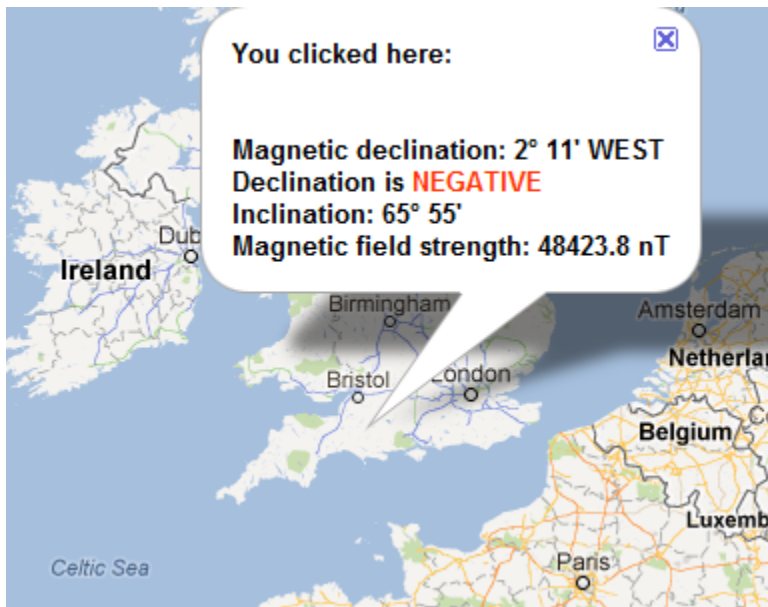


## SUNDIALS ~ Winsham, Somerset

lat: N 50° 51' 50.9  
lng: W 2° 53' 2.9  
alt: 356'  
mag dec: 2° 11' west August 2012

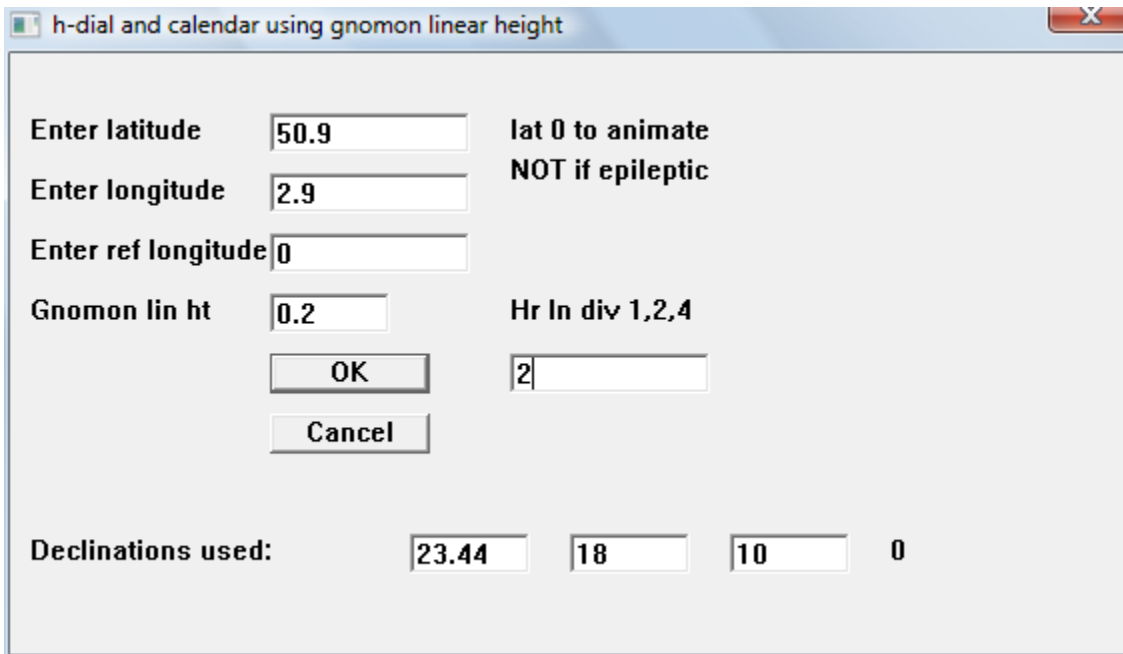


**NOTE:** Saltillo tile must be well sealed and even then may flake with humidity and freeze thaw cycles.

Parameters used:-

lat: N 50° 51' 50.9  
lng: W 2° 53' 2.9 2.9 degrees is 11.6 minutes from legal meridian  
alt: 356'  
mag dec: 2° 11' west

DeltaCAD macro: MAIN-h-dials.bas choice:



Tools and materials for engraving, and setting the final plate, in this case a Dremel with a 1.25" cut disk was used.



