

HAL COMMUNICATIONS CORP.
01 March 1991

DRAWING PLOTTING STANDARDS
using
HP Laser-Jet IIP Printer
and
PACIFIC DATA PRODUCTS Cartridge P.E

1.0 GENERAL

The HP Laser-Jet IIP Printer may be used to plot AutoCAD drawings directly on 8.5" x 11" paper. This can be used to produce very clean and reproducible illustrations within HAL documents. The following discussion presents a procedure which may be used to simplify the process of plotting AutoCAD drawings at the location, size, and orientation required to meet the publication requirements. While there are many other techniques that may be used to produce the same effects, the following procedure is reproducible and minimizes "cut and try" test plots.

2.0 AutoCAD DRAFTING AND SET-UP

The set-up used in preparing and displaying the drawing is critical to production of correctly plotted drawings. The same set-up procedure must be followed for each drawing in order that plotting may be reproduced at a later time, such as is required to plot a revised drawing. The following procedure is strongly recommended.

2.1 Preparing the Drawing Field

It is very important that uniform drawing procedures be used so that plot procedures may be standardized. I use the following procedures to start new drawings:

1. SET DRAWING LIMITS: (17,11 for "B"; 22,17 for "C"; 34,22 for "D"). Please do not use "A" or "E" sizes.
2. SET GRID: (0.2" for "B", and 0.2" or 0.5" for "C" or "D").
3. SET SNAP: (0.1" in general; SET ON (F9))
4. SET ORTHO ON (F8)
5. SET COORDS ON (F6)
6. ZOOM - ALL (A)

7. INSERT TITLE BLOCK AT (0,0): (STD/BTTLBLK, STD/CTTLBLK, STD/DTTLBLK)
8. LABEL TITLE BLOCK (on title block layer "0").
9. ZOOM - Extents (E)
10. CREATE OBJECT LAYER: (I use Layer #1, but it may also be named "OBJECT").
11. CHANGE TO OBJECT LAYER (or #1)
12. CREATE DRAWING

When drawing is complete, make the final step to be:

13. ZOOM - Extents (E)
14. SAVE FILE.

The above will produce uniform drawings with the title block and its labeling on a separate layer which may be turned OFF for plotting. It also results in a standardized saved file format. Additional layers may, of course, be created as required. Separate layers for text, hidden lines, hatch, etc. are often very desirable. Manual illustrations in particular may require freezing the title block and hidden layers and sometimes different text from the "standard" drawing.

PLEASE avoid creating drawings that are not referenced to the (0,0) lower left corner reference or has entities that extend beyond the drawing limits. If increased limits are required, change to the next larger title block size - and change the title block itself (HAL MAXIMUM = "D" size).

DO NOT SCALE ENTIRE DRAWINGS! Scale block within a drawing if necessary, but particularly **DO NOT SCALE TITLE BLOCKS!**

2.2 Text Size

When a drawing is reproduced in a manual, the Military requirement is that all "non-graphic" text be reproduced at a "6-point" or larger text size. This roughly corresponds to a final printed text height of 0.090". Since a drawing is scaled to fit the 8.5" x 11" page, the minimum text size used in AutoCAD will therefore vary with the drawing size. The following are rough guidelines to be used on manual illustrations:

SIZE	MINIMUM	PREFERRED

B	0.15"	0.20" and larger
C	0.25"	0.30" and larger
D	0.30"	0.40" and larger

For a complicated drawing, this may require a separate, less detailed text layer than that used on the standard full-sized drawing. ALWAYS use grid and snap when lettering - this makes it much simpler to change at a later date. In general, use the "STANDARD" text style, non-compressed (1.0 width).

Title block text guidelines:

Drawing Title: 0.18" High
DATE, SCALE, NAME: 0.12" High
Drawing NO.: 0.20" High
SNAP: 0.025" (Best fit to DATE & NAME blanks)

2.3 Line Work

All major object outlines should use poly-lines (PLINE). The PLINE width should be 0.020" minimum for all drawing sizes, preferably increasing to 0.030" for "C" and 0.040" for "D" drawings. A manual illustration must be uncluttered and this may require removal of some details (as well as simplified text) for a manual publication. For this reason, very fine details may be best placed on a separate layer (or moved to a separate layer before plotting for a manual illustration). Interior lines may be standard ("0" width).

