SPREADSHEETS

Microsoft Office ~ Excel ~ .xls
Open Office flawlessly uses these

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- **To get started with the Excel version (Office 2003 is much easier to use than Office 2007, 2010, or 2013 if you plan to modify the sheets)**

  - addintools.com is low cost and makes Office 2007 and later look like Office2003
  - ubitmenu is a free ware menu replacement also

- **Open Office now fully converts .XLS files so no separate .ODS sheets are available**

  - openoffice.apache.org

- **Why smart phones have a different set of sheets**

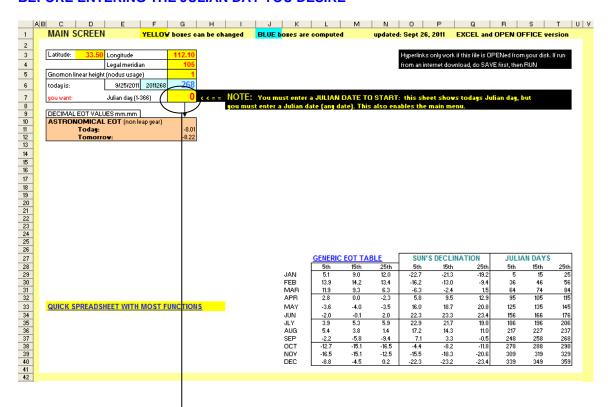- **Spread sheet notes when programming them**

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NOTE: The front page of the main spreadsheet may look different to the examples Here because it will evolve and improve over time. See next page for an example of a revised spreadsheet.

NOTE: If you run this directly from an internet download, the hyperlinks will not work. Do a SAVE first from that download, and then do a RUN.
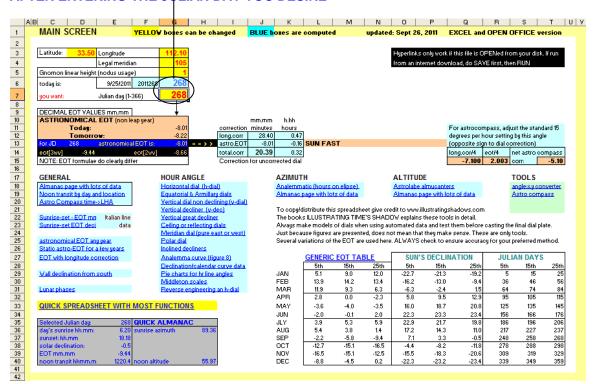
Simon Wheaton-Smith
February 13, 2013

SPREADSHEETS RELATING TO SUNDIAL DESIGN
Open Source

CURRENT INITIAL SCREEN as of Sept 26, 2011
BEFORE ENTERING THE JULIAN DAY YOU DESIRE

	MAIN SCREEN	YELLOW boxes can be changed	BLUE boxes are computed	updated: Sept 26, 2011	EXCEL and OPEN OFFICE version

Latitude: 33.50 Longitude 112.10
Legal meridian 105
Gnomon linear height (nodus usage) 1
today is: 9/25/2011 2011268 268
you want: Julian day (1-366) 0 < < = = NOTE: You must enter a JULIAN DATE TO START: this sheet shows todays Julian day, but you must enter a Julian date (any date). This also enables the main menu.

Hyperlinks only work if this file is OPENed from your disk. If run from an internet download, do SAVE first, then RUN

DECIMAL EOT VALUES mm.mm
ASTRONOMICAL EOT (non leap year)
Today: -8.01
Tomorrow: -8.22

QUICK SPREADSHEET WITH MOST FUNCTIONS

	GENERIC EOT TABLE			SUN'S DECLINATION			JULIAN DAYS		
	5th	15th	25th	5th	15th	25th	5th	15th	25th
JAN	5.1	9.0	12.0	-22.7	-21.3	-19.2	5	15	25
FEB	13.9	14.2	13.4	-16.2	-13.0	-9.4	36	46	56
MAR	11.9	9.3	6.3	-6.3	-2.4	1.5	64	74	84
APR	2.8	0.0	-2.3	5.8	9.5	12.9	95	105	115
MAY	-3.6	-4.0	-3.5	16.0	18.7	20.8	125	135	145
JUN	-2.0	-0.1	2.0	22.3	23.3	23.4	156	166	176
JLY	3.9	5.3	5.9	22.9	21.7	19.8	186	196	206
AUG	5.4	3.8	1.4	17.2	14.3	11.0	217	227	237
SEP	-2.2	-5.8	-9.4	7.1	3.3	-0.5	248	258	268
OCT	-12.7	-15.1	-16.5	-4.4	-8.2	-11.8	278	288	298
NOV	-16.5	-15.1	-12.5	-15.5	-18.3	-20.6	309	319	329
DEC	-8.8	-4.5	0.2	-22.3	-23.2	-23.4	339	349	359