holding a gnomon vertical while epoxy cures



tools to size the gnomon



## Italian and Babylonian hour line end points data

ITALIAN LINES			
SUN SET			
for the lat/long, no EOT			
	winter solstice	equ	summer solstice
sunset	16.0	18.2	20.3
-1	15.0	17.2	19.3
-2	14.0	16.2	18.3
-3	13.0	15.2	17.3
-4	12.0	14.2	16.3
-5	11.0	13.2	15.3
-6	10.0	12.2	14.3

BABYLONIAN			
SUN RISE			
for the lat/long, no EOT			
	winter solstice	equ	summer solstice
sunrise	8.3	6.2	4.0
+1	9.3	7.2	5.0
+2	10.3	8.2	6.0
+3	11.3	9.2	7.0
+4	12.3	10.2	8.0
+5	13.3	11.2	9.0
+6	14.3	12.2	10.0

LENGTH OF DAY			
for the lat/long			
	winter solstice	equ	summer solstice
	7.7	12.0	16.3

LAT	LONG	ref:long
50.90	2.90	0

**SUNRISE/SUNSET time LEGAL hh.hh**  
**EOT mm.mm [4 yr astro avg] is used.**

Summer time is not considered.

Date	Julian	decl	eot m.m	LEGAL TIME		Daylight duration	Sunrise azimuth	Noon altitude
				rise h.hh	set h.hh			
3/20	79	-0.5	7.6	6.4	18.3	11.92	89.3	38.6
6/21	172	23.5	1.7	4.1	20.4	16.30	129.1	62.6
9/22	265	0.6	-7.1	6.0	18.1	12.10	91.0	39.7
12/21	355	-23.4	-2.1	8.3	16.0	7.71	50.9	15.7
1/5	5	-22.7	5.1	8.34	16.21	7.87	52.3	16.4
1/15	15	-21.3	9.2	8.25	16.44	8.18	54.9	17.8
1/25	25	-19.2	12.2	8.08	16.71	8.62	58.6	19.9
2/5	36	-16.2	14.0	7.82	17.03	9.21	63.8	22.9
2/15	46	-13.0	14.2	7.53	17.33	9.81	69.2	26.1
2/25	56	-9.4	13.2	7.19	17.63	10.44	75.0	29.7
3/5	64	-6.3	11.6	6.91	17.86	10.95	79.9	32.8
3/15	74	-2.4	9.0	6.54	18.14	11.60	86.1	36.7
3/25	84	1.5	6.1	6.17	18.42	12.25	92.4	40.6
4/5	95	5.8	2.8	5.76	18.72	12.95	99.2	44.9
4/15	105	9.5	0.1	5.41	18.99	13.58	105.1	48.6
4/25	115	12.9	-2.0	5.07	19.25	14.19	110.8	52.0
5/5	125	16.0	-3.3	4.76	19.52	14.76	115.9	55.1
5/15	135	18.7	-3.7	4.49	19.77	15.28	120.5	57.8
5/25	145	20.8	-3.1	4.28	20.00	15.72	124.3	59.9
6/5	156	22.5	-1.6	4.13	20.21	16.08	127.3	61.6
6/15	166	23.3	0.4	4.07	20.33	16.26	128.8	62.4
6/25	176	23.4	2.5	4.09	20.38	16.30	129.1	62.5
7/5	186	22.9	4.5	4.18	20.35	16.17	128.1	62.0
7/15	196	21.7	5.9	4.34	20.24	15.90	125.8	60.8
7/25	206	19.8	6.5	4.55	20.06	15.51	122.5	58.9
8/5	217	17.2	6.0	4.80	19.79	14.98	117.9	56.3
8/15	227	14.3	4.6	5.05	19.49	14.44	113.1	53.4
8/25	237	11.0	2.2	5.30	19.16	13.85	107.7	50.1
9/5	248	7.1	-1.1	5.59	18.76	13.18	101.3	46.2
9/15	258	3.3	-4.6	5.84	18.39	12.55	95.3	42.4
9/25	268	-0.5	-8.1	6.10	18.01	11.91	89.2	38.6
10/5	278	-4.4	-11.4	6.37	17.64	11.27	83.0	34.7
10/15	288	-8.2	-14.1	6.64	17.28	10.64	76.9	30.9
10/25	298	-11.8	-15.9	6.92	16.93	10.01	71.0	27.3
11/5	309	-15.5	-16.5	7.25	16.59	9.35	65.0	23.6
11/15	319	-18.3	-15.5	7.54	16.33	8.80	60.1	20.8
11/25	329	-20.6	-13.2	7.81	16.14	8.32	56.1	18.5
12/5	339	-22.3	-9.6	8.05	16.02	7.96	53.1	16.8
12/15	349	-23.2	-5.1	8.23	15.98	7.75	51.3	15.9
12/25	359	-23.4	-0.1	8.34	16.05	7.71	51.0	15.7

NOON TRANSIT FOR SPECIFIC LOCATION

hhmm.mm

EOT used is the mid point of four years of astronomical EOT data

Longitude of design dial: 2.90

Longitude of standard time: 0.00

Diff in degrees: 2.90

mins: 11.6

To change the location, use the main table of contents sheet [main table of contents](#)

