as well as the HP plotters which are compatible to this, like "HP 7475", and the laser printer "HP LaserJet 3P" as well as the color printer "HP PaintJet XL 300" are supported by "AMOS-CAD". All devices have to be fitted with an ICE-bus interface or can be fitted afterwards with an interface, which can be delivered by us. In addition to this the "HP LaserJet 3P" requires a four MByte memory extension, which will already be installed, if the printer has been delivered by us. It is recommendable to install a memory extension also to the "HP PaintJet XL300". Under menu point "Plotter Type " the various output devices can be changed. Thereby the ICE-bus address, which appears under point "Interface Nr.", is automatically placed to the default value, which is stored in the program. A change of addresses is only necessary if the periphery devices used by you are configured to other addresses as it is usual here. The default addresses of periphery devices delivered by us are correct.

Plot graphic fit to paper or manually scaled and choose orientation

Plot graphic with fix scale (mm/step). Set orientation and origin and start the whole plot on selected plotter type (normaly the windows standard printer)

Export CAD graphic to the clipboard, save as EMF-file (enhanced meta file format) or preview EMF-file

Set sheet size: For "WINDOWS" printer is only A4 available

Set line types, colors, fill types,… (only for plotters)

Set plotter type: Select plotter or "WINDOWS" for default Windows® printer

Append graphic output setup data to AMOS-CAD files (*.icd*)

For HPGL-list export set plotter type "LJET 3P" on interface nr. 66

Note: The adjustments of plotter type and sheet size have to be done before the output is started.


At all output modi the positions of the drawings, which are already issued, are stored and marked on the positioning area by blue streaked-pointed frames. This serves as an aid for placing, if several graphics or text, from the text editor combined with graphic, shall be printed or plotted on one sheet of paper.

3.1 Fix Scale Plot

By this point a fix scale in millimeters per screen steps can be indicated. With this, it is possible to print out drawings which are true to scale in original extent 1:1 or an exactly defined enlargement or reduction factor.
The following menu "POSITION" adjusts direction and situation of the drawing on the plot area with the mouse.

Apart from the page extent, there is also shown the default and maximum plot area. The rectangle shows the area of the drawing
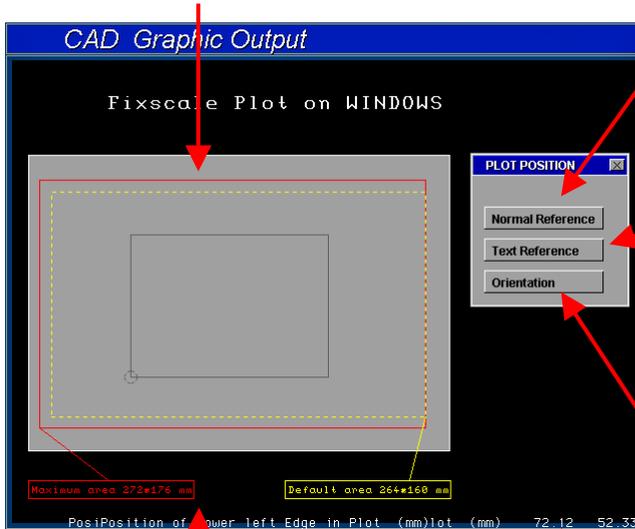
Normal Reference: The drawing is placed with the mouse from the total area needed. The rectangle shows the area of the drawing, whereas the small circle in this modus marks the lower left corner of the drawing.

Text Reference: Refers to the initial point of a prospective text. The small circle now marks the initial point of the first symbol of a prospective text. This initial point is defined by the adjusted parameters "SXY:.../..." in the text editor of the output menu and refers to the point (0/0) of the drawing area.

Orientation: Choose direction of the drawing from the lower left corner.

Plot area for most common printers   Reference position (to origin)

3.2 Auto Scale Plot

Under this point of the menu no fixed scale is indicated, the extent of output is therefore free to select. The relation of the sides X and Y to one another is, however, fixed, that means, it is not possible to distort the drawing.
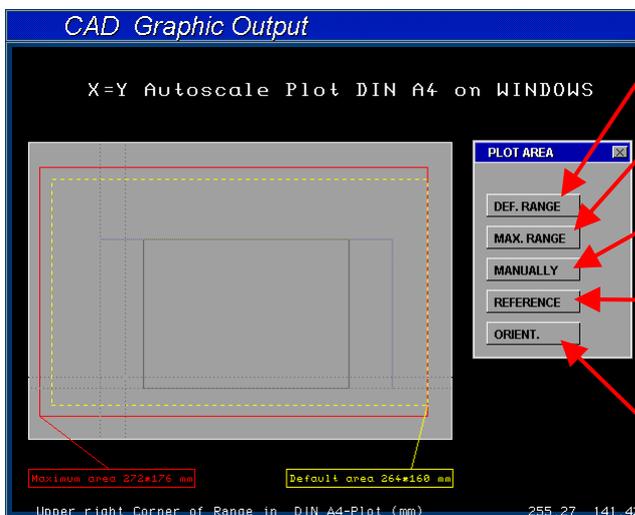
Def. Range: The drawing is placed within the default area (yellow marked).

Max. Range: The drawing is placed within the maximum area (red marked).

Manually: The drawing is placed within the user defined area (gray marked) proportional.

Reference: Convert the position of the drawing between the middle or flush to the lower left, upper left, upper right and lower right corner.

Orient.: Choose direction of the drawing from the lower left corner.

The dotted line shows the area at disposal, the rectangle in it shows the area, which is really needed for the drawing.

