Solar Time from Clock Time: Equation of Time and Longitude

Solar time, hour angle and the clock time of solar noon from local standard time, longitude, time zone and day of the year (equation of time).

Input parameters

Unit system: SI

Parameter	Value	Unit
Day of the year (1 = 1 January, 365 = 31 December)	105.00	
Clock time (24-hour)	12.000	h
Longitude (east positive, west negative)	80.270	°
Time zone, hours ahead of UTC (India +5.5, US Central -6)	5.5000	
Daylight saving time in force	No	

Calculated results

Parameter	Value	Unit
Equation of time	-0.23643	min
Solar time minus standard time	-9.1564	min
Solar time	11.847	h
Hour angle (morning negative)	-2.2891	°
Clock time of solar noon	12.153	h

Notes for this case

- The sun crosses 1° of longitude in 4 minutes; the equation of time (Spencer, 1971) adds the effect of the earth's elliptic orbit and tilt, between about −14 and +16 minutes over the year.

Formula and method

$$t_s - t_{std} = 4(L_{loc} - L_{st}) + E \quad (\text{minutes; longitudes east positive, } L_{st} = 15 \times \text{UTC offset})$$

$$E = 229.2(0.000075 + 0.001868\cos B - 0.032077\sin B - 0.014615\cos 2B - 0.04089\sin 2B), \quad B = (n-1)\frac{360}{365}$$

$$\omega = 15^\circ(t_s - 12)$$

Variables

n	Day of the year (1 = 1 January, 365 = 31 December)	-
t_{clock}	Clock time (24-hour)	s
L_{loc}	Longitude (east positive, west negative)	rad
UTC offset	Time zone, hours ahead of UTC (India +5.5, US Central -6)	-
DST	Daylight saving time in force	-
E	Equation of time	s
$t_s - t_{std}$	Solar time minus standard time	s
t_s	Solar time	s
ω	Hour angle (morning negative)	rad
t_{noon}	Clock time of solar noon	s

Method and standards

Longitude correction and Spencer's equation of time.

Assumptions and limits

- The equation of time is accurate to about 30 seconds.

Report details

Report reference	FCC-629T-AGET (the same inputs always give the same reference)
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Calculator	Solar Time from Clock Time: Equation of Time and Longitude
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Release checks	3 reference cases of this calculator, computed independently, are checked on every release

Results are for engineering estimation. Verify critical designs against the referenced standards and your own data.

This calculator online

https://calc.firecad.com/environmental/solar-thermal/solar-time-equation-of-time

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.