	Jan	Feb	Mar	Apr	May	Jun	Jly	Aug	Sep	Oct	Nov	Dec
1	1214.85	1225.11	1224.03	1215.58	1208.75	1209.37	1215.38	1217.96	1211.75	1201.43	1155.16	1200.47
2	1215.33	1225.24	1223.83	1215.29	1208.63	1209.52	1215.57	1217.90	1211.44	1201.10	1155.13	1200.85
3	1215.79	1225.37	1223.62	1214.99	1208.52	1209.68	1215.75	1217.82	1211.12	1200.78	1155.12	1201.24
4	1216.25	1225.47	1223.41	1214.70	1208.42	1209.85	1215.94	1217.74	1210.79	1200.47	1155.12	1201.63
5	1216.70	1225.57	1223.19	1214.41	1208.33	1210.02	1216.11	1217.65	1210.46	1200.16	1155.14	1202.04
6	1217.15	1225.65	1222.96	1214.13	1208.25	1210.20	1216.29	1217.54	1210.13	1159.86	1155.17	1202.46
7	1217.59	1225.72	1222.72	1213.84	1208.18	1210.38	1216.45	1217.43	1209.79	1159.56	1155.22	1202.88
8	1218.02	1225.77	1222.48	1213.57	1208.12	1210.57	1216.61	1217.30	1209.45	1159.28	1155.28	1203.31
9	1218.44	1225.81	1222.23	1213.29	1208.06	1210.76	1216.77	1217.17	1209.10	1158.99	1155.35	1203.76
10	1218.85	1225.84	1221.98	1213.02	1208.02	1210.96	1216.91	1217.03	1208.76	1158.72	1155.44	1204.20
11	1219.26	1225.85	1221.72	1212.75	1207.99	1211.16	1217.05	1216.87	1208.41	1158.45	1155.54	1204.66
12	1219.65	1225.85	1221.45	1212.49	1207.96	1211.36	1217.18	1216.71	1208.06	1158.19	1155.66	1205.12
13	1220.04	1225.84	1221.18	1212.24	1207.95	1211.57	1217.31	1216.54	1207.70	1157.94	1155.79	1205.59
14	1220.41	1225.82	1220.91	1211.98	1207.94	1211.78	1217.42	1216.36	1207.35	1157.70	1155.93	1206.06
15	1220.78	1225.78	1220.63	1211.74	1207.94	1211.99	1217.53	1216.17	1206.99	1157.47	1156.09	1206.54
16	1221.13	1225.73	1220.35	1211.50	1207.96	1212.20	1217.63	1215.97	1206.64	1157.24	1156.26	1207.02
17	1221.47	1225.67	1220.06	1211.26	1207.98	1212.42	1217.72	1215.77	1206.28	1157.03	1156.45	1207.50
18	1221.81	1225.59	1219.77	1211.04	1208.01	1212.63	1217.80	1215.55	1205.92	1156.83	1156.65	1207.99
19	1222.12	1225.51	1219.48	1210.82	1208.05	1212.85	1217.88	1215.33	1205.57	1156.63	1156.87	1208.48
20	1222.43	1225.41	1219.19	1210.60	1208.10	1213.07	1217.94	1215.09	1205.21	1156.45	1157.10	1208.97
21	1222.73	1225.30	1218.89	1210.39	1208.16	1213.28	1218.00	1214.85	1204.86	1156.28	1157.34	1209.47
22	1223.01	1225.19	1218.59	1210.19	1208.23	1213.50	1218.04	1214.61	1204.50	1156.11	1157.60	1209.97
23	1223.28	1225.06	1218.29	1210.00	1208.31	1213.72	1218.08	1214.35	1204.15	1155.96	1157.87	1210.46
24	1223.54	1224.92	1217.99	1209.82	1208.39	1213.93	1218.11	1214.09	1203.80	1155.82	1158.15	1210.96
25	1223.78	1224.77	1217.69	1209.64	1208.49	1214.15	1218.12	1213.82	1203.45	1155.70	1158.45	1211.45
26	1224.01	1224.61	1217.39	1209.47	1208.59	1214.36	1218.13	1213.54	1203.10	1155.58	1158.75	1211.95
27	1224.23	1224.44	1217.09	1209.31	1208.70	1214.57	1218.13	1213.26	1202.76	1155.48	1159.07	1212.44
28	1224.43		1216.78	1209.16	1208.82	1214.78	1218.11	1212.97	1202.42	1155.39	1159.41	1212.93
29	1224.62		1216.48	1209.01	1208.95	1214.98	1218.09	1212.67	1202.09	1155.31	1159.75	1213.42
30	1224.80		1216.18		1209.08		1218.06	1212.37		1155.25		1213.90

BLACK

time is at or after legal noon standard time [no summer time correction]

