P4/P10 conversions for vertical placement of SCORE staves.

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22 April 2015

Staves in SCORE data can be placed vertically on a page using two different methods:

- A (semi-)relative method: Staves have a default position on the page, and P4 is used to give vertical offsets from these positions in units of diatonic steps (at the current vertical scaling of the staff).
- An absolute method: Staves are placed on the page at a fixed physical distance above the bottom line of the first (bottom) staff position on the page.

1 Relative vertical position (P4)

The most common method for vertical staff placement is to give a diatonic step offset in P4 of staves (where staves are indicated by P1=8 for a SCORE item). The default spacing of staves on a page are 0.7875 inches from the bottom line of one staff to the bottom line of the next higher staff. For example staff two's position is 0.7875" above staff 1, and staff three is 2 × 0.7875" = 1.5750" above the bottom line of staff 1. The default height of the space between staff lines is 0.0875", so the spacing between the bottom lines of staves can also be expressed as 0.7875/0.0875 = 9 staff lines, or 18 diatonic steps. For example if P4=−18 for staff 2, then it would exactly overlap the lines of staff 1 (provided that both use the default scaling (P5=0 or P5=1). Additionally, the distance between the top line of staff 1 and the bottom line of staff 2 at the default scaling would be 9 lines − 5 lines = 4 lines or 8 diatonic steps. This would visually create a single staff with 10 lines. Setting P4=−10 would create a single visual staff with 9 lines, since the bottom line of staff 2 would exactly overlap the top line of staff 1.

When staves are scaled other than 100%, the position above the first staff can be calculated by also considering the individual staff's scaling (P5). The default position of a staff is unaffected by the P5 scaling for a staff, but the P4 offset is affected by the P5 scaling. For example to calculate the vertical position in inches of the second staff (P2=2) when its P5=0.6 and P4=17 would be:

$$\text{Vpos} = (P2 - 1) * 0.7875" + P4 * P5 * 0.0875"/2 = 1.23375" \text{ above the default position of staff 1.}$$

If staff 1 has a non-zero P4 value and/or P5, then the physical distance from the bottom line of staff 1 to the bottom line of staff 2 would be:

$$\text{Vpos} = (P2_{P2=2}-1)*0.7875" + P4_{P2=2}*P5_{P2=2}*0.04375" - P4_{P2=1}*P5_{P2=1}*0.04375"$$
$$= 0.7875" + (P4_{P2=2} * P5_{P2=2} - P4_{P2=1} * P5_{P2=1}) * 0.04375"$$

There is an additional page scaling which is not given within the data, but is applied at printing time. For example if the page scaling is 0.5, then the above vertical position values would also be scaled by 0.5.

2 Absolute vertical position (P10)

A second method for describing the vertical positions of staves is to give a non-zero value in P10 for the staff item. This will cause the give staff by be place P10's value in inches above the default bottom line of the bottom staff. The units of P10 may be inches or centimeters, depending on the units setting in the SCORE editor. The inches/centimeter units are also stored in binary SCORE files (usually ending in .MUS or .PAG), but are not encoded in PMX data (ASCII macro files), nor are the units indicated within the parameters of the staff items. So be careful as to whether or not inches are being used as the spatial units. Also note that when P10 is non-zero, then the P4 value will be ignored.

To convert between the P4 and P10 methods for describing vertical positions of staves, used the equations provided in the previous section. For example the P10 value of any staff can be calculated with this equation:

P10 = (P2 – 1) * 0.7875" + P4 * P5 * 0.0875/2"

The P10 value of any staff is not affected by any offset in the bottom staff's offset or vertical scaling.

To convert a P10 value into a P4 offset, solve the above equation for P4:

P4 = P10 – (P2 – 1) * 0.7875" / (P5 * 0.0875"/2)
= [P10/0.04375" – 18 * (P2 – 1)] / P5

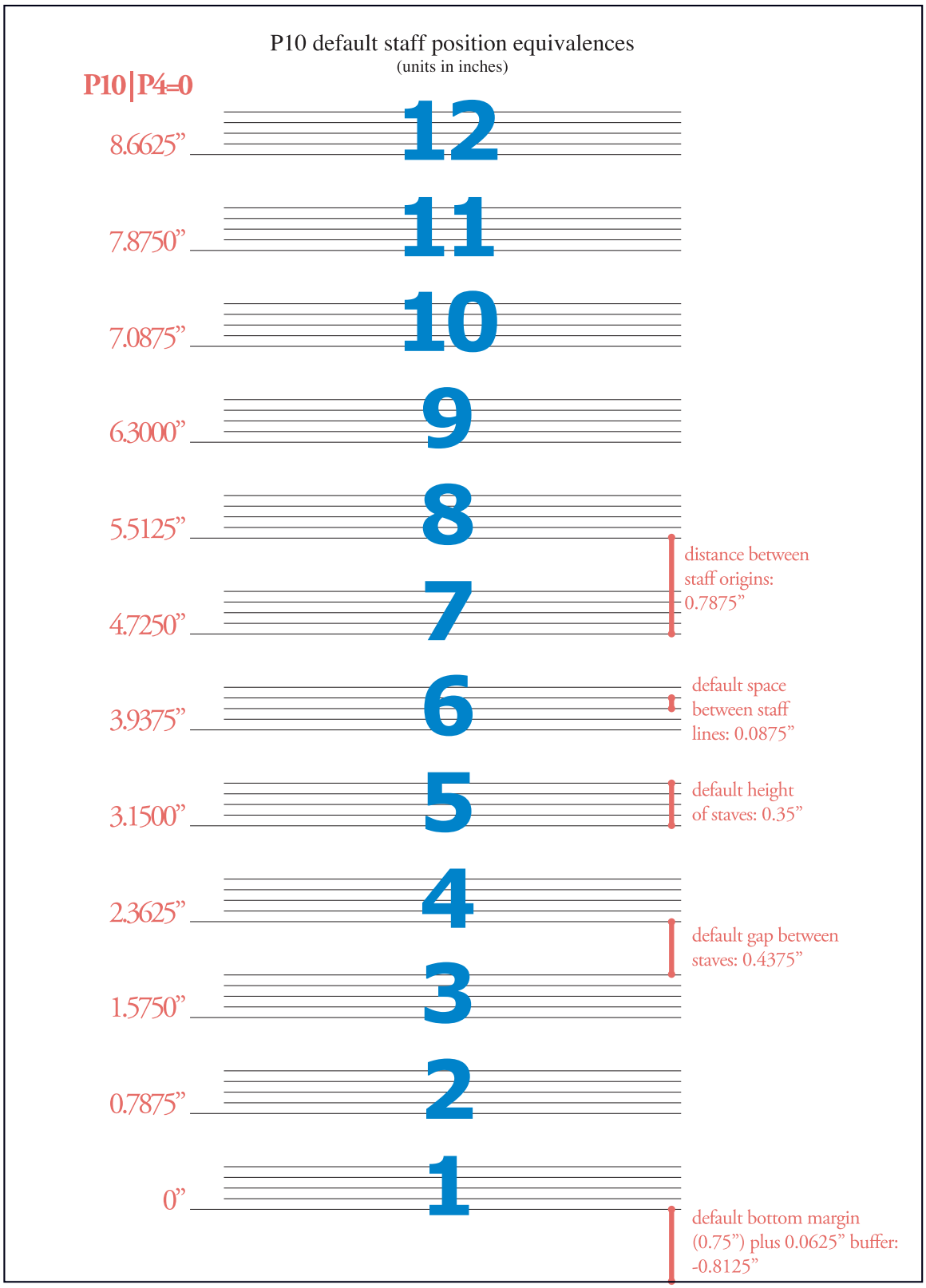
3 Absolute vertical position on the page

To calculate the exact position of any staff on a page will be dependent on two printing parameters which are not present within the data: (1) The page scaling (PS) with a default scaling of 1.0, and the page's bottom margin (BM), which has a default value of 0.75".

Vpos = P10 * PS + BM + 0.0625"
= [(P2 – 1) * 0.7875" + P4 * P5 * 0.04375"] * PS + BM + 0.0625"

This is the distance from the bottom of the physical page in inches, assuming P10 units are inches. To calculate the vertical position from the top of the page, subtract this value from the height of the page. Note that 0.0625" is an additional fixed vertical offset to the bottom margin that SCORE adds when printing onto a page.

The figure on the next page illustrates useful physical values for vertical staff positions on a page.


P10 default staff position equivalences
(units in inches)
P10|P4=0
8.6625”
12
7.8750”
11
7.0875”
10
6.3000”
9
5.5125”
8
4.7250”
7
3.9375”
6
3.1500”
5
2.3625”
4
1.5750”
3
0.7875”
2
0”
1
distance between staff origins: 0.7875”
default space between staff lines: 0.0875”
default height of staves: 0.35”
default gap between staves: 0.4375”
default bottom margin (0.75”) plus 0.0625” buffer: -0.8125”