Reference each object to the grid system. This makes it a lot simpler to move or scale portions of a drawing without losing the original reference. I suggest that the reference point be the lower left corner of the left-edge of a center line. In block diagrams and other drawings with arbitrary-sized details, match major dimensions to a 0.100" grid. Remove all locating "tick" markers before ending the drawing!

If, when modifying a detail, it is necessary to extend a line, either redraw the line (erase old and draw new line) or use the STRETCH command to extend the line(s). Do not try to splice extensions to previously drawn lines. Even if you do match the end of the previous line, it is highly likely that the plotter will insert a blemish when it picks-up and sets-down again in mid-line.

Please do not over-draw one line or detail with another. When erasing, only the closest layered line is actually removed, even though the display may appear "clean".

3.0 PLOTTING ON TH HP-LJ IIP:

The Hewlett-Packard Laser-Jet IIP is a 300 dpi printer which will also emulate the HP7475A plotter when the PACIFIC DATA PRODUCTS Cartridge P.E is plugged-in.

NOTE: The cartridge should be installed before turning the printer power ON. The cartridge must be removed to print text (turn power OFF before removing).

The following technique depends upon normalizing the drawing on the PC display before plotting. To assure repeatability, it is extremely important that the same procedure be used on each drawing to be plotted.

3.1 Normalize The Display

Before plotting, choose the exact area of the drawing that should be plotted. Use the ZOOM - Window (W) option to display the area of interest.

The AutoCAD display has a "(X,Y)" coordinate display system ("X" = horizontal screen axis). The aspect ratio (X/Y) of the screen is approximately 1.4:1. Your ZOOM will probably cause display of more area than you desire in the "Y" (vertical) direction. This cannot be helped.

If the plot output is to include the title block, ZOOM-E (Extents) will fill the screen with the full title block.

If you wish to plot only a small section of the drawing, first freeze and turn-off the title block (Layer 0). Then, use ZOOM-W to fill the display with the details to be plotted. You may also wish to use the PAN feature to shift the object to within 0.100" of the bottom of the screen - this makes for more accurate positioning on the HPLJ output plot. As will be discussed later, it may also be desirable to PAN the zoom window towards the left or right, depending upon which plot orientation is to be used (0 or 90 degrees).

EXTREMELY IMPORTANT: Once the desired ZOOM window has been defined, write down the zoom window coordinates! This assures that we can duplicate the screen set-up for later plots. When plotting a manual figure, I SAVE the drawing in the exact zoom-window configuration used and then archive that version on diskette.

3.2 HPLJ Plot Parameters

The following procedures set-up a repeatable method of plotting the specified drawing area to a desired page location and size. The opposite-corner method of plot size specification is used. While this does in fact automatically cause scaling of the drawing, it is NOT the same as specifying a plot scaling percentage.

3.2.1 Minimum Margins

The HPLJ IIP plotter cannot plot on the full extent of the 8.5" x 11" page. In fact, the plot has the minimum margins shown in drawing C1511. For a "sideways" drawing (plot rotation = 0 degrees), the bottom and left minimum margins are 1/8" (0.125"). The top and right-side minimum margins are 5/8" (0.625"). The same margins also apply to a "vertical" format (plot rotation = 90 degrees), but now the minimum bottom and right margin is 1/8" and the top and left-side minimum margin is 5/8".

ANY PORTION OF A DRAWING BEYOND THESE MARGINS IS NOT PLOTTED.