3.3 Plotting/Listing

After the way of output is chosen, a jump to the sub-menu "PLOTTING/LISTING" is effected. Here it is possible to adjust pen numbers and colors, and to start respectively stop the output.
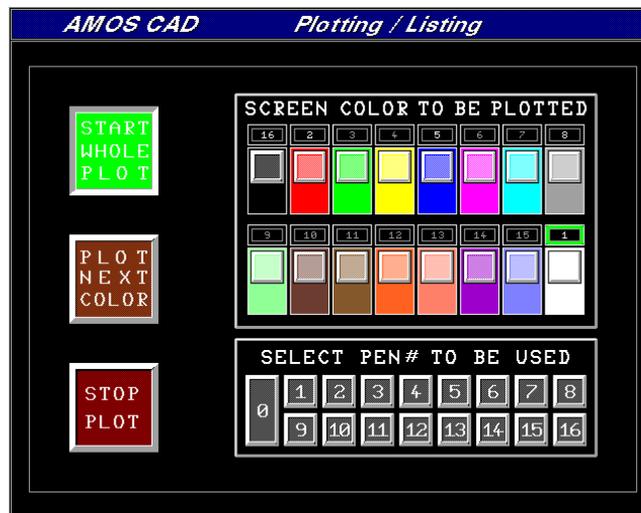
| **Note:** | The adjustments are only necessary for real plotter output. For standard output with Windows® default printer you can start the plot immediately by "START WHOLE PLOT" |

For each screen color a pen number can be adjusted in the right two windows as follows: first click the desired screen color and then the corresponding pen number. The figure above the color shows the actually adjusted pen number, the green frame around the figure the actually adjusted color. If a figure is white, the color occurs in the drawing, if it is gray, it doesn't.

In case, that the output is to be done on the "HP LaserJet" or "HP PaintJet", there are already adjusted default values stored in the program. These default adjustments need not be modified unless some color should be changed for another (screen blue should be red in the output), or should be omitted (pen number 0 to omit color).

If a pen plotter is used, the pen numbers have to be adjusted, corresponding to the succession of the pens in the magazine of the plotter.

With the button "START WHOLE PLOT" the output is started for the whole palette of colors. To print all colors, the green frame has to be put to the first color, white has to be clicked. Only colors which are left of the green frame (incl.) are printed.

Only the color marked with the green frame is printed with the button "START NEXT COLOR". So it is possible to print out only one or few colors from a drawing.

The output can be interrupted with "STOP PLOT" at any time. If the output is complete, a jump back to the menu "PLOT MODUS" is effected. A pen plotter will have finished drawing at this time. If a "HP LaserJet" or "HP PaintJet" is used point 8 "FORM FEED" has to be clicked to get the drawing. Using one of these two devices it is possible to plot two or more drawings on one sheet of paper. To do so all desired drawings are printed out, without any form feed between. The point "FORM FEED" has to be clicked when all drawings are completely sent to the plotter's memory (see also point 8). A special function is provided with pen number 16. It can be used only on the "HP LaserJet" and "HP PaintJet". A color adjusted to pen number 16 is deleted in the plotters memory. For example, if you want to place some blue writing on a white rectangle (on the paper) within a fill, there has to be placed a black rectangle on the screen and then the writing on the rectangle.
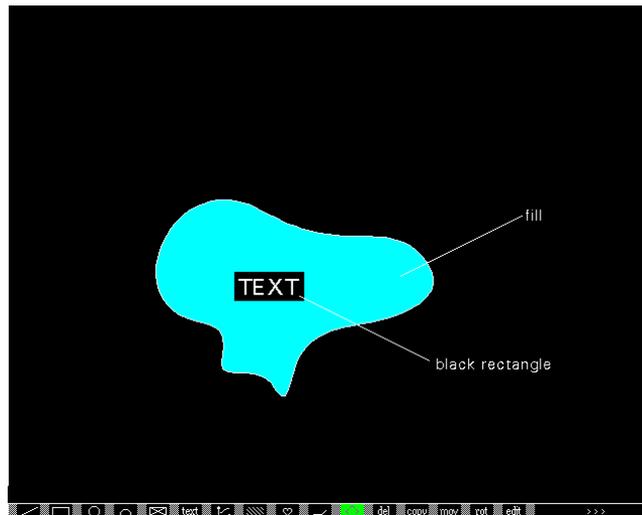
To achieve the desired effect, it is necessary to plot first the color of the fill, then the color black with pen number 16 and then the color of the writing, each with "PLOT NEXT COLOR", as described the page before.

3.4 Setup Plot Defaults

If the point "SETUP PLOT DEFAUFTS" is chosen, a jump to the submenu "Plot Defaults" will take place. In this sub menu, the parameters for the graphic output can be adjusted as desired. To this, the desired bar diagram is turned on with the mouse. (RETURN). By moving the mouse adjusting can be made and confirmed with RETURN. If the sub-menu is not chosen before output, the default values, which can be seen on the picture, are chosen.
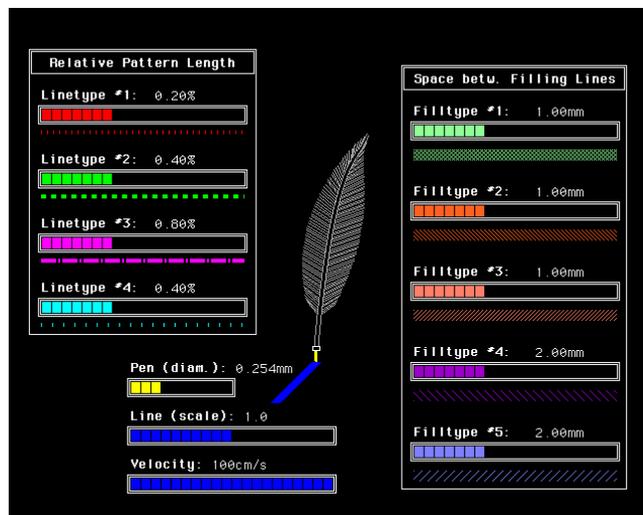
"Relative Pattern Length" can adjust the relative dash length of the 4 interrupted types of lines. There, the repetition distance from the beginning of an individual line segment to the next is put into relation proportional to the length of the page diagonal. The graphical representation under the bar diagrams gives an optic impression of the chosen adjustment.