AFTER ENTERING THE JULIAN DAY YOU DESIRE

	MAIN SCREEN	YELLOW boxes can be changed	BLUE boxes are computed	updated: Sept 26, 2011	EXCEL and OPEN OFFICE version

Latitude: 33.50 Longitude 112.10
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you want: Julian day (1-366) 268

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DECIMAL EOT VALUES mm.mm
ASTRONOMICAL EOT (non leap year)

				mm.mm	h.hh				
Today:		-8.01	correction	minutes	hours		For astrocompass, adjust the standard 15		
Tomorrow:		-8.22	long.corr	28.40	0.47		degrees per hour setting by this angle		
for JD	268	astronomical EOT is: -8.01	= = > >	astro.EOT	-8.01	-0.16 SUN FAST	(opposite sign to dial correction)		
eot[3wv]	-9.44	eot[2wv]	-8.66	total.corr	20.39	0.32	long.corr/4	eot/4	net astro compass
NOTE: EOT formulae do clearly differ				Correction for uncorrected dial			-7.100	2.003	corr: -5.10

GENERAL
- Almanac page with lots of data
- Noon transit by day and location
- Astro Compass time->LHA
- Sunrise-set - EOT mn   Italian line
- Sunrise-set EOT deci   data
- astronomical EOT any year
- Static astro-EOT for a few years
- EOT with longitude correction
- Wall declination from south
- Lunar phases

QUICK SPREADSHEET WITH MOST FUNCTIONS

HOUR ANGLE
- Horizontal dial (h-dial)
- Equatorial & Armillary dials
- Vertical dial non declining (v-dial)
- Vertical decliner (v-dec)
- Vertical great decliner
- Ceiling or reflecting dials
- Meridian dial (pure east or west)
- Polar dial
- Inclined decliners
- Analemma curve (figure 8)
- Declination/calendar curve data
- Pie charts for hr line angles
- Middleton scales
- Reverse engineering an h-dial

AZIMUTH
- Analemmatic (hours on elipse)
- Almanac page with lots of data

To copy/distribute this spreadsheet give credit to www.illustratingshadows.com
The books ILLUSTRATING TIME'S SHADOW explains these tools in detail.
Always make models of dials when using automated data and test them before casting the final dial plate.
Just because figures are presented, does not mean that they make sense. These are only tools.
Several variations of the EOT are used here. ALWAYS check to ensure accuracy for your preferred method.

ALTITUDE
- Astrolabe almucanters
- Almanac page with lots of data

TOOLS
- angle:x:y converter
- Astro compass

	GENERIC EOT TABLE			SUN'S DECLINATION			JULIAN DAYS		
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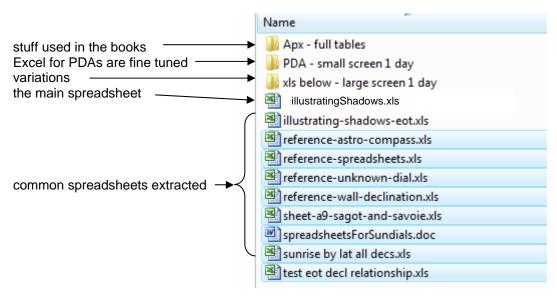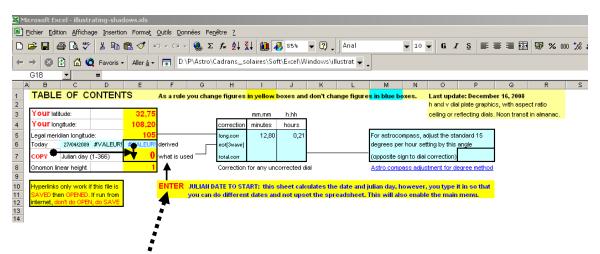| Selected Julian day:	268	QUICK ALMANAC	
day's sunrise hh.mm:	6.20	sunrise azimuth	89.36
sunset: hh.mm	18.18		
solar declination:	-0.5		
EOT mm.mm	-9.44		
noon transit hhmm.m	1220.4	noon altitude	55.97