3.2.2 Plot References

AutoCAD and the HPLJ plotter have an "X-Y" coordinate system, similar to that used to prepare the drawing. However, note in C1511 that the plot reference point is different for "sideways" and "vertical" plot formats. Also note that the plot axis labels "X" and "Y" relate to the paper dimensions and not to horizontal and vertical dimensions. In the plot, the "X" axis is always the direction of the long (11.0") dimension of the paper; the "Y" axis always corresponds to the narrow (8.5") paper dimension. Therefore, the (X,Y) method of specifying locations has different meanings when plotting "sideways" (0 degree rotation) and "vertical" (90 degree rotation). The corresponding "X" and "Y" measurement directions are shown in C1511.

3.2.3 Plot Origin

When plotting "sideways", the plot origin reference (0,0) is at the same corner as the AutoCAD display reference - the lower-left corner.

When plotting using the "vertical" format (90 degree rotation), the plot origin reference is the lower right-hand corner of the page which works out to also be the lower right-hand corner of the CRT display - DIFFERENT from the display coordinate reference point.

You specify the plot origin location dimensions in inches. However, recall that the HPLJ has an 1/8" minimum margin offset at both reference corners (0 degrees and 90 degrees). This minimum margin offset is not included in AutoCAD's plot origin specification. Therefore, when centering a drawing plot, you must add 0.125" to the plot origin to determine the actual on-paper "plot origin".

Also, note that what you will be plotting is the contents of the display window. This includes the blank spaces between the screen edges and the object. For this reason, the display window should be adjusted so that the bottom edge of the object is very close to the bottom of the display screen (0.100" recommended).

If you are going to plot "sideways", also PAN the display so that the left edge of the object is very close to the left edge of the screen (0.1"). This places the object close to the "plot origin" reference point for "sideways" plotting.

If you are going to plot in the "vertical" format, PAN the display so that the right edge of the object is very close to the right edge of the display (0.1"). This gives close match to "plot origin" reference point for "vertical" plots.

3.2.3 Plot Area

AutoCAD uses a two-corner method of specifying the area to be plotted. The reference corner position is specified using the "plot origin" (X,Y) coordinates as discussed above. The (X,Y) plot area specifications may be thought of as "inch offsets" from the plot origin location. The plot area entry actually specifies the full dimensions of a plot of the entire displayed screen area.

Recall that the "aspect ration" of the display screen is approximately 1.4:1 ("X" dimension is 1.4 times the "Y" dimension). Few drawings actually have this aspect ratio. While most HAL drawings will fill the horizontal screen display ("X" display parameter), few drawings also fill the vertical screen area. This is especially true of "B" sized title block drawings which rarely use the space below the top of the text entry block. The title blocks themselves have an aspect ratio of 1.55:1; only 65% of the vertical screen area is used.

However, AutoCAD plot output assumes that the full horizontal and vertical screen areas are plotted, using the 1.4:1 aspect ratio. Therefore, the specified plot area almost always exceeds the actual area to be plotted. Further, as previously noted, all blank and object areas of the screen are included in the plot area, including blank areas.

Specifying the exact plot origin and plot area therefore requires generating a few "cut-and-try" test plots. Positioning the object close to screen edges reduces the number of "test guesses", but does not eliminate them entirely. With practice and a few "pre-set" suggestions, it should require less than 6 test plots to produce the desired output.

3.2.4 Test Plot Procedure

The following is offered as a guide to producing plotted outputs:

1. Decide if your plot will be "sideways" or "vertical".
 - 2a. If "sideways", set the display ZOOM window so that the left and bottom edges of the object are close to the left and bottom edges of the screen (0.1" suggested).
 - 2b. If "vertical", set the display ZOOM window so that the right and bottom edges of the object are close to the right and bottom edges of the screen.
3. WRITE DOWN THE ZOOM WINDOW COORDINATES: Lower Left (X,Y); Upper Right (X,Y).
- 4a. If "sideways" try a test plot with plot origin at (0,0) and plot area at (9.7,7.1). Respond "N" to "Rotate 2D plots 90 degrees clockwise?" (0 degree rotation).
- 4b. If "vertical" try a test plot with plot origin at (0,0) and plot area at (5.4,7.45). Respond "Y" to "Rotate 2D plots 90 degrees clockwise?" (90 degree rotation).
5. Specify Pen Width = 0.005" (always on HPLJ plotting).
6. Answer "Y" to "Adjust area fill boundaries for pen width?" and "F" for Fit.
7. Ignore any "WARNING - PLOT EXCEEDS PLOT AREA" message!

