An accurate sundial for a wall—two case studies

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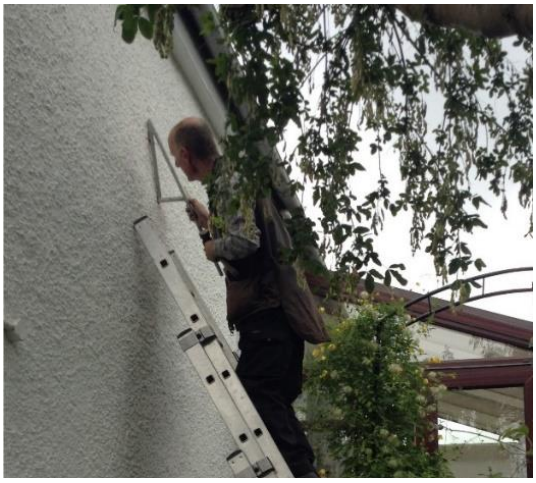
Sundial accuracy has many faces. The theory goes hand in hand with practical problems. In the end an accurate result depends very much on the particular path you choose. Each case is its own problem and there are few if any perfect solutions.

A sensible way to describe accuracy is how closely the apparent time on the sundial corresponds to time on the clock. The adjustments between solar time and clock time have to be made first, as sundial people will recognise.[1] This begs a number of questions and not everyone will refer to sundial accuracy in the same way.

From experience of making sundials for a wall, here are some pointers to consider. The starting point has to be measurement of the declination of the wall. You calculate the gnomon and the hour lines from there. But if your wall measurement is in error, it is the first of the errors you must contend with. There are some parts of sundial construction you can control very well, like dimensions and angles, but wall declination is key. It is not always easy to measure.



Installing the gnomon on the wall

Sometimes the question of accuracy puts the focus on the penumbra or hazy shadow of the gnomon. This is really more to do with resolution or discrimination of shadow position than accuracy. In other words the sundial may not be truly accurate, for example not well made or the gnomon not well aligned with true north, but you can still observe very small changes in the position of the shadow. Ultimately the penumbra limits these observations, which can be as small as 1 minute apart or even less. This is a limit of resolution and is not the same as the accuracy of the sundial.

Case Study—Sundial on a house wall

The wall is vertical and the wall declination from south has been measured. The gnomon and hour line angles have been computed and an accurate gnomon designed for the wall. To install the gnomon our blacksmith used a template to set the angle between sub-style and noon line. The artist client placed each of the hour marks and numerals in their correct positions using a full-scale template that we supplied for them.

In brief, to measure declination, we set up a horizontal table against the wall. We aligned a chart on

[1] Longitude correction, equation of time, and summer time (daylight saving), are the principal adjustments between solar time and clock time.

the table and measured sun azimuth angle by the shadow of a vertical edge. We repeated the measurements over several hours and took an average. Thus we had a measure of the declination of the wall and an estimate for our measurement error. This is the principle we applied in this case, there is more than one approach to the problem.

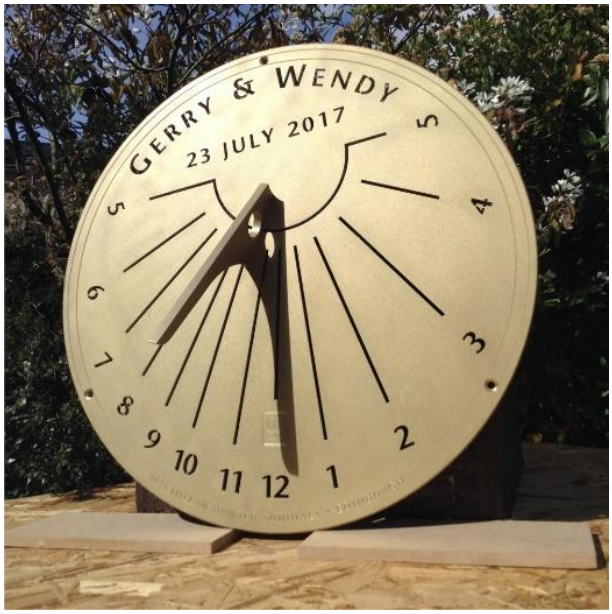
Accurate wall sundial

It is an accurate sundial. The theory and practice are sound, and well-considered methods have been used from start to finish. For this particular sundial, there is no effect of the penumbra because the reading line is the centre line of the shadow cast by the round gnomon rod.

It is true that the sundial has not been calibrated for accuracy, which would determine whether it is accurate to ½ hour, 10 minutes, 5 minutes, or even 1 minute. The probable figure is between 10 and 5 minutes. Proper calibration is seldom done, and it is a separate and lengthy measurement task.

Case Study—Wall plate sundial

In this case we have a dial and gnomon with precise design and accurate construction. But the declination of the wall, which should provide the basic information for the design, has not been measured well. The measurement amounted to a client's cellphone reading and a cross-check with Google maps. This information was the best available but its accuracy could not be confirmed. The property was too distant for us to make any measurements ourselves.



Accurate dial plate

Following our written instructions, the client installed the sundial on the wall. The outcome is that this is a well-constructed sundial, designed for a specific declination, which is probably not the real declination of the client's wall. The case illustrates one of the many practical difficulties in trying to control all aspects of the accuracy of a sundial.

The accuracy has not been quantified and is probably less than we would have liked. On the other hand the client may not be concerned about actual error in the time readings. They did query the time shown on the dial and we explained how to apply the adjustments for solar time. The penumbra width is not significant.