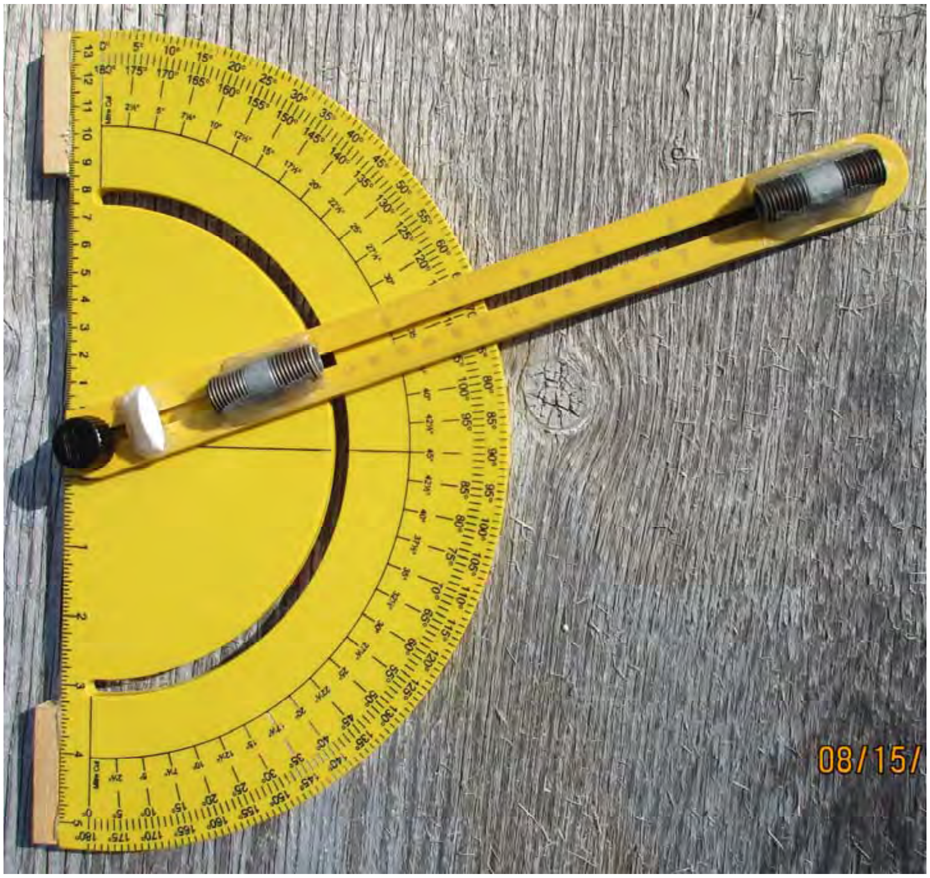
Sun Position Measurements Using a Protractor

(9/11/2016)



The basic protractor was purchased from Harbor Freight tools. The sun makes a shadow of each round pipe that falls onto the white surface. When both shadows of the sun align, then the reading is taken.

The following shows what it looks like, when both shadows of the sun are in alignment, and shown as one bright circle, so the angle reading can be taken.

Typically, the measurement is made at solar noon, or close to it. This is when the sun is highest in the sky, in your location.

Sun Position Measurements Using a Protractor

(9/11/2016)

Construction

Two pipe nipples at 1.5” long by 3/8”. or 1/4” were used as shown. A glue gun was used to attach the pipes, and wood spacers on the base. The wood spacer on the base, helps when the protractor is taking a measurement at an angle to the surface, so that the black knob doesn’t hold the protractor off the surface.

For the white reflective surface, anything will work that is white. A cut off portion of a plastic bottle top, or a white plastic angle, or anything of similar shape that can be securely glued on.

Elevation Readings

The elevation of the sun measurement is when the sun is highest in the sky (called solar noon). At your current location, this is compared to the results found by putting your location, time-date into the following link. http://www.esrl.noaa.gov/gmd/grad/solcalc/ The measurement can be written down to 0.1 of a degree if one wishes to estimate the fraction of a degree. Realizing the reading is only good to about .5 degree.

A bubble level can be used to find a true vertical side of something that is south facing, possibly a building that doesn’t move. This is used as the surface to measure the angle of the sun with respect to the vertical. This is the complement (90-mesurment) of the elevation found in tables.

As an example one can use magnets on the side of a metal building, or container to assist with vertical and horizontal alignment. The placement of these alignment stops can be determined using a good bubble level. The vertical is used for elevation angle measurements to the sun at or near solar noon. The horizontal is used for local azimuth readings when appropriate. The basic reading is the sun’s elevation. That is what this unit is best used for measuring.

Latitude	-1hr	-30 min	-10 min	Elevation at solar noon	+10 min	+30 min	+1hr
64	-1.21	-0.32	-0.04	31.3	-0.03	-0.28	-1.14
34	-3.2	-0.83	-0.09	61.3	-0.09	-0.84	-3.23
20	-6	-1.7	-0.2	75.3	-0.2	-1.72	-6.02

In reference to the table above, at high latitudes one can relax, and take the reading plus, or minus 30 minutes of solar noon. At low latitudes one must get the reading within plus or minus 10min of solar noon. In between get the reading within plus or minus 15min of solar noon. Any reading can be written down to the nearest 1/10 of a degree but is only accurate to plus or minus about 0.5 degree.

Well before the pole shift time, when the sun is available and wobbling is not noted, take daily measurements to establish a base line of familiarity as to what to expect. Then watch for deviations. If deviations from expected get to be more than one degree and are getting bigger over several days then take note that something is happening out of the ordinary.

Horizontal azimuth readings

Horizontal angle measurements can be taken at different times of the day. This can be compared during the last days to see the slowing and possibly indicate when earth is slowing and stops turning.

If tables or internet look up is not available, then compare azimuth angles to previous days at the same, or near same times during the day. A table of approximate elevation and azimuth of the Sun at solar max (transit time) can be printed out for a date range ahead of time by using the following link. http://aa.usno.navy.mil/data/docs/mrst.php This table doesn't change much from year to year and is only good to the nearest degree.

Horizontal or azimuth measurements of the sun have a marginal usefulness. Because these measurements are enviably not taken in the exact same plane as the ecliptic then the theoretical .25 degree/min rotation becomes something less. Thus this does not become that useful for accurate time determination based on the suns angle.

If however two days are close together and a measurement is taken of the angle of the sun for one day it will be reasonably accurate to assume that at the same time a few days latter it would be close to that same reading for that same time of day. In this way one could use it in the last days to measure rotation slowing and stopping.

Azimuth measurements are most accurate late or very early in the day and to a surface that is close to being perpendicular to the sun. For example if solar max or noon is 12:00 pm then measure azimuth at or near 6:00 am or 6:00 pm.

The rotation of the earth or azimuth angle at any given time of the day month to month doesn't change enough to make a difference when making horizontal angle measurements. This is usefully to know near pole shift time.

Additional usefully links:
Glossary: http://www.esrl.noaa.gov/gmd/grad/solcalc/glossary.html
Solar System Live : http://www.fourmilab.ch/cgi-bin/Solar
Degrees, Minutes, Seconds to Decimal Degrees Conversion Calculator
http://www.satsig.net/degrees-minutes-seconds-calculator.htm