By "Pen (diam)" input of the pen width is effected. Plotters have to be seen to that the adjusted pen width corresponds with the actually used pen, because otherwise problems about thick lines or wholly covered areas can appear. At "LaserJet 3P" the chosen pen width corresponds automatically to the diaphragm opening of the printer.

The relative line width "Line (scale)" is a kind of possibility for correction. Here it is possible to alter the line width independent of the pen width. The parameter "1,0" is in accordance with the output in original extent 1 to 1. A reduction of lines on the plotter is, of course, only possible up to the width of

the used pen. The alteration of the line width at the stilisized feather serves for illustration and is not directly negotiable.

Plot speed is adjusted by "Velocity". The right speed is dependent of the used output device and the type of output. For a clean result, for indian ink there has always to be adjusted a lower speed than for felt-tips. If a value is indicated, which is below or above the velocity range of the plotter, the device works with the minimum or maximum speed, which is possible, without showing a fault message for this. For the "HP LaserJet 3P" the indication of "Velocity" is superfluous, because the laser printer only plots virtual in its memory. The output speed is not influenced by this. In the input window "Space between filling lines" the distance between the various lines can be varied between rastered or dotted filled areas. The distance is directly shown in millimeters. The indication under the bar diagram gives an optic impression of the chosen adjustment.
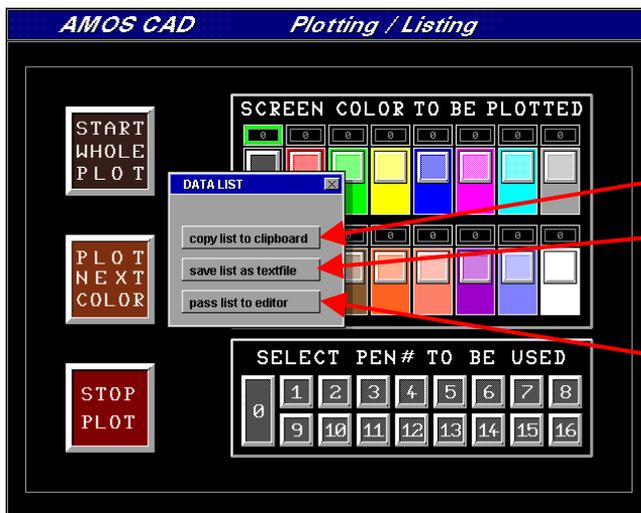
3.5 Plot/List

For standard plot output select "on Plotter"

For HPGL-list export the plotter type, interface nr. and the plot output should be set as follows.

To export HPGL-list start the plot "Fix Scale Plot" or "Auto Scale Plot". After "START WHOLE PLOT" a data list menu appears.

Copy HPGL-list (ASCII-format) to clipboard.

Opens the save text list dialog box. Browse to destination folder and type in file name for HPGL-list (.*txt*) .

Copy HPGL-list directly to the ZEdit text editor for further edit and export.

3.6 Form Feed

As briefly mentioned, the positions of the drawings, which have already been output, are memorized and optically plotted on the placing level as blue dash-dotted frames. By means of this help, it is easy, for example, to arrange graphics to one another when they shall be printed on the same page. It is also possible when texts transmitted from the text editor shall be output with one or more graphics.

In this case, writing is indicated on the field and therefore there is no problem in placing the graphics. If a plotter is adjusted as an output device, the function "Form feed" only counteracts the deleting of the positions so far. A form feed in the actual meaning is certainly impossible on this plotter.

This is different regarding the laser printer. The above described possibilities also exist here, it is especially suitable for the combined text/graphic output. The difference is, however, that the laser printer only plots in its memory first, the output on paper is not started before a "Form feed".

4. Output as a Printer Hardcopy

This sub function is not yet implemented!

5. New Graphic

With help of this function the whole drawing area of the graphic editor can be deleted. When a new drawing shall be drawn up, the various deleting functions of the graphic editor need not be used for the respective parts of the drawing.

> **!** The relevant drawing is not automatically stored by doing this. This has to be done under "File operations" before. To prevent that a graphic is erroneously deleted, the scanning "Are you sure?" is effected first. Only when this scanning is confirmed, the relevant drawing will be deleted.
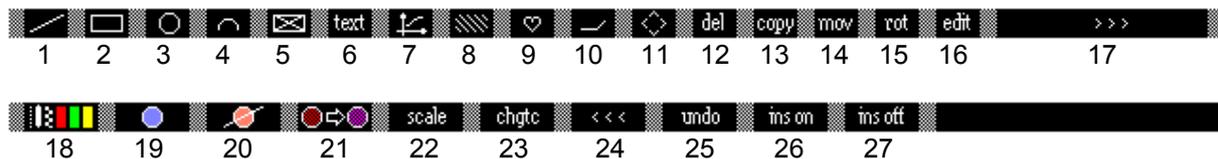
6. Graphic Editor

After the description of program and menu structure, the explanation of the "Graphic editor", the core of the "CAD" program follows.
If no drawing, which already exists, has been loaded before choosing this point of the menu, a entirely free drawing area with the cross hair appears, which always shows the position of the cursor. Otherwise the loaded graphic builds itself up.
By a "HOME" command (the press button in the middle of the mouse) a jump to the menu band at the lower edge of the screen takes place. Here the desired function can be chosen; the chosen function can be recognized by the pictogram, where green color has been put underneath. If a function is confirmed with "RETURN" (press right button of the mouse) the cross hair appears again on the drawing area. The chosen function is even now always recognizable.