Once the above test plot has been run, you will have an idea of how your drawing will look. Measure the drawing reference offset and size and computer new plot origin and plot area coordinates to match the page spacing requirements. Don't forget the 1/8" HPLJ plot origin offset and the minimum 5/8" gap for the other two margins. I next make major approximate adjustments and the try another test plot. It may take 2 or 3 more minor adjustments, but the desired location and size are quickly determined if this method is followed.

3.2.5 Examples

Drawings C1511 and C1512 are examples of a "D" size drawing plotted using the HPLJ IIP printer/plotter. C1512 shows maximum plot sizes for two cases:

1. Maximum "B" or D" drawing, centered X & Y. This is the largest centered plot possible due to the 5.8" margin limitation.
2. Manual Page margins and typical "B" & "D" drawing placement. This positioning allows use of one header (.h1) and three footers with the Figure title in the .f1 footer. It assumes that no text other than the header and three footer lines are placed on the page.

Drawing C1511 is plotted to condition (1) (maximum centered) and C1512 is plotted to march manual page margin requirements.

3.2.6 "Pre-Set" Coordinates

The following preset coordinates have been experimentally determined (always set Pen Width = 0.005"):

"B" Drawings: (ZOOM-E on title block)

1. Maximum Centered - Sideways: (0.50,1.05) = Plot Origin
(9.75,7.06) = Plot Area
"N" = Rotation (0 deg)
2. Fit Manual Margins - Sideways: (1.10,1.28) = Plot Origin
(9.00,6.52) = Plot Size
"N" = Rotation (0 deg)
3. Maximum Centered - Vertical: (3.00,0.35) = Plot Origin
(5.40,7.45) = Plot Area
"Y" = Rotation (90 deg)
4. Fit Manual Margins - Vertical: (3.33,0.91) = Plot Origin
(4.63,6.39) = Plot Area
"Y" = Rotation (90 deg)

"D" Drawings: (ZOOM-E on title block)

1. Maximum Centered - Sideways: (0.57,1.05) = Plot Origin

(C1511 Example) (9.65,7.00) = Plot Area
"N" = Rotation (0 deg)

2. Fit Manual Margins - Sideways: (1.00,1.18) = Plot Origin
(C1512 Example) (9.10,6.59) = Plot Area
"N" = Rotation (0 deg)

Use of pre-set drawing zoom window coordinates and plot coordinates is shown in the attached "ST8AFIGS.WK1", a tabulation of the settings required for all illustrations of the ST-8000A OPERATOR'S MANUAL. A similar list should be prepared for all manuals and other illustrated documents issued by HAL in the future.

4.0 OTHER PLOTTERS

The techniques outlined above may be used with any plotter. However, the margin requirements are different for each plotter. Therefore, the Plot Origin and Plot Area coordinates will also vary with each plotter.

Settings which work on the HP7475 11x17 plotter ("B" mode) are:

"B" Drawings to Fill Page: (0.00,0.00) = Plot Origin
(16.00,11.60) = Plot Area
"N" = Rotation (0 deg)

"C" Drawings to Fill Page: (2.60,0.00) = Plot Origin
Fill "vertical", offset (13.81,10.00) = Plot Area
horizontal to right end. "N" = Rotation (0 deg)

"D" Drawings to Fill Page: (0.00,0.00) = Plot Origin
(15.60,11.30) = Plot Area
"N" = Rotation (0 deg)

5.0 FUTURE PROJECTS:

The exact minimum margin requirements for each plotter should be measured and documented. At present, HAL owns the following plotters: HP7470 ("A" Size), HP7475 ("B" Size), HP 7570 ("D" size), HPLJ IIP w. Plotter Cartridge ("A" Size).

Corresponding tables of pre-set plot origin and plot area coordinates need to be defined for these plotters.

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