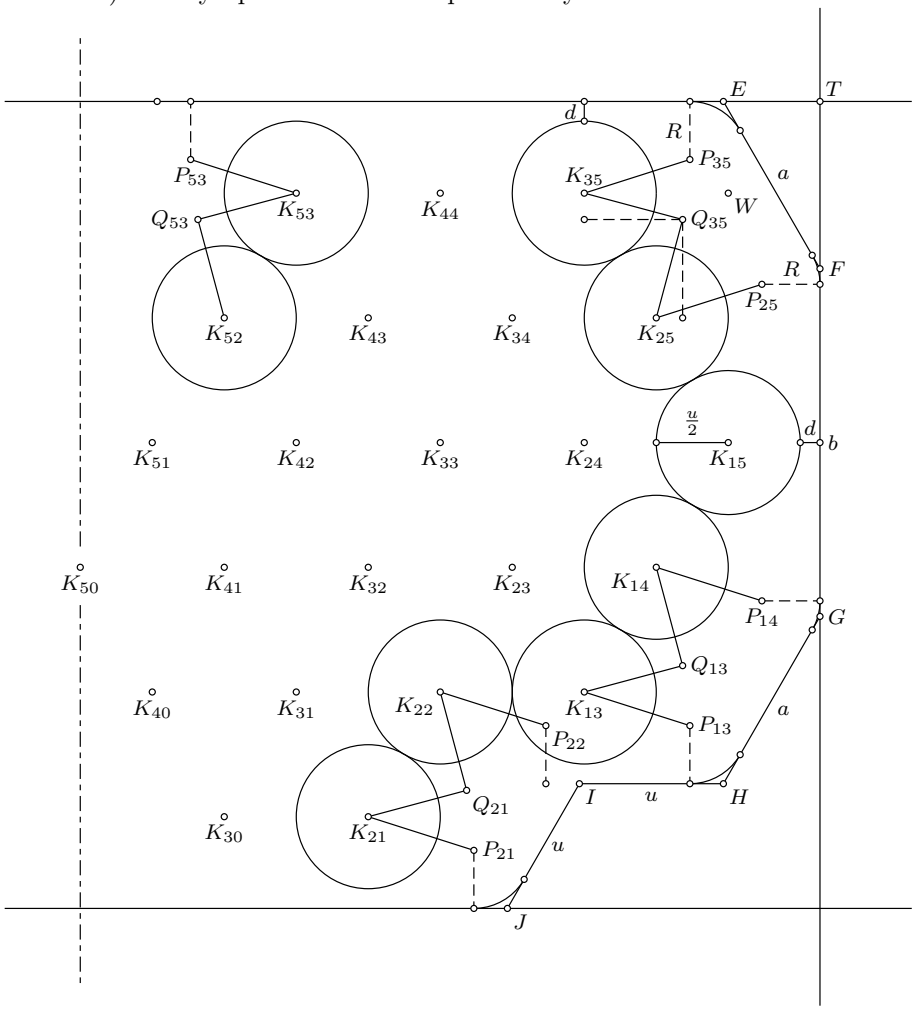
This is a specification to the CAD drawing of the chassis ver. 4 of the Forever Ambre keyboard, independent of the drawing. It can be used to check the current drawing, or to make a replica from scratch.

Ver. 4 is a refined version of ver. 1a. It is aimed at creating a more useful geometry and with a more concise description for the chassis.

The chassis consists of a bottom plate connected to a top plate across a middle plate at 12 threaded spacers. A PCB is mounted to the middle plate at 8 threaded self-clinching standoffs. As the chassis is symmetrical, here is depicted only one half (the right-hand one). The outline of the bottom plate is identical to that of the top plate, but the top plate has (up to) 45 round or hexagonal holes for keycaps to slide through while the bottom plate has not. Correspondingly, on the middle plate there are 45 square holes for mounting keyswitches. In the assembled chassis (in 2D view) the keycap hole and the respective keyswitch hole are cocentric.



Let holes of the keyboard's chassis be identified by their centers. A key (switch or cap) hole is denoted by K_{ij} where i is a row index and j is a column index, for example, K_{50}. A hole for a spacer is denoted by P_{ij} where indices i and j are from

a nearby keyhole. Every P_{ij}, except P_{22}, identifies a spacer's hole. A hole for a self-clinching standoff is denoted similarly, by Q_{ij}.

The *base rectangle* is the bounding rectangle of the set of all K_{ij}.

