

Program Title SUNRISE, SUNSET & TWILIGHT FROM 1900

Contributor's Name DAVID B. WESTCOTT

Address 14 DORNOCH DRIVE

City ISLINGTON ONTARIO

State CANADA

Zip Code M9B 5N8

Program Description, Equations, Variables THE HELIOCENTRIC DATA FOR THE APPARENT ORBIT OF THE SUN, EPOCH 1900 1 0.5, FROM THE AMERICAN EPHEMERIS & NAUTICAL ALMANAC, IS USED TO CALCULATE THE SUN'S RIGHT ASCENSION & DECLINATION FOR USE IN THE HOUR ANGLE FORMULA. PERTURBATIONS OF THE SUN'S LATITUDE & LONGITUDE & NUTATION ARE NEGLECTED (AS IN THE EPHEMERIS). "APPROXIMATE" EVENT TIMES ARE CALCULATED BASED ON THE JULIAN DAY NUMBER AT NOON ON THE CHOSEN DATE. FOR "EXACT" EVENT TIMES, THE JULIAN DAY NUMBER IS CORRECTED TO AGREE WITH THE "APPROXIMATE" EVENT TIME AND THE EVENT TIME RECALCULATED. IF DESIRED, ADDITIONAL APPROXIMATIONS CAN BE CALCULATED; HOWEVER ONE CORRECTION SUFFICES UP TO 60° LATITUDE & TWO SUFFICE ABOVE 60° LATITUDE. THE DATA ON THE APPARENT ORBIT IS CONVERTED FROM DEGREES TO RADIANS FOR USE IN THIS PROGRAM. TIMES ARE IN THE 24 hr SYSTEM. IF AN EVENT DOES NOT OCCUR THE REASON IS DISPLAYED IN PLACE OF A TIME.

Necessary Accessories TWO MEMORY MODULES

Operating Limits and Warnings DO NOT ATTEMPT DATES BEFORE 1900 1 1. RARELY THE PROGRAM MAY NOT STOP: IN THIS CASE SEE PAGE 4 NOTE 1 (LAST LINE).

COMPUTATION INACCURACY OCCASSIONALLY RESULTS IN DIFFERENCES OF $\pm 1'$ FROM THE EPHEMERIS.

Reference(s) AMERICAN EPHEMERIS (ANY YEAR); SUPPLEMENT TO AMERICAN EPHEMERIS 1946;

HP PROGRAM 01241 D "PERPETUAL SUN & ARIES ALMANAC" BY DR. PAUL NIELSEN

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(CONTINUATION PAGE)

FORMULAE: MEAN VALUES OF Γ, L, e & $E = C_0 + C_1 T + C_2 T^2 + C_3 T^3$

$$E = M + e \sin E$$

WITH $a=1$ $r \cos N = a (\cos E - e) = \cos E - e$

$$r \sin N = a \sqrt{1-e^2} \sin E = \cos(\sin^{-1} e) \sin E$$

$$\text{ABERRATION IN } \Gamma \text{ \& } L = 9.936741207 \times 10^{-5} \text{ RAD/T}$$

$$\Theta = \Gamma + N - \text{ABERRATION}$$

$$\alpha = \tan^{-1}(\tan \Theta \cos E)$$

$$\delta = \sin^{-1}(\sin \Theta \sin E)$$

$$t = \alpha - L + \text{ABERRATION}$$

$$-\cos H = \sin \delta \sec \varphi \sec \delta + \tan \varphi \tan \delta$$

$$n = 50' \text{ FOR SUNRISE \& SUNSET}$$

$$= 6^\circ \text{ FOR CIVIL TWILIGHT}$$

$$= 12^\circ \text{ FOR NAUTICAL TWILIGHT}$$

$$= 18^\circ \text{ FOR ASTRONOMICAL TWILIGHT}$$

$$H, H \text{ ROUNDED TO THE NEAREST MINUTE} = ((H.H) 6) \text{ ROUNDED TO } 1/10 \text{ TH'S} / 6$$

$$T = (d + [365.25 g(m,y)] + [30.6 f(m)] - [9(m,y)/100] + [9(m,y)/400] - 694023) / 36525$$