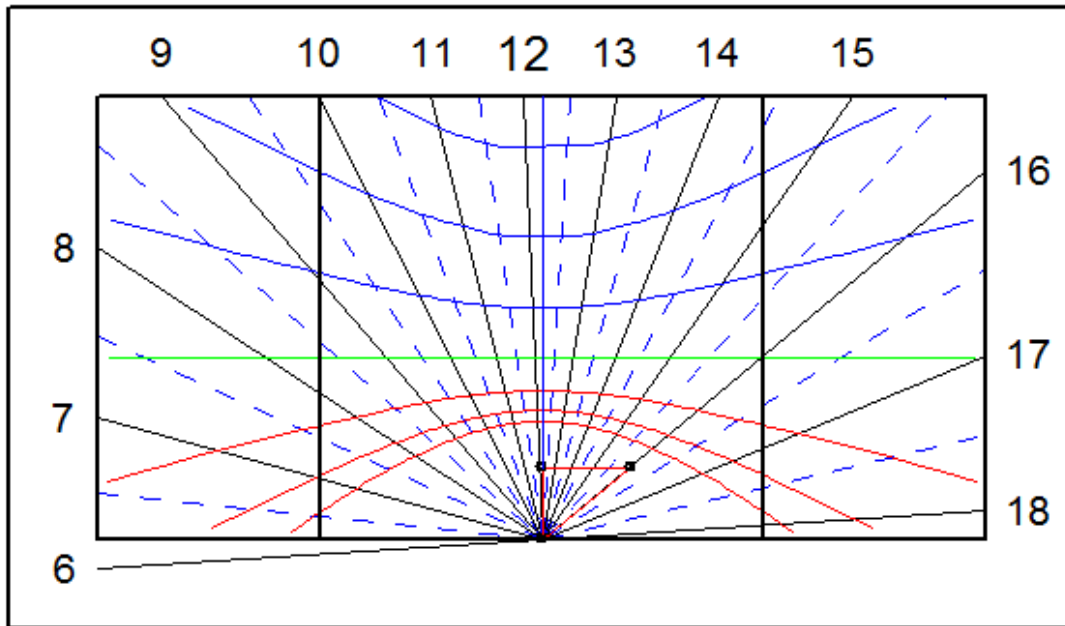
If a leap year then after February

BLUE

before legal noon standard time [no summer time correction]

28 use the next day's value

# h-dial a horizontal dial for Winsham, Somerset



h-dial and calendar using gnomon linear height

check 11-1

Lat: 50.9 d.Long: 02.9

6	7	8	9	10	11	12	13	14	15	16	17	18
86.3	-74.6	-56.6	-40.7	-26.7	-14.1	-02.3	09.4	21.7	35.0	50.2	67.4	86.3

Hours below horizontal use the 90 reference line below horizontal.