The instruction refers to the following numbering of the functions in the menu band.

| 1 | 2 | 3 | 4 | 5 | text 6 | 7 | 8 | 9 | 10 | 11 | del 12 | copy 13 | mov 14 | rot 15 | edit 16 | >>> 17 |

| 18 | 19 | 20 | 21 | scale 22 | chgtc 23 | <<< 24 | undo 25 | ins on 26 | ins off 27 |

6.1 Line, Rectangle, Circle and Circular Arc (1-4)

The functions (1)-(4), line, rectangle, circle and circular arc can be summed up with regard to the handling. After the function has been chosen and the cross hair appears, the desired initial point can be started with the mouse and fixed with "RETURN". Now line, rectangle, circle and circular arc are drawn in the desired direction and extent. When the farthest point is reached, it is confirmed with "RETURN". If it is noted that the initial point is placed wrongly, its position will be deleted by "HOME" as long as the farthest point is not confirmed. The initial point can now be set newly with help of the line cross. At any time the step width can be operated from rastered to fine and back with the left button of the mouse. The circle center is defined as initial point; no matter in which direction the mouse is moved, only the radius of the circle changes. As far as the circular arc is concerned the angle of the circle segment is scanned first (10uoU-330uoU). By this, the curve of the arc can be chosen. Before the initial point is fixed, the position of the line cross on the right at the menu band is shown with regard to the screen origin. As soon as the initial point is fixed, the X and Y position of a line as well as the radius (...r) and the angle (...a) with regard to the polar co-ordinates is shown.
The rectangle also shows the X and Y position, which corresponds with width and height. As only the radius of a circle can be changed, only this one is shown. The indication of the circular arc is effected as it is by the line, but it is only calculated on the direct connection line between initial and farthest point.
Comment: due to a mask fault caused by the manufacturer of the processors, processor hang-ups can occasionally appear at certain angles in connection with certain positions at the circular arc function. Then a flickering circle appears in stead of the circular arc. This error is prevented by a soft ware timeout, which has the effect that circle and line cross remain in the erroneous position, but it is possible to place the circular arc further with the real cross hair. The possibly recognizable arcs and line crosses disappear after a new built up (back jump to the main menu and new start of the graphic editor leads to new built up) of the graphic. By using one or more "HOME" commands, it is possible to chose another graphic function or to jump back to the main menu.

6.2 Defining Fields (5)

Any sectors of the drawing area can be defined as rectangular fields by means of this function. First, the function has to be chosen which indicates what to do with the field. The functions (12)-(15) may be

used for this. The function (5) cannot be chosen alone, as a defined field without working instruction is senseless. The exact sequence of input can be seen from the corresponding sub-points of this instruction.

6.3 Setting of writing (6)

At any place of the drawing level graphic writing can be produced in any extent with this function. The first thing after choosing the function is the scanning of extent and direction.
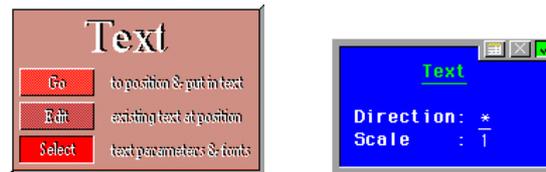
The extent of writing can be chosen between 0.5 and 15. 1 is the normal extent and is stored as default value. The indication of direction is effected by the numbers 0-3, whereby 0 is directed from left to right, 1 from down to up, 2 from right to left (upside down) and 3 from up to down.
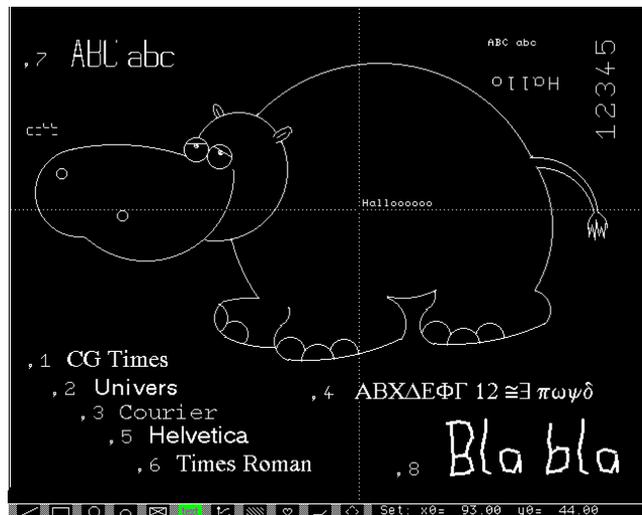
This is also the position to add the command for another type of writing with a comma. Only the direction without any addition means standard graphic writing.
By typing "*" for direction, it is possible to choose another type, wight and/or symbol of the following ones:
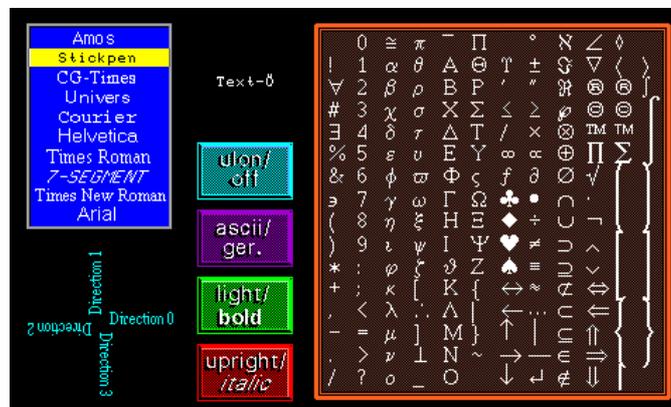
If a writing has already been used in a drawing, the parameters which have been chosen at last are automatically suggested.

