Confirmation of the Design Latitude of Horizontals Dials

It is well known that one can provide an input, at least, to the confirmation of the latitude for which a good quality horizontal dial was designed by measuring the angle of the gnomon to the dial plate. Then, subject to the dial not being mounted at some inclination to the horizontal, it is possible to form a judgement of whether or not the dial is in its original setting.

Measuring the angle of the gnomon is not itself a very easy thing to do with any precision though devices are available, both custom and home made (1) that will assist in this. In my own experience one can usually get adequate readings from tracing the profile of the gnomon onto paper and, when one gets home, extending this to permit a measurement or calculation to be made.

This of course only really allows a judgement to be made about the design of the gnomon. Sometimes there is no gnomon present. Sometimes there may be some doubt as to the provenance of the gnomon relative to the dialplate. In these circumstances it would be convenient to be able to make a similarly easy measurement from the markings on the dialplate.

Clearly, if it is intended to make measurements which later might be used to manufacture a replacement gnomon, then a number of readings needs to be taken and the results averaged. However, if it is only required to confirm that the gnomon angle and the inscribed lines each have a consistent design latitude, then it would be sufficient to measure just one of the lines. But which one?

The noon line(s) and the 6am/6pm lines of a horizontal dial remain at 0 and 90 degrees to the appropriate edge of the gnomon regardless of the latitude for which the dial was originally designed and so one might intuitively presume that, being midway in between these extremes, the 9am/3pm lines might provide the best choice for such a measurement; and that does indeed prove to be not far from the truth.

Essentially one is looking for the time of day when there is the maximum change in hour line angle per hour. That will ensure that the measurement will be the most sensitive. If, for different latitudes, one calculates the rate of change of the angle between the hour lines of a horizontal dial, it can be seen that the time of the maximum varies slowly between the 8am/4pm and 9am/3pm lines as one moves from latitudes like 38degrees N to the higher ones like 60 degs N. See Figure1. Equally, the angular separation decreases for higher latitudes.

There is little practical purpose in attempting to identify a specific maximum applicable to a particular dial since only full hours are likely to be drawn on the dial with any certainty and of course it is usually only the hour lines that are drawn more or less fully across the dial plate. Thus one may use either (or both) of these two sets of hour lines in order to make a measurement.

Of course one may copy these angles onto paper and measure them at a later date or one may measure the lines' position at one or more points along the gnomon. In this way the design latitude of the dialplate may be estimated to about half a degree.

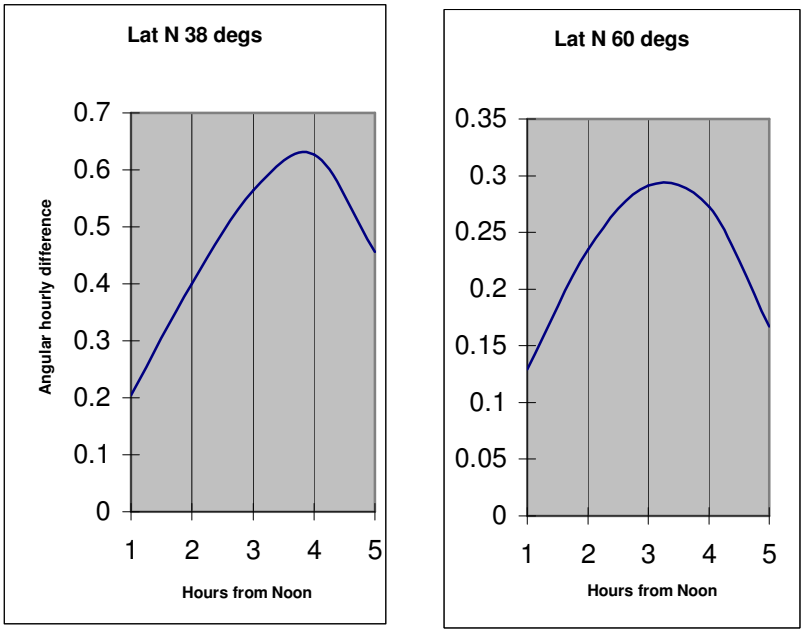

Figure1. Variation of angular hourly difference with time from Noon at Lat 38N and at Lat 60N

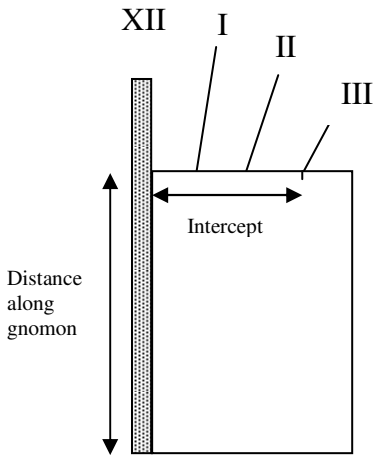

Figure 2. Measurement of Intercept of the 3pm line from the gnomon.