TO GET STARTED WITH THE EXCEL VERSION

The Microsoft Office Excel version of this major spreadsheet, actually two separate master sheets, uses what is called conditional formatting, and has extensive use of macros.

illustratingShadows.xls   all common sundial needs, this included the astronomical EOT
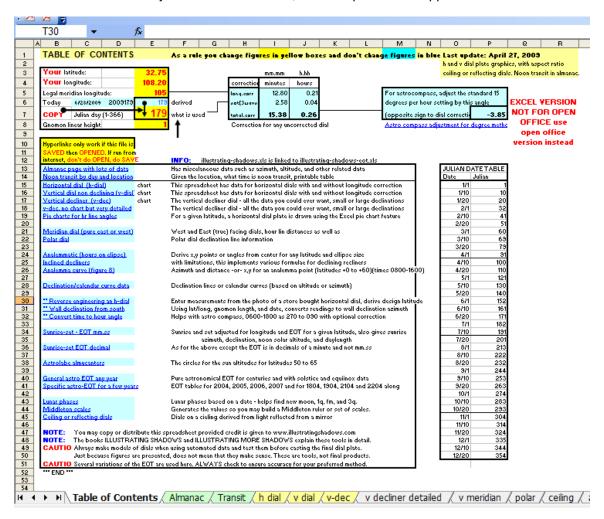   spreadsheet: illustrating-shadows-eot.xls

stuff used in the books → Apx - full tables
Excel for PDAs are fine tuned variations → PDA - small screen 1 day
                                          → xls below - large screen 1 day
the main spreadsheet → illustratingShadows.xls

common spreadsheets extracted →

The Excel, and Open Office, spreadsheets have many functions. The Excel begins with a blank screen.

Nothing much else will appear until you enter a Julian day. The reason for this is to let you select any day of the year while still telling you what the Julian day is today. While you could alter this cell to equal the cell immediately above it, you may forget that change the day on a subsequent day and thus make mistakes.
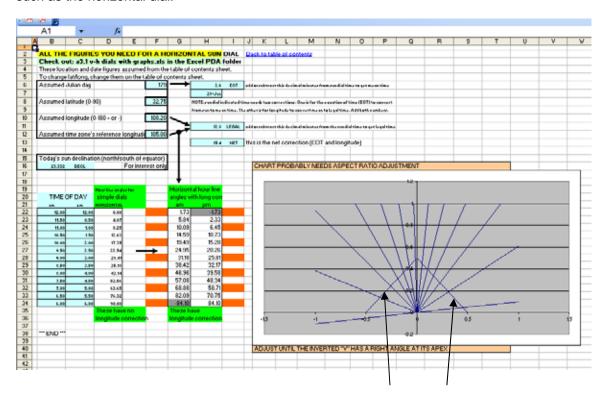
As soon as the Julian day is entered in that cell, a list of options then appears.

The important point to remember is that formulae are used extensively, and if you alter a formula with data or vice versa, that becomes a permanent change.

Secondly, if you download the sheet from the website, you must SAVE it before using it. If you download and then open without an intermediate save, then hyperlinks will cause problems.

The spreadsheet and its sub sheets are self explanatory. However some sheets use graphics, such as the horizontal dial.
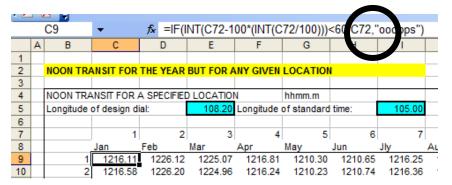
There is an inverted V in the graph, a technique used in some other graphical depictions programmed in other languages.
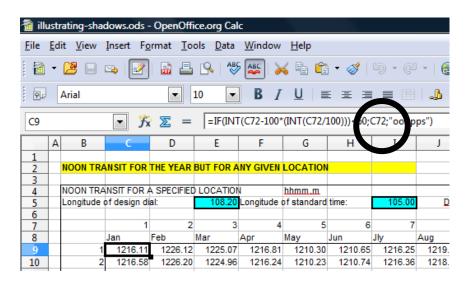
The apex should be a 90 degree angle. So if you do a screen capture and the aspect ration is questionable, simple stretch or compress one axis until the apex measures 90 degrees.

The astronomical equation of time sheet (EOT) is a separate spreadsheet due to its size. It always provides two tables of results. One assumes a leap year while the other does not. You select the appropriate table.

WHY OPEN OFFICE NO LONGER HAS A DIFFERENT VERSION

Open Offices is free, unlike Microsoft's Office. While it is almost compatible, it is not quite.