6.4 Curves Off-Hand and Splines (7)

The "CAD" program offers the possibility to draw curves off-hand with the mouse. For this, function (7) is chosen.

Then the sub-menu "CURVES" appears on the drawing area, where point 0 "Curve off-hand" has to be chosen. The initial point is, as already known, fixed with "RETURN". Even in this case, it is possible to convert the step width from rasterd to fine.

The line results exactly from the mouse moving. If the line does not have the desired course, it is possible to delete it step by step from behind with "HOME" as long as the farthest point is not fixed.

"spline" of the sub-menu provides the possibility to mark any samples on the drawing level, by which the program draws a clean and homogeneous curve. The desired position of the samples is placed with the cross hair and fixed with "RETURN". When the samples are complete, the calculation of the curve is started with "HOME".
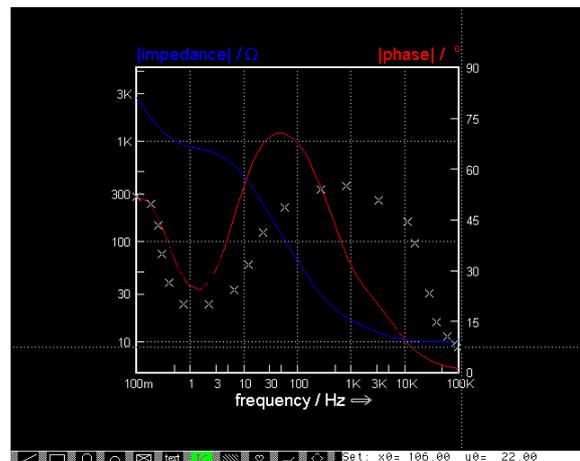

The spline is approximated by a series of straight lines. The precision of the resolution can be defined with the left press button of the mouse, independent of the fact whether the samples have been put in rough or fine modus, the modus decides about the resolution when the "HOME" button is pressed. High resolution means finer curve structure, but also more need of memory and lower embodiment speed. When setting samples, it is important that they are connected in the succession which they were indicated in, that means, a sample which was forgotten must not be put in afterwards, but the samples must be placed newly.

By confirming the sample, which was indicated last, again, it can be deleted. Above all, the application of this function is to draw up diagrams and the completing of curves in diagrams which have already been drawn up. The previous graphic deals with a BODE-diagram of an equivalent circuit which was taken from the "EIS" program. The curve, which was not marked by circles, was drawn up in the diagram after wards with the "spline" function.

The function of point 2 "periodic spline" in the sub-menu "CURVES" differentiates itself from the "spline" function, because it produces a diversely able curve at the connection point, when the farthest point is put on the initial point.

The following graphic shows curves which have the samples with "spline" and "periodic spline".
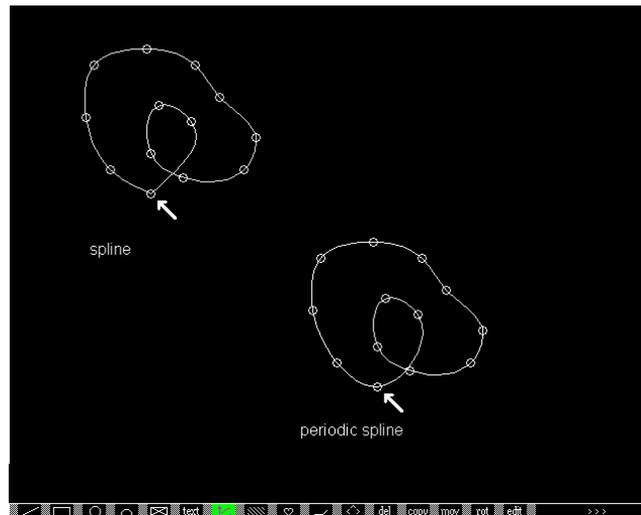
To make it clear, the circles mark the samples here, and the vectors point to the initial and farthest point of the curves.

It can clearly be seen that the "spline" function produces a "corner" at this place, whereas the "periodic spline" leads through the point steadily and simply to differentiate.

Both things may be desired, therefore you can decide before which of the two functions is more qualified for the desired application.

6.5 Flat Rectangle (8)

This function has to be handled like the already described rectangle function (2), but it produces flat filled rectangles instead. Initial and farthest point are placed and confirmed with the mouse as usual.

Such rectangles are especially qualified as background for text windows or, for example, for bar diagrams.

6.6 Open and Defining Shapes (9)

AMOS-CAD can handle three different types of shapes:

Standard shape   shapes (*.bmp*)
Icons with transparency   tshapes (*.ico*)
True color bitmaps   pictures (*.jpg*)
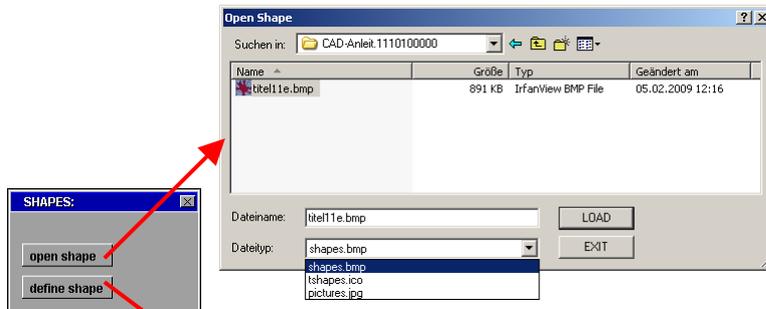
After loading a shape you have to click on the insertion position of this shape.
Transparencies are displayed correctly after "Screen center and scale" (11)