mag dec: 2° 11' west

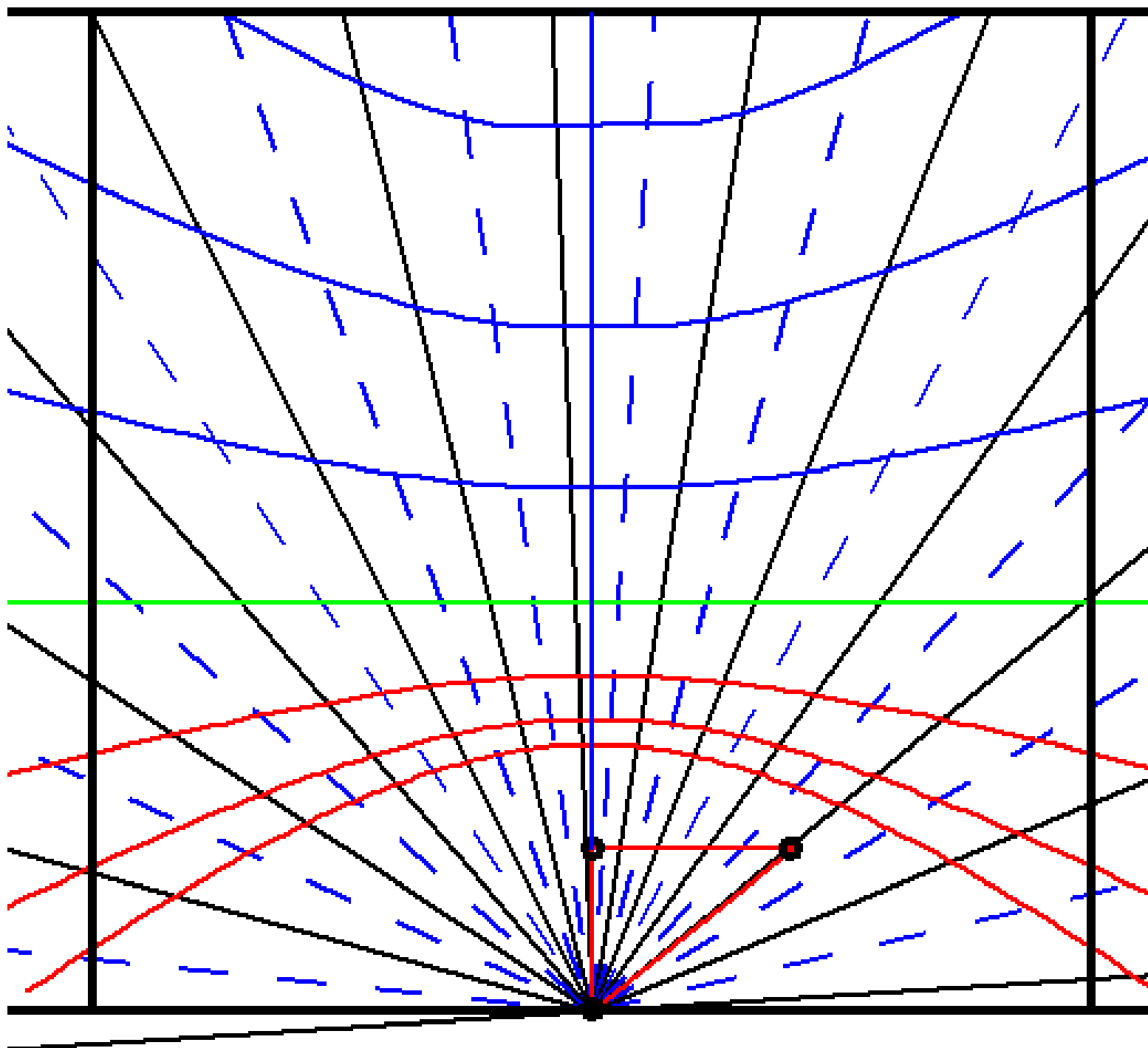
10

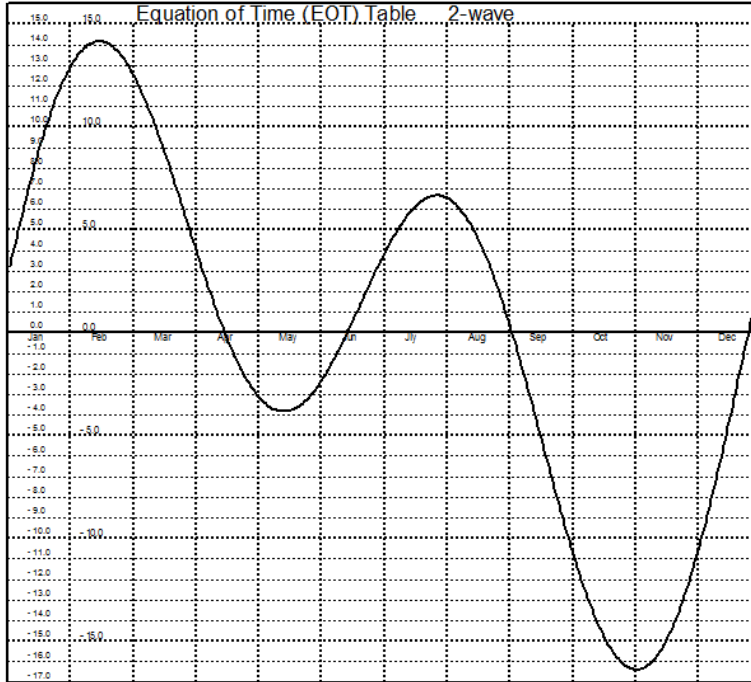
11

12

13

14



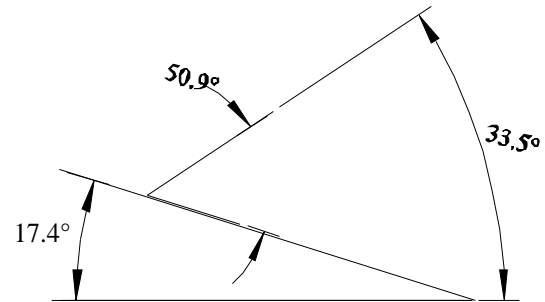




To use this dial in Phoenix AZ, the following two steps must be taken

Step 1

design lat:	50.9
lat used at:	33.5
delta:	17.4

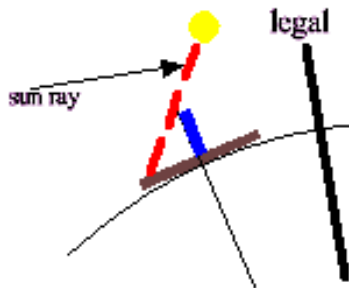


( 1 ) tilt the dial 17.4 degrees

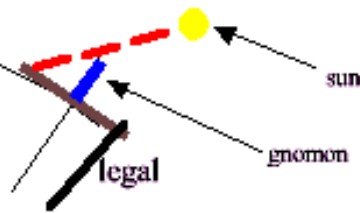
Now the gnomon's style is correct, now we must consider longitude differences