WHERE [EXPRESSION] MEANS THE INTEGER PART OF THE EXPRESSION

AND

IF	$g(m,y) =$	$f(m,y) =$
$m=1 \text{ OR } 2$	$y-1$	$m+13$
$m > 2$	y	$m+1$

$$\mathcal{T} = \text{LONG} / 15 - (\text{LONG} / 15) \text{ ROUNDED TO INTEGERS} + 12 + t / 15 + H / 15$$

WHERE: Γ IS MEAN LONGITUDE OF PERIGEE

L IS GEOMETRIC MEAN LONGITUDE

e IS ECCENTRICITY OF EARTH'S ORBIT

E IS OBLIQUITY OF THE ECLIPTIC

E IS ECCENTRIC ANOMALY

M IS MEAN ANOMALY $= L - \Gamma$

N IS TRUE ANOMALY

φ IS LATITUDE OF OBSERVER (+N, -S)

LONG IS LONGITUDE OF OBSERVER (+W, -E)

T IS JULIAN CENTURIES OF 36525 DAYS

FROM 1700 1 0.5

n IS THE EXCESS OF THE SUN'S TRUE ZENITH DISTANCE OVER 90°

SUNRISE } WHEN THE SUN'S UPPER LIMB APPEARS TO BE AT THE HORIZON. THE CENTRE OF THE
SUNSET } SUN IS ASSUMED TO BE $50'$ BELOW THE HORIZON TO ALLOW FOR REFRACTION & SUN'S RADIUS

CIVIL TWILIGHT IS THE TIME PERIOD BETWEEN SUNRISE OR SUNSET & THE TIME THE CENTRE OF THE SUN IS 6° BELOW THE HORIZON.

NAUTICAL TWILIGHT IS THE PERIOD WHEN THE CENTRE OF THE SUN IS BETWEEN 6° & 12° BELOW THE HORIZON.

ASTRONOMICAL TWILIGHT IS THE PERIOD WHEN THE CENTRE OF THE SUN IS BETWEEN 12° & 18° BELOW THE HORIZON.

FULL NIGHT IS WHEN THE SUN IS MORE THAN 18° BELOW THE HORIZON.

$\mathcal{T}$ IS THE EVENT TIME.

H IS THE SUN'S HOUR ANGLE

t IS EQUATION OF TIME

Θ IS APPARENT LONGITUDE OF THE SUN

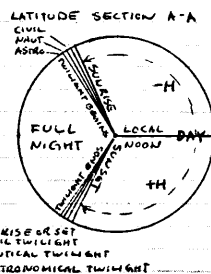
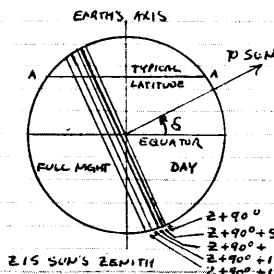
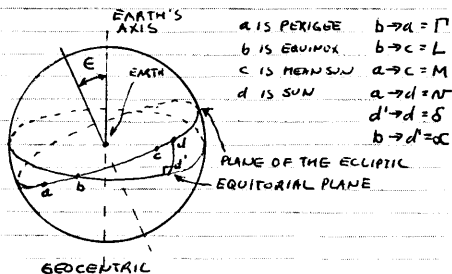
α IS THE SUN'S RIGHT ASCENSION

δ IS THE SUN'S DECLINATION

a IS THE MEAN DISTANCE FROM EARTH TO THE SUN = 1 ASTRONOMICAL UNIT

r IS THE TRUE DISTANCE FROM EARTH TO THE SUN IN ASTRONOMICAL UNITS

C_0, C_1, C_2, C_3 ARE CONSTANTS FOR T, T^2, T^3 FOR Γ, L, e & E



00508C PROGRAM DESCRIPTION II

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Sample Problem (Sketch if Desired)

FIND THE APPROXIMATE EVENT TIMES FOR LATITUDE $56^{\circ}N$, LONGITUDE 0°
FOR 1980 MAY 4. EVENT TIMES TO BE IN STANDARD TIME. FIND EXACT EVENT TIMES.
THE SOLUTION ASSUMES THE PROGRAM AND ORBITAL DATA HAVE BEEN LOADED AS PER
USER INSTRUCTIONS, STEPS 1 AND 2

FOR INTEREST (NO SOLUTION GIVEN) TRY FOR LATITUDE $89^{\circ}N$, LONGITUDE 0° (OR ANY OTHER)
USE APPROXIMATE SOLUTION.