The top spreadsheet is Microsoft Excel in action. The circled area shows a comma "," in a conditional formula, whereas the Open Office below has a semi colon ";". These differences happen only when formulae or special features are used. Open Office fully converts these correctly, hence no separate .ODS files are provided.

NOTE: if you OPEN an Excel sheet in Open Office, then the formulae are correctly converted.

NOTE: The Open Office handling of conditional formatting is different, which is why the Open Office version shows the menu of choices on the main sheet right at startup whereas the Excel version does not. Conditional formatting and hyperlinks have issues.

NOTE: Open Office auto-fill can be a pain, and data validation does not help. In essence the most common cell to be auto-filled is the GNOMON LINEAR HEIGHT. If it auto-fills, just hit DELETE, or, you co do TOOLS, CELL CONTENT, and click AUTOFILL off.

WHY SMART PHONES HAVE A DIFFERENT SET OF SHEETS

Smart phones have a small screen and scrolling around the screen is tedious. For that reason there are special sheets designed for the small screen. Further, graphing is managed differently, and hyperlinks are not functional.

	A	B	C	D	E	F
1	HORIZONTAL SUN DIAL					
2	Latitude (0-90)			32.75		corr
3	Longitude (0-180 + or -)			108.20		12.8
4	Legal reference longitude			105.00		
5			Horizontal hour line			
6	TIME OF DAY		angles with long corr			
7	am	pm	am	pm		
8	12.00	12.00	1.73	-1.73		
9	11.50	0.50	5.84	2.33		
10	11.00	1.00	10.09	6.45		
11	10.50	1.50	14.59	10.73		
12	10.00	2.00	19.49	15.28		
13	9.50	2.50	24.95	20.26		
14	9.00	3.00	31.18	25.81		
15	8.50	3.50	38.42	32.17		
16	8.00	4.00	46.96	39.58		
17	7.50	4.50	57.08	48.34		
18	7.00	5.00	68.88	58.71		
19	6.50	5.50	82.09	70.75		
20	6.00	6.00	-84.10	84.10		
21	These have		longitude correction			

These sheets are great in Excel and in Open Office as they are VERY SIMPLE to use.

SPREAD SHEET NOTES WHEN PROGRAMMING THEM

[Extracted from several pages in the Illustrating Shadows books] Describing a formula or set of formulae (English) or formulas (American) is easier said than actually getting them into a spreadsheet for real usage. The following points all relate to a common spreadsheet, the one used for this book.

ANGULAR MEASURE

Angular measures are commonly in degrees, 90 degrees being a right angle and there are 360 degrees in a circle. However, spreadsheets use radians, which are different to degrees. There are 2 * pi radians in a circle of 360 degrees.

Thus, every formula that uses degrees needs the measure to be converted to radians.

> =RADIANS(360)   would return 6.283

Thus the trigonometric functions SIN, COS, TAN, COTAN, and so on, need the radian conversion first.

> =TAN(RADIANS(45))   would return 1.0

Similarly, any function that returns an angular measure, such as ATAN, ACOS, ASIN, or ARCTAN, ARCOS, ARCSIN, also printed as TAN^{-1}, COS^{-1}, SIN^{-1}, would need to be converted back to degrees, and this is done using the DEGREES function.

> =DEGREES(6.283)   would return 359.984 or 360.0 depending on precision

Which raises another issue, that of rounding and precision. The number of significant digits on the fractional side not only determines accuracy, it also controls rounding. Thus when the above function is given one decimal position, the results is 360.0 rather than 359.9.

ROUNDING

The number of significant digits after the decimal point is controlled by the FORMAT, CELLS, NUMBER option. Some functions do rounding of their own, and in some surprising ways.

> =INT(5.1)   =INT(5.9)   =INT(-5.1)   =INT-(5.9)   returns
> 5   5   -6   -6

The INT (integer) function returns the integer part of a number on the left side of the decimal point, rounds down. And the number below 5.9 is 5, however the number below -5.1 is -6 because this is already in the negative scale.

However, the ABS (absolute) function which removes the sign may be used if the above rounding down on the negative side is not desired.

> =INT(ABS(5.5))   =INT(ABS(-5.5))   returns
> 5   5

If the sign must be retained, then the SIGN function can be used. Assume that cell B3 has a value of 5.5 and cell B4 has value of -5.5 then the following results can be obtained:

> =SIGN(B3)*INT(ABS(B3))   =SIGN(B3)*INT(ABS(B3))   returns
> 5   -5