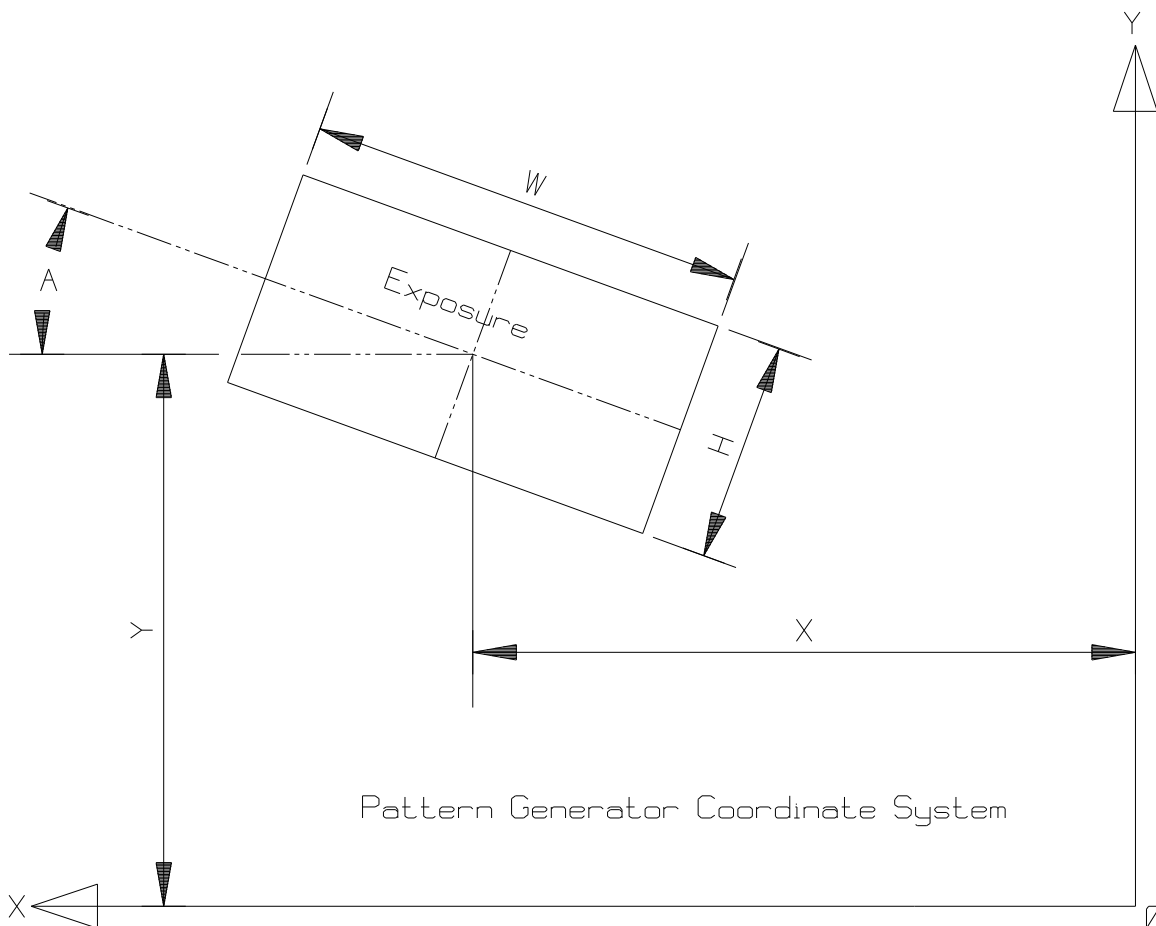# Mann Pattern Generator Data Format

D. W. Mann format is a way of representing the size and position of rectangular exposures which make up a photomask pattern. Each exposure in a pattern file is defined by the X and Y coordinates of the centre of the exposure, the height H and width W of the exposure and the angle A between the W and X axes.

Pattern Generator Coordinate System

A standard two dimensional, (X,Y) rectilinear coordinate system is used, except that it is left handed. The origin (0,0) is considered to be in the lower right-hand corner, with positive X axis values increasing to the left, positive Y-axis values increasing upwards and positive angles measured clockwise from the positive X axis.

For the Mann 1600A/2600/3000 pattern generators, X and Y data are constrained to lie in the positive 1st quadrant (+X,+Y). For the GCA/Mann 3600 pattern generator, the origin is considered to be in the centre of the photomask. X and Y data are then signed (+ or -) and allowed to lie in any of the four quadrants.

Mann Data Format (1600A/2600/3000)

For both English and metric pattern generators in the 1600A/2600/3000 family, Mann format data file will contain information in the following form:

*   each exposure must define the X and Y coordinates of the centre of the exposure, the height (H), width (W) and the angle (A) between the aperture width (W) and the scan stage X coordinate.