1980 FEB 21 - 24 HR NAUTICAL TWILIGHT
1980 MAR 15 - 24 HR CIVIL TWILIGHT
1980 JUNE 21 - 24 HRS OF SUNSHINE
1980 DEC 31 - 24 HR FULL NIGHT

SOLUTION:

Input	Function	Display	Comments
56	[ENTER 1]	56.0000	DECIMAL PLACES MAY VARY HERE ONLY
0	[B]	LAT 56.0000	
		LONG 0.0000	
1980.0504	[A]	STND 0.0	STANDARD TIME IN STD. TIME ZONE
		1980.0504	DATE
		APPROX	APPROXIMATE EVENT TIMES
		ASTRO TOO LT	SUN TOO HIGH (TOO LIGHT) FOR THE EVENT
		NAUT 2.18	NAUTICAL TWILIGHT BEGINS
		CIVIL 3.23	CIVIL TWILIGHT BEGINS
		RISE 4.08	SUNRISE
		NOON 11.57	LOCAL APPARENT NOON
		SET 19.45	SUNSET
		CIVIL 20.31	CIVIL TWILIGHT ENDS
		NAUT 21.35	NAUTICAL TWILIGHT ENDS
		ASTRO TOO LT	ASTRONOMICAL TWILIGHT DOES NOT END
			WITH FULL NIGHT BECAUSE IT IS TOO LIGHT
			IF THE SUN IS TOO HIGH.
	[X56][J]	1980.0504	DATE
		EXACT	"EXACT" EVENT TIMES
		ASTRO 0.10	* ASTRONOMICAL TWILIGHT BEGINS (FULL NIGHT ENDS)
		NAUT 2.20	NAUTICAL TWILIGHT BEGINS (ASTRO ENDS)
		CIVIL 3.24	CIVIL TWILIGHT BEGINS (NAUT ENDS)
		RISE 4.09	* SUNRISE (CIVIL ENDS)
		NOON 11.57	LOCAL APPARENT NOON
		SET 19.46	* SUNSET (CIVIL BEGINS)
		CIVIL 20.31	CIVIL TWILIGHT ENDS (NAUT BEGINS)
		NAUT 21.36	NAUTICAL TWILIGHT ENDS (ASTRO BEGINS)
		ASTRO TOO LT	* TOO LIGHT FOR FULL NIGHT TO BEGIN
			* THESE ARE THE TIMES GIVEN IN THE
			AMERICAN EPHEMERIS AND NAUTICAL
			ALMANAC. THESE TIMES AGREE EXACTLY
			BUT COULD DIFFER BY 1 MINUTE. THE
			OTHER TIMES ARE NOT GIVEN IN THE
			EPHEMERIS.