Set the area of the shape (rectangle marks)
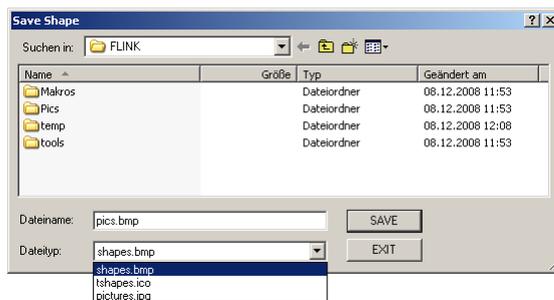
Note:	The transparency color of icons is defined as the color of the pixel at the upper left corner of the bitmap. The file format for icons is the standard windows bitmap format with only a different file extension (*.ico*).

6.7 Editing Lines (10)

With this function, it is possible to establish lines to those which already exist. For this, the line cross is put on the desired line and started with "RETURN". The type of function depends on the position of the line which is started.
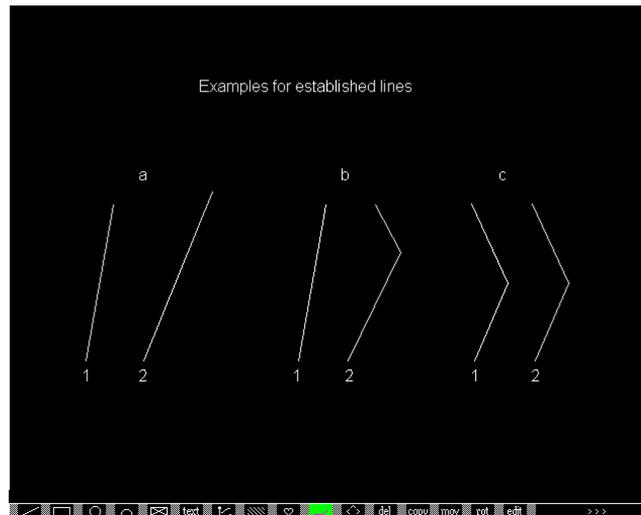
In example "a" of the picture shown above the line was started at the upper end. Then the line can be moved in such a way as it is in the line modus (function 1), as if the lower point seems to be the relevant initial point. Although the line (2) has the same initial point, it is changed in direction and length.

If a line is started at any position between the farthest points, like in example "b", initial and farthest point remain fix. Two lines develop themselves and connect the position of the line cross with initial and farthest point.

As it was shown in example "c", even the corner point of two lines (1), which are connected together, can be started. The corner point can be moved in any direction, whereas the two lines (2) furthermore connect the farthest points with the corner point. Remains of lines of old positions disappear after a new installation of the graphic.

It is also possible to establish lines, which are connected together, separately or to divide them by starting a position of the desired line which is only a picture point in the fine raster away from the corner point of the two lines.
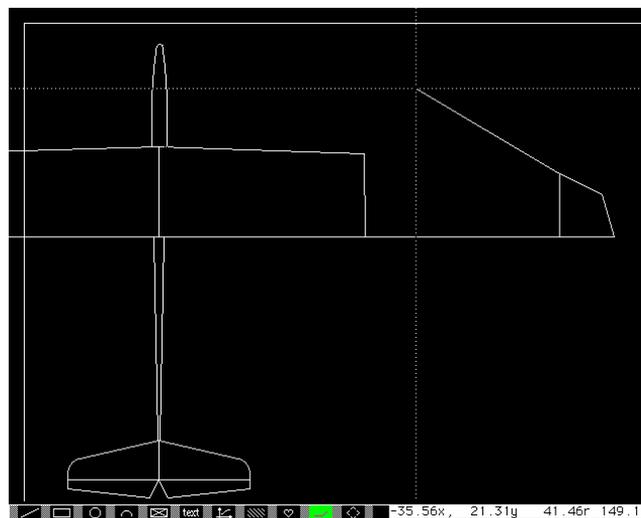
Therefore it is superfluous to delete lines which are slightly wrong and to set them completely new or to make up parts of a drawing newly in case of a change.

It shall often be continued with further lines at established lines. Therefore the sequence "Editing line" has been made easier by the program as follows. After confirmation of the established line with "RETURN", there is a jump into the menu band with "HOME". Here, the function "LINE" lights up automatically and needs only to be confirmed with "RETURN".

The line cross jumps automatically to the farthest point of the line established first, provided that it is placed on a point of the rough raster. When the farthest point has been set in the fine raster, the line cross jumps to the next point of the rough raster. If the drawing shall be continued after establishing with another function, the offered line function in the menu band will not be confirmed, but the desired function is chosen.

6.8 Screen centre and scale (11)

With help of this function the central point of the visible screen center can be shifted, and/or the representation can be changed. This is important, because the drawing area, which is normally at disposal, is much bigger than the part which is visible on the screen. If drawings are bigger than the visible area, a smaller scale than "1" has to be chosen, if the whole drawing shall be plotted. It is not advisable, however, to take too small a scale for drawing, because then it will be difficult to set up small details. If only the screen center shall be shifted, the function is started with "RETURN", the cross hair is placed on that position of the screen which shall be shifted to the screen center. Then the position is confirmed with "RETURN". The following scanning "TOTAL AREA" has to confirm the suggested value "1" with "RETURN". Then the picture builds itself up with the central point, which was just chosen.