*   each exposure consists of one or more characters representing an exposure setting, followed by a set of digits (called a word) representing the value of the setting, in the form XxxxxxYyyyyyHhhhhWwwwwAaaa

    e.g. X43000Y22000H100W100A20;

*   the decimal point is assumed depending on the resolution of the pattern generator

*   one set of words followed by a semicolon character (;) is called a block. One block produces one exposure on the photomask.

*   if a word is not specified then the value from the previous exposure is assumed.

*   the maximum and minimum acceptable values for the X, Y, H, W and A settings are found in the Mann 1600A/2600 and Mann 3000 specification tables.

*   the final character of a word is constrained by the resolution of the target pattern generator e.g. an English 1600A word can only end in the digits 0, 2, 5 or 7 representing multiples of the 0.00025" resolution of the machine. Leading zeros may be deleted.

*   angle words are expressed as multiples of the angle resolution with an assumed decimal point e.g. A34 represents 34 degrees in an English 1600A but 3.4 degrees in an English 3000

*   comments must be preceded by a " (double quote) character and end with a carriage return/line feed (CR/LF)

• the dollar sign character ($) marks the end of a data file

A single exposure data file might look like:

```
"Sample number 1
X115Y5H50W100A15;
$
```

In a metric 3000 machine, this gives an exposure centred at (0.115,0.005) mm with height (H) and width (W) settings of 0.050mm and 0.100mm respectively, at an angle of 1.5 degrees.

Mann Data Format (3600/3600F)

• the first record of each pattern file must identify itself as a 3600 format file with the sequence '"T3600' at the beginning. Metric data can use '"T360M' and English data can use '"T360E'.

• each exposure must define the X and Y coordinates (signed) of the centre of the exposure, the height (H), width (W) and the angle (A) between the aperture width (W) and the scan stage X coordinate. At an angle of zero degrees, W is measured along the X axis and H along the Y axis.

• R can be used for arrays of exposures that 'repeat in X' by an amount I
```
e.g. R19I010X110H6
means repeat for 19 X values starting at 0.110 and incrementing by 0.010
with all other settings (Y,H,W and A) remaining unchanged
```

• for angle data, a decimal point is assumed at the end unless explicitly given.
```
A45   = A45.0 = 45 degrees
A45.3 = 45.3 degrees
A4    = 4 degrees
A.4   = 0.4 degrees
A450  is illegal
```

• for the other motion data (X, Y, H and W), assume a decimal point at the beginning unless explicitly given.
```
Metric     H2          = H200 = 0.2mm
           H2.0        = 2.0mm
           H02         = H.02 = 0.02mm
           H201020356 = 0.201mm (rounded)
           X-1.0401 = -1.0401mm
           Y24126     = +0.2413mm
English    H1          = H10 = 0.1 inches
```

```
H012      = H.012 = 0.012 inches
```

- each exposure consists of one or more characters representing an exposure setting, followed by a set of digits (called a word) representing the value of the setting in the form XxxxxxYyyyyyHhhhhWwwwwAaaa

  e.g. X43.000Y22.000H100W100A20;

- one set of words followed by a semicolon character (;) is called a block. One block produces one exposure on the photomask.

- if a word is not specified then the value from the previous exposure is assumed.

- the maximum and minimum acceptable values for the X, Y, H, W and A settings are found in the 3600 specification table.

- comments must be preceded by a " (double quote) character and end with a carriage return/line feed (CR/LF)

- the dollar sign character ($) marks the end of a data file

A simple exposure data file might look like

```
"T360M
Sample number 1
X10.03Y11.05H3.0W0.5A0.3; Y9.0; Y8.0; Y10.0X0.100; Y9.3;
$
```

Mann/GCA Pattern Generator Specifications

Machine	Units	Stage Position (X,Y)			Aperture Height,Width (H,W)			Aperture Angle (degrees)		
		Max	Min	ΔX,Y	Max	Min	ΔH,W	Max	Min	ΔA
Metric 1600A/ 2600	mm	100.000	0.000	0.005	3.000	0.005	0.005	89	0	1
	steps	20,000	0	1	600	1	1	89	0	1
English 1600A/ 2600	inches	4.00000	0.00000	0.00025	0.1200	0.00025	0.00025	89	0	1
	steps	16,000	0	1	480	1	1	89	0	1
Metric 3000	mm	100.000	0.000	0.001	3.000	0.004	0.001	89.9	0.0	0.1
	steps	100,000	0	1	3,000	4	1	899	0	1
English 3000	inches	4.00000	0.00000	0.00005	0.12000	0.004	0.00005	89.9	0.0	0.1
	steps	80,000	0	1	2,400	4	1	899	0	1
Metric 3600/ 4600	mm	+75.000	-75.000	0.00025	1.5000	0.002	0.0005	89.9	0.0	0.1
	steps	+300,000	-300,000	1	3,000	4	1	899	0	1