Step 2

DIAL IN USE AT  
longitude 7.1 from legal  
(i.e. Phoenix 112.1 legal 105)



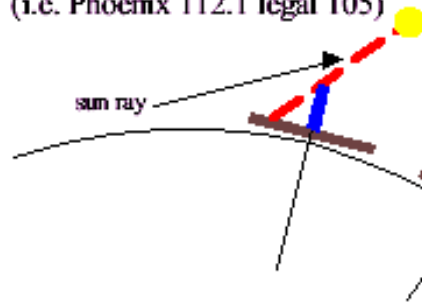
BUT DESIGNED FOR  
longitude 2.9 from legal  
(i.e. Winsham, Somerset, UK is 2.9  
with a legal of 0.0)



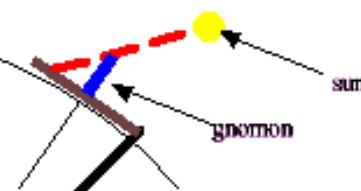
to get the hour line correct, one must wait for the sun to travel further west, in the above example. If the actual location was east of the design longitude then the opposite would be true.

In all cases, the EOT must be applied.

DIAL IN USE AT  
longitude 7.1 from legal  
(i.e. Phoenix 112.1 legal 105)



BUT DESIGNED FOR  
longitude 2.9 from legal  
(i.e. Winsham, Somerset, UK is 2.9  
with a legal of 0.0)



legal meridian  
now common to the left (actual) and right (design) dial

Design lat:	2.9	legal: 0.0	diff = 2.9		
Used at:	112.1	legal 105.0	diff = 7.1	net diff = 4.2	degrees
				mins = 16.8	mm.m

( 2 ) add 16.8 + EOT

or use the EOT tables that follow that are corrected for differing longitudes

**NOTE:** this works for hour lines, it does NOT work for Babylonian nor Italian lines. However, the declination curves (calendar lines and curves) will be correct.

EOTandLONG worksheet of: illustratingShadows.xls

Revised EOT for relocated dial			
Dial:	2.9	Used:	112.1
	5th	15th	25th
Jan	21.9	26.0	29.0
Feb	30.8	31.0	30.0
Mar	28.4	25.8	22.9
Apr	19.6	16.9	14.8
May	13.5	13.1	13.7
Jun	15.2	17.2	19.3
Jly	21.3	22.7	23.3
Aug	22.8	21.4	19.0
Sep	15.7	12.2	8.7
Oct	5.4	1.3	0.9
Nov	0.3	1.3	3.6
Dec	7.2	11.7	16.7

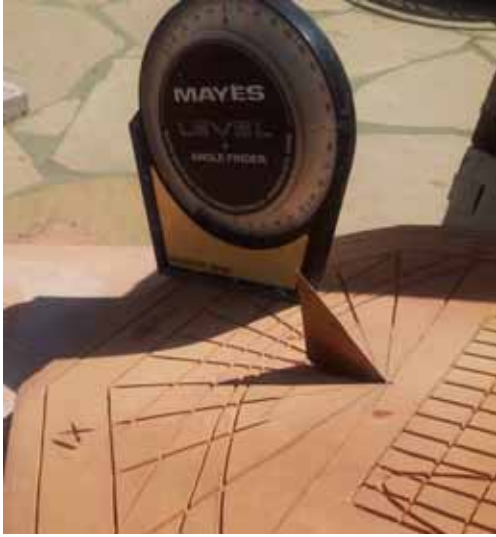
  

SMALLEST CORRECTION:	0.32
LARGEST CORRECTION:	31.05

This chart can be used when a dial is designed for the legal time meridian but used at a different longitude. It can also be used when a dial is moved in longitude but the latitude is substantially the same.