Instead using a rectangular piece of paper, one may measure the intercept of the 3pm or 4pm line at one or other distances along the gnomon from its root as shown diagrammatically in Figure 2.

Figure 3 converts these intercepts to Latitude for the 9am/3pm line for three distances along the gnomon; 6, 9 and 12 cms. Figure 4 does the same for the 4pm line.

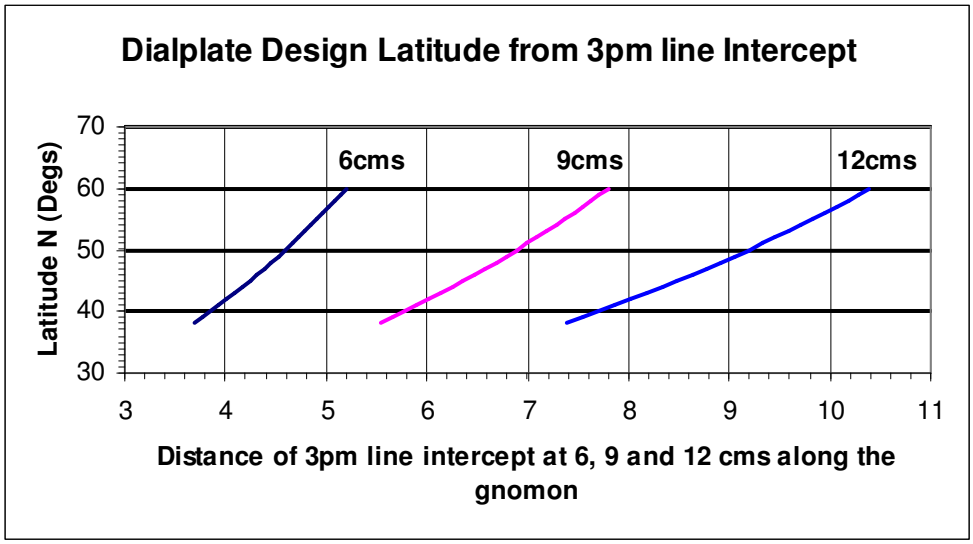

Figure 3. Conversion of Intercept of the 3pm line to Design Latitude, in degrees.

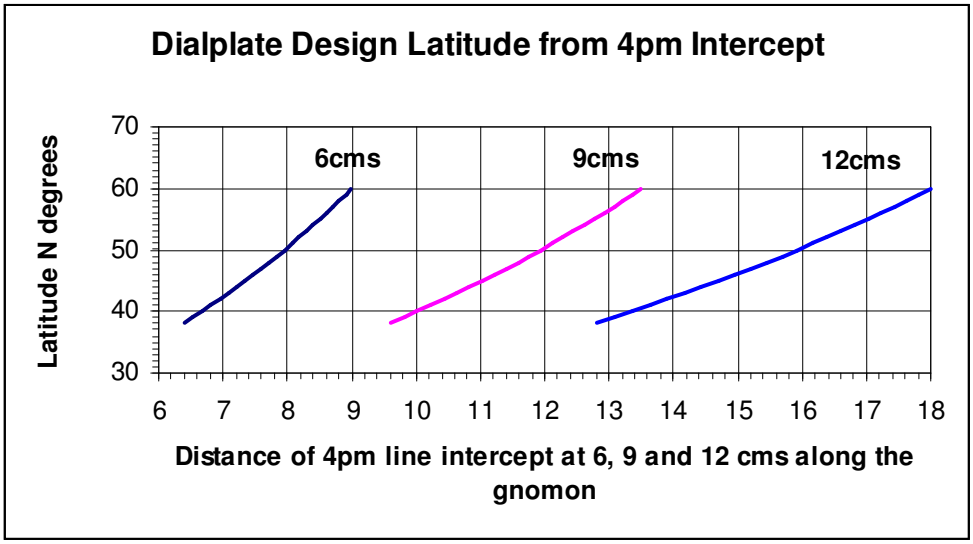

Figure 3. Conversion of Intercept of the 4pm line to Design Latitude, in degrees.