The chassis is defined by the following constraints:

(1) All K_{ij} are nodes of an equilateral triangular grid with pitch $u = 0.75''$.
(2) Q_{35} has the same distance to K_{35} and K_{25}, as well as the same distance to the horizontal line through K_{25} and the vertical line through K_{35}.
(3) The distance from P_{35} to the horizontal line through K_{35} equals to that from P_{25} to the vertical line through K_{15}.
(4) The straight line $P_{25}P_{35}$ is 120° directed.
(5) The ratio of the vertical edge $b = FG$ per chamfer edge $a = EF = GH$ of the top plate is $\frac{b}{a} = \frac{8}{5}$.
(6) The distance from P_{35} to the horizontal line through Q_{35} is $\frac{5u}{12}$.
(7) P_{13} is the mirror image of P_{35} in the same mirror (i.e. reflection across a straight line) that would give K_{13} from K_{35}. Similarly, P_{53}, P_{14}, Q_{13}, Q_{53} is mirror image of P_{35}, P_{25}, Q_{35}, Q_{35}, respectively. Likewise, P_{21} is the shift image of P_{13} in the same translation that would give K_{21} from K_{13}, and similarly P_{22}, Q_{21} is the shift image of P_{13}, Q_{13}, respectively.
(8) The bounding polygon of the middle plate consists of the polyline $P_{53} \ldots P_{21}$ joined with its mirror image across the center line, i.e. the vertical line through K_{50}, offsetted outwards by certain distance r so that its bounding rectangle coincides with the base rectangle offsetted outwards by $\frac{u}{2}$.
(9) The bounding polygon of the top plate is obtained similarly, but offsetted outwards by certain distance R so that its bounding rectangle has a ratio of length (L) per width (H) of $\frac{L}{H} = \frac{16\sqrt{3}}{15}$.

NOTES. Table 1 lists some metrics that are derived from the specification. There we use a local coordinate system origined at W, the top right corner of the base rectangle.

Technically, the spacer's clearance zone has a larger radius than $P = \frac{u}{6}$, but the difference (cca 10^{-3} mm) is negligible. The spacer's clearance zone is the circle centered at P_{ij} and tangent to the respective standoff's clearance zone, i.e. one centered at Q_{ij} with radius $Q = \frac{u}{4}$.

R is the radius of fillet for convex vertices of the top plate (i.e. vertex E, F, G, H, J.) And similar is r for the middle plate.

Specified are location and size of clearance zones around holes. The size of holes is unspecified.

TABLE 1. Metrics. Coordinates are relative to the top right corner (W) of the base rectangle.

Description	Denotation	Value
Length of the base rectangle	l_0	$9u$
Width of the base rectangle	h_0	$\frac{5\sqrt{3}}{2}u$
Length of middle plate	l	$l_0 + u$
Width of middle plate	h	$h_0 + u$
Length of top plate	L	$l + 2d$
Width of top plate	H	$h + 2d$
Offset from middle to top plate's outline	d	$\frac{40\sqrt{3}-53}{181}u$
Radius of fillet at middle plate	r	$(\frac{\sqrt{3}}{4} - \frac{1}{6})u$
Radius of fillet at top plate	R	$r + d$
Width of middle plate at sides	h'	$h - \frac{\sqrt{3}}{2}u$
Width of top plate at sides (EH)	H'	$h' + 2d$
Length unit for side edges	w	$\frac{6030-3161\sqrt{3}}{1991}u$
Length of chamfer edge (EF, GH)	a	$5w$
Length of vertical edge (FG)	b	$8w$
Radius of standoff zone	Q	$\frac{u}{4}$
Radius of spacer zone	P	$\frac{u}{6}$
Abscissa of Q_{35}	x_Q	$\frac{\sqrt{3}-3}{4}u$
Ordinate of Q_{35}	y_Q	$\frac{1-\sqrt{3}}{4}u$
Abscissa of P_{35}	x_P	$(\frac{77827\sqrt{3}}{9} - \frac{62401}{4})\frac{u}{1991}$
Ordinate of P_{35}	y_P	$(\frac{2}{3} - \frac{\sqrt{3}}{4})u$
Abcissa of P_{25}	$x_{P'}$	$(\frac{2}{3} - \frac{\sqrt{3}}{4})u$
Ordinate of P_{25}	$y_{P'}$	$(\frac{345155}{12} - \frac{52276\sqrt{3}}{3})\frac{u}{1991}$