EOT per se = 0
15-Apr
15-Jun
1-Sep
25-Dec

								DIAL DESIGNED FOR		BUT USED HERE		
EQUATION OF TIME (EOT):		NON LEAP YEAR		LONGITUDE CORR		16.8 mins		Long	2.9	new long	112.1	
generic EOT table								legal	0.0	legal	105.0	
	Jan	Feb	Mar	Apr	May	Jun	Jly	Aug	Sep	Oct	Nov	Dec
1	20.05	30.31	29.23	20.78	13.95	14.57	20.58	23.16	16.95	6.63	0.36	5.67
2	20.53	30.44	29.03	20.49	13.83	14.72	20.77	23.10	16.64	6.30	0.33	6.05
3	20.99	30.57	28.82	20.19	13.72	14.88	20.95	23.02	16.32	5.98	0.32	6.44
4	21.45	30.67	28.61	19.90	13.62	15.05	21.14	22.94	15.99	5.67	0.32	6.83
5	21.90	30.77	28.39	19.61	13.53	15.22	21.31	22.85	15.66	5.36	0.34	7.24
6	22.35	30.85	28.16	19.33	13.45	15.40	21.49	22.74	15.33	5.06	0.37	7.66
7	22.79	30.92	27.92	19.04	13.38	15.58	21.65	22.63	14.99	4.76	0.42	8.08
8	23.22	30.97	27.68	18.77	13.32	15.77	21.81	22.50	14.65	4.48	0.48	8.51
9	23.64	31.01	27.43	18.49	13.26	15.96	21.97	22.37	14.30	4.19	0.55	8.96
10	24.05	31.04	27.18	18.22	13.22	16.16	22.11	22.23	13.96	3.92	0.64	9.40
11	24.46	31.05	26.92	17.95	13.19	16.36	22.25	22.07	13.61	3.65	0.74	9.86
12	24.85	31.05	26.65	17.69	13.16	16.56	22.38	21.91	13.26	3.39	0.86	10.32
13	25.24	31.04	26.38	17.44	13.15	16.77	22.51	21.74	12.90	3.14	0.99	10.79
14	25.61	31.02	26.11	17.18	13.14	16.98	22.62	21.56	12.55	2.90	1.13	11.26
15	25.98	30.98	25.83	16.94	13.14	17.19	22.73	21.37	12.19	2.67	1.29	11.74
16	26.33	30.93	25.55	16.70	13.16	17.40	22.83	21.17	11.84	2.44	1.46	12.22
17	26.67	30.87	25.26	16.46	13.18	17.62	22.92	20.97	11.48	2.23	1.65	12.70
18	27.01	30.79	24.97	16.24	13.21	17.83	23.00	20.75	11.12	2.03	1.85	13.19
19	27.32	30.71	24.68	16.02	13.25	18.05	23.08	20.53	10.77	1.83	2.07	13.68
20	27.63	30.61	24.39	15.80	13.30	18.27	23.14	20.29	10.41	1.65	2.30	14.17
21	27.93	30.50	24.09	15.59	13.36	18.48	23.20	20.05	10.06	1.48	2.54	14.67
22	28.21	30.39	23.79	15.39	13.43	18.70	23.24	19.81	9.70	1.31	2.80	15.17
23	28.48	30.26	23.49	15.20	13.51	18.92	23.28	19.55	9.35	1.16	3.07	15.66
24	28.74	30.12	23.19	15.02	13.59	19.13	23.31	19.29	9.00	1.02	3.35	16.16
25	28.98	29.97	22.89	14.84	13.69	19.35	23.32	19.02	8.65	0.90	3.65	16.65
26	29.21	29.81	22.59	14.67	13.79	19.56	23.33	18.74	8.30	0.78	3.95	17.15
27	29.43	29.64	22.29	14.51	13.90	19.77	23.33	18.46	7.96	0.68	4.27	17.64
28	29.63	29.46	21.98	14.36	14.02	19.98	23.31	18.17	7.62	0.59	4.61	18.13
29	29.82	16.80	21.68	14.21	14.15	20.18	23.29	17.87	7.29	0.51	4.95	18.62
30	30.00		21.38	14.08	14.28	20.38	23.26	17.57	6.95	0.45	5.31	19.10
31	30.16		21.08		14.42		23.21	17.27		0.40		19.58



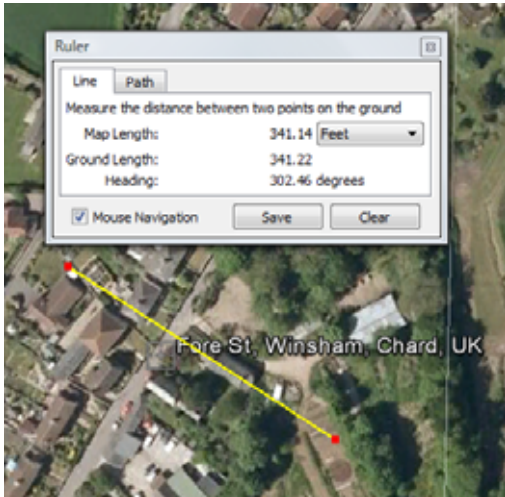
Two views of the dial plate sloping 17.4 degrees and the picture was taken 16.8 minutes plus the EOT (5.1 minutes) being 21.9 minutes past ten o'clock in the morning, and the shadow falls on the 10:00 hour line as it should.