If the scale of the representation on the screen shall be changed in addition to this, the desired value is simply put in by the scanning "TOTAL AREA". In this case, the values 0.125, 0.25, 0.5, 0.75 and 1-8 (the whole number) are possible. Input always refers to the original scale "1", and not to the scale chosen before.

6.9 Deleting (12)

The function "DEL" (12) makes it possible to delete either individual elements or whole part areas of a graphic. If only individual elements shall disappear, it happens as follows:

first, the deleting function (12) is chosen and confirmed with "RETURN". The mouse vector, however, still remains in the menu band as long as the function, which shall be deleted, is chosen and confirmed. There, it is possible to chose between functions which are placed on the left side of "DEL". As soon as this has happened, the cross hair appears and the unwanted parts can be deleted. If, for example, the deleting of lines is chosen, the cross hair is placed on a point of the line which shall be deleted and confirmed with "RETURN". The recognized line begins to blink for about 2 to 3 seconds. Only if the deleting command is confirmed with "RETURN" again with in this time, the line will be deleted. If, for example, the point of intersection of two or more lines has been clicked, all recognized lines will blink in succession. Then it is waited until the desired line blinks, or the choosing is accelerated with "HOME" and confirms it. For rectangles and circles, it is enough to click any point within the figure. As already described, all recognized rectangles or circles blink in succession and the desired one can be confirmed and consequently it can be deleted.

All other figures, like the line, have to be clicked for recognition directly.

As already hinted by function (5), it is also possible to delete a defined field. The deleting function (12) is chosen first again, and then the function (5) "Defining field". Then the lower left corner of the field is set with the cross hair. Now width and direction of the field is free to choose with the mouse. The field appears as a dotted frame. If the area, which shall be deleted, is completely inside the frame, it is confirmed with "RETURN" again; after that the frame blinks. As before, the field is not deleted until it is confirmed with "RETURN" again during blinking.

If an element was directly chosen, for example, a line with "DEL" and the line function (1), then it is also possible to delete elements, which are not entirely within the visible area of the screen.

It is different, however, if a defined field shall be deleted. To do this, all elements which shall be deleted have to be entirely within the limiting frame. In other words: elements which partly jut out of the frame are not deleted.

An exception to this are the circular arcs: only initial and farthest point have to be within the field and not the whole arc.

If an element or field has been erroneously clicked, but shall not be deleted, it can either be awaited the end of blinking without a second confirmation or it is possible to escape with "HOME".

6.10 Copying (13)

The copying function "CPY" (13) has to be handled fundament ally the same as the deleting function "DEL". The only difference is that the chosen elements are not deleted, but copied. Firstly, function "CPY" (13) is chosen, and then the element which shall be copied is chosen with the cross hair.

When the element is recognized, it is blinking for about 2 to 3 seconds. Within this period a second confirmation has to be effected. Now the element is copied and can be taken to its destination position with the mouse, where it can be placed by a further "RETURN".

On the right side of the menu band the position of the copy with regard to the original is shown in rastered points. By this, the copied element can exactly be placed as desired. As long as the copied element is not placed, the copying process can be reversed by "HOME", for example, when the false element has been copied.

Just as it is when deleting, it is also possible when copying to copy defined fields wholly. The fields are defined as it was described by deleting. Even here, it has to be seen to it that all elements which shall be copied are entirely within the limiting frame, which is also plotted in dotted lines.

If the period of blinking has been passed without confirmation, the chosen element will be released again, that means, another element which shall be copied can be started and chosen.

6.11 Moving (14)

The moving function "MOV" (14) is exactly the same as the two functions described before according to the handling. With help of this function, individual elements of the graphic or defined fields again can be moved on the drawing area. The succession is, as already known: starting "MOV" first, then the function of the element which has to be moved or function (5) if a whole sector of the graphic shall be moved. Then the desired element is chosen with the line cross and started.

Here, the recognized elements also blink one after another for 2 to 3 seconds. Within this period the desired one has to be confirmed for the second time. Now the element can be taken to its destination position with the mouse, and there it can be placed with a further "RETURN". With regard to the starting position, the position of the element is also shown on the right side of the menu band. The moving process can be interrupted with "HOME" as long as the element is not placed. Then the element is in its starting position again. If no element is confirmed during blinking, the cross hair is free again after blinking to move other elements of the chosen type.

6.12 Rotation, Inversion (15)

The function "ROT" (15) makes it possible to rotate graphic elements within 90 degrees steps and/or to mirror them.

Contradictory to the 3 functions described before, deleting, copying and moving, individual graphic elements, for example, a spline cannot be rotated or inverted here, but only defined fields. Owing to this, only function (5) is offered, after function "ROT" (15) has been chosen. If this one is confirmed, the field is defined in a way which is already known. If all elements in the field are recognized, it blinks again for 2 to 3 seconds. Within this period it has to be confirmed with "RETURN" once again. By this confirmation the first rotation of 90 degrees is effected. The direction of the rotation is always left. After confirmation of the field it can be rotated with "RETURN" as often as desired without limitation of time. Now the field can be inverted with the left mouse button in each of the 4 positions, which are possible on a vertical axis. When the desired presentation is reached, the field can be placed with "HOME".

6.13 Editing (16)

After selecting Edit you can choose the type of the element you want to edit. So far the edit function is only implemented for text objects and shapes.

With the text edit function you can only edit the text characters not the properties like font name, size and direction. The shape edit function allows you to change the bitmap file (source) for the shape.

6.14 Continued Menu Band (17)

If this function (>>>) is chosen, a jump to the next part of the menu band is effected. There are the functions (17)-(22).

6.15 Line Widths, Types and Colours (18)

Choosing this function leads to the following sub-menu in which types of lines, line widths, areas or types of hatching and colors can be chosen.

| (a) | (b) | (c) | (d) | (e) |

In section "a" of the menu band the adjustment of the closable parameters at the moment is shown. On the left, you can see the type of the line or the line width and on the right the type of hatching. Both types are plotted in the color adjusted. In section "b" of the menu band, one of five line types at disposal can be chosen by clicking. Then this type is immediately shown under "a".
The line width can be chosen in section "c" by clicking. It is also shown under "a" at once.
In section "d" there are 6 different types of hatching at disposal. The chosen one is shown on the right under "a".
In section "e" there is finally the possibility to choose one of the 16 colors. The color is also shown in section "a".
Comment: owing to the used graphic processor there are restrictions with regard to line widths and types and several graphic elements. Therefore it is not possible to draw circles with thick lines. Thick circles can be plotted by either placing together several circles with the same center, but different radius or by setting an inner- and external circle at thicker circles and filling the intermediate space. (mentioned in point 18).
At the function of the circular arc neither thick lines nor interrupted types of lines are possible. The way described above may be helpful, if large circular arcs are necessary. The open ends between two parallel circular arcs have to be locked with short lines before filling. Interrupted circular arcs can only be produced by stringing together individual arcs in the desired distance. Thick lines are not possible in the text, too. Larger writing can be produced, for example, by copying the writing several times and each time place it a little more to the upper right. If the same writing is put one on top of the other in two different colors, effects like shades can be produced.

6.16 Add Filling (19)

By means of this function it is possible to fill any sector, which is limited by lines, wholly. In the simplest case such a sector is, for example, a circle or a quadrangle. But also entirely unsteady sectors are possible, for example, between several splines. After the function has been clicked, the menu band "fill" appears and asks for "Select fill color/type" to choose the desired color and type of filling. After the jump into the menu band "fill", the color adjusted in "type of lines/color" of the sub-menu is shown in sector "a". It is the limiting color for the filling function. The adjusted color of lines by (17) must confirm with the color of the lines, which are limiting the sector which has to be filled. Lines of other colors are not accepted as limitation. Therefore the color of line adjusted by (17), which is, for example, red, fills only a red circle. All lines which are limiting the sector must have the same color. Now, one of six types of hatching under "b" and one of 16 colors under "c" can be adjusted just by clicking. The relevant adjustment of these parameters is always shown under "a". Now the menu band can be left with "HOME". The cross hair has to be placed on a central point within the sector, which has to be filled and the "fill" is set by "RETURN".
Menu band "fill" and examples:

| (a) | (b) | (c) |

So there can be set as much homogeneous "fills" as desired. If color or type of filling shall be changed, there has to be effected a jump into the menu band once again and adjustment has to be made.
Important: it is necessary to see to the limiting lines that they are entirely locked, otherwise the fill leaks, that means, the whole screen could be filled. Should this once happen, the fill can certainly be deleted (see to this point 19). Mind out, if limiting lines of already existing fills have been changed or deleted or if the whole sector shall be scaled with fill (see to this point 20). The safest way to avoid problems with complicated drawings is to delete the fills in question before changings and afterwards to set them newly.

6.17 Deleting Fills (20)

Obviously, it is possible to delete placed fills again. To do this, the function "unfill" is chosen. Then the line cross and all fills, which positions are now marked by small quadrangles appear again. The quadrangles of the fills which have to be deleted are clicked with the cross hair. The recognized quadrangle blinks for about 2 to 3 seconds, like it is when normally deleting. During this period is has to be confirmed with a further "RETURN". Then the quadrangle disappears at once, the whole "fill" not before a new installation of the graphic.
This is an example for different fills, which are already marked for deleting with the quadrangles.

6.18 Editing Fills (21)

With a variety of different fills, a graphic will become quite difficult to edit. For easier work with fills this function will display all fills of a graphic (little squares). After selecting one of these fills you can move this fill. A second mouse click "RETURN" will place the fill on the actual position and lets the user choose the type and color of the fill. Beware that fills are always placed inside a closed object. If not, the fill will leak out to the whole screen!

6.19 Scaling (22)

With the function "SCALE" (20) parts of the graphic can be enlarged or reduced. Hereby it deals with a real change of the width and not only with the presentation as it is described under point (11).
If point (20) is chosen, the cross hair appears again on the drawing area. Now the sector, described as by the points (12) to (15) is defined and shall be scaled, that means, first the corner is clicked with "RETURN", then the field has to be lifted in the desired direction and width and has to be confirmed again with "RETURN". When all elements are recognized, the field blinks for 2 to 3 seconds, in the period of which it has to be confirmed.
After that, scanning "AREA   scale: "1" follows. If the default value "1" is confirmed, the width does not change. Otherwise the factor for the desired enlargement or reduction has to be put in and has to be confirmed with "RETURN".
Owing to the limited pixel resolution of the screen, few inaccuracies can appear by using crooked scale factors. These inaccuracies have to be corrected after scaling. Due to these inaccuracies, for example, a fill may leak.
In the following example the apple on the right has been reduced with the factor 0.5. Before that, both apples had the same width.

6.20 Change Type and Color (23)

You can change the line/fill type and color of all basic objects (1-10) with the actual chosen ones. So you have to set the new line and color settings (11) before selecting this function.

6.21 Previous Menu Band (24)

There are 2 possibilities to get into the previous menu band with the basic functions. Either the function (<<<) (22) is chosen or "HOME" is simply pressed as often as the desired menu has been reached.

6.22 Undo (25)

Undo the last operation.

6.23 Insertion Mode On (26)

This sub function is not yet implemented!

6.24 Insertion Mode Off (27)

This sub function is not yet implemented!