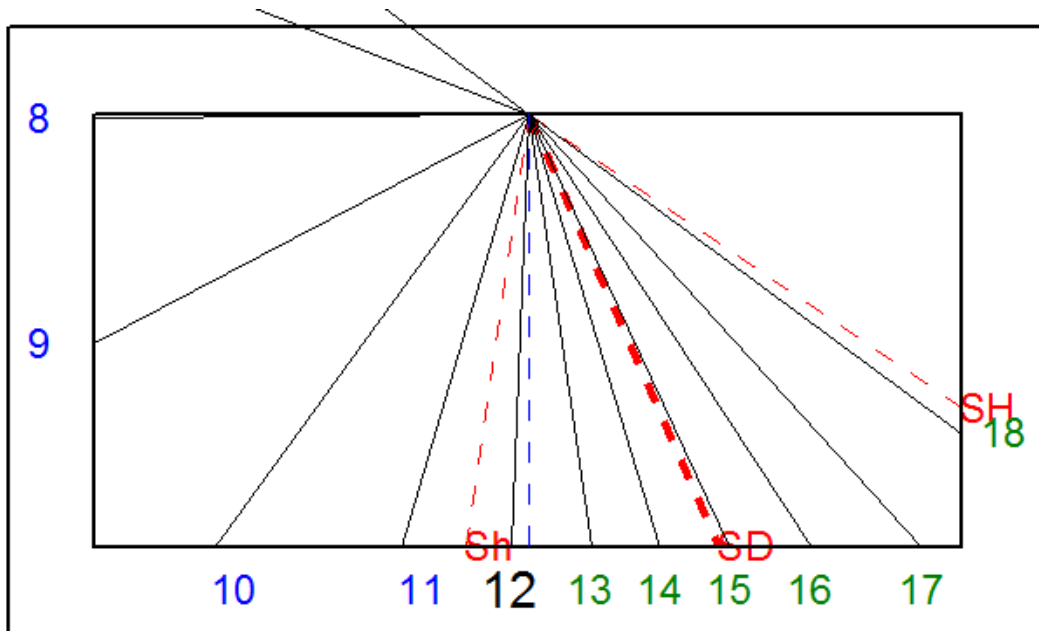
The dial is grouted, and heavily sealed. This dial will spend its life in a conservatory so Saltile tile was acceptable. Were it to spend its life in the English rain and freeze thaw environment, then a media less susceptible to the elements would have been chosen.

# vDec-dial vertical decliner



heading is 303 degrees, thus wall faces:  $303-90 = 213$  thus declination is:  $213-180 = S 33 W$

mag dec:  $2^{\circ} 11'$  west



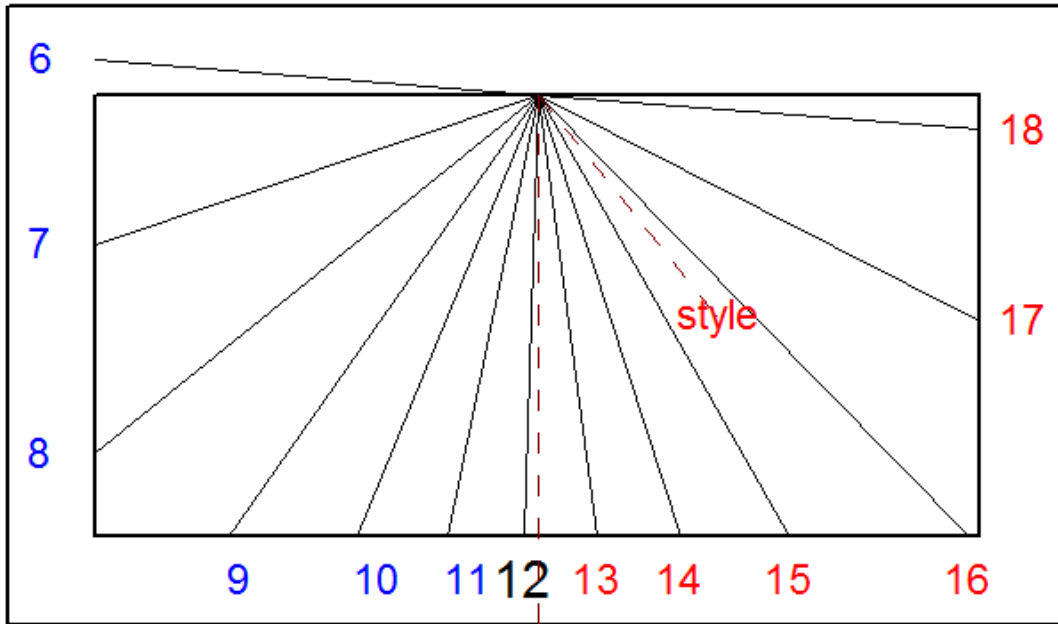
Hour and hour line angle VERTICAL DECLINER DL= -42.8

6	7	8	9	10	11	12	13	14	15	16	17	18
53.6	68.9	-89.4	-62.0	-35.8	-16.2	-02.2	08.3	17.0	25.0	33.2	42.3	53.6

Lat: 50.9 Long: 02.9 Dec: -33 SW \*\  
 SD: 23.9 SH: 31.9

# v-dial true south vertical dial for Winsham

mag dec: 2° 11' west



Hour and hour line angle VERTICAL NON DECLINER

6	7	8	9	10	11	12	13	14	15	16	17	18
85.4	-71.2	-50.9	-34.9	-22.2	-11.5	-01.8	07.7	17.9	29.7	44.3	62.9	85.4

Lat: 50.9      Long: 002.9      co-lat [sh]: 039.1