00508C USER INSTRUCTIONS

Page

SIZE: 045

STEP	INSTRUCTIONS	INPUT	FUNCTION	DISPLAY
1	LOAD PROGRAM CARD SIDES 1 TO 7, CHECK STATUS, SET USER MODE, SWITCH OFF THEN ON TO CLEAR FLAGS		[ON] [ON]	
2	LOAD DATA CARD SIDES 1 & 2. THIS CARD CONTAINS ORBITAL DATA & OBSERVER'S USUAL POSITION.	26.044	RDTAX	
3	OPTIONAL: INPUT ALTERNATE POSITION OF OBSERVER			
	LATITUDE (NORTH +, SOUTH -)	Q (D.MS)	[ENTER ↑]	Q
	LONGITUDE (WEST +, EAST -)	LONG (D.MS)	[B]	LAT (Q) LONG (LONG)
4	SELECT PRECISION DESIRED (RUNNING TIME ABOUT 30 SEC FOR APPROX, 3 MIN FOR EXACT)		[E]	APPROX (OR) EXACT (ALTERNATE EACH USE)
5	SELECT DOUBLE PRECISION IF LATITUDE > 60° (RESETS TO "EXACT" AFTER EACH USE - RUNS ≈ 5 MIN)		[D]	EXACT
6	INPUT DATE OF DESIRED TIMES (SEE NOTE 1)	YYYY.MMDD		
	FOR STANDARD TIMES		[A]	SEE
	OR FOR DAYLIGHT SAVING TIMES		[C]	LIST #1
7	OPTIONAL: REVIEW TIMES	NONE	[A] OR [C]	SEE
	OPTIONAL: ONE MORE LEVEL OF PRECISION	NONE	[XEQ] [J]	LIST #2
8	NEW CASE: SAME LOCATION - GO TO STEP 4			
	NEW LOCATION - GO TO STEP 3			
	NOTE: TIMES ARE IN THE 24 hr SYSTEM			
•	DISPLAY LIST #1			STND 0 (OR) DST 1 (+LIST #2)
•	DISPLAY LIST #2 - NOTE: IF THE EVENT DOES NOT OCCUR, THE TIME WILL BE REPLACED BY "TOO DK" IF THE SUN IS TOO LOW AND BY "TOO LT" IF THE SUN IS TOO HIGH. E.G. IF ASTRO & NAUT BEGIN & END "TOO LT" & CIVIL BEGINS & ENDS "TOO DK" THERE IS 24 hr NAUTICAL TWILIGHT.			YYYY.MMDD APPROX (OR) EXACT ASTRO (TIME) } NAUT (TIME) } CIVIL (TIME) } RISE (TIME) NOON (TIME) SET (TIME) CIVIL (TIME) } NAUT (TIME) } ASTRO (TIME) } E D S
NOTE 1	• THE NUMBER AT DISPLAY LIST #1 IS THE TIME DIFFERENCE FROM STANDARD TIME IN A STANDARD TIME ZONE. IF A DIFFERENT DIFFERENCE IS REQUIRED, INPUT IT AT THE PAUSE IE. AT DISPLAY. TO PERMANENTLY SET FOR A NON-STANDARD TIME ZONE SEE COMMENTS ON PROGRAM LISTING AT LINES 211 TO 213.			
•	IF THE "BIRD" STOPS FOR MORE THAN 15 SECONDS		[R/S] [FIX] [4] [RS]	

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STEP/ LINE	KEY ENTRY	KEY CODE (67/97 only)	COMMENTS	STEP/ LINE	KEY ENTRY	KEY CODE (67/97 only)	COMMENTS
01	LBL	"SUN		51	LASTX		
02	LBL	B	STORE OR RECALL	52	FS?C 15		
03	FIX	4	LATITUDE & LONGITUDE	53	GTO 06		IF ALPHA
04	FC?C	22		54	FS? 17		
05	GTO	06		55	CHS		IF PM TIMES
06	HR			56	RCL 21		
07	STO	44		57	+		
08	RDN			58	LBL 06		
09	HR			59	STO IND		STORE EVENT TIME
10	STO	43		02			OR NO-EVENT MESSAGE
11	LBL	06		60	ISG 02		
12	ADV			61	FS? 18		
13	ADV			62	RTN		IF APPROX TIMES
14	RCL	43		63	LBL 14		EVENT DATE CORRECTION
15	"LAT "			64	RCL IND		
16	XEQ	08	DISPLAY- PRINT	02			
17	RCL	44		65	SIGN		
18	"LONG"			66	X=0?		IF NOT ALPHA
19	GTO	08	DISPLAY- PRINT	67	GTO 14		IF ALPHA TRY 12HRS
20	LBL	09	NO - EVENT DISPLAYS!	68	RCL 04		FROM NOON
21	"TOO DK"		IF SUN TOO LOW	69	FS? 17		
22	X=0?		OK	70	CHS		
23	"TOO LT"		IF SUN TOO HIGH	71	RCL 12		
24	ASTO IND			72	+		
18				73	ABS		
25	ASTO X			74	LBL 14		DATE CORRECTION IN
26	FS? 16			75	LASTX		JULIAN CENTURIES
27	RTN		RTN IF-H CMC. ONLY.	76	RCL 07		
28	GTO	06	TO STORE CALCULATED TIME	77	-		
29	LBL	04	HOOR ANGLE CALCULATION	78	876600		
30	DSE	18		79	/		
31	SIN			80	STO 18		
32	RCL	19		81	GTO 14		
33	+			82	LBL 07		CALC SIN & SIN U,
34	RCL	20		83	INT		COS & COS U,
35	/			84	STO 18		T-X
36	ENTER↑			85	LASTX		CALCULATED FOR JULIAN
37	FRC			86	FRC		CENTURIES OF 365.25
38	X=Y?			87	1 E2		DAYS FROM 1900-1-05
39	GTO	09		88	STO 19		
40	CHS			89	STO 22		
41	ACOS		-H	90	*		
42	15			91	FRC		
43	/			92	ST* 19		
44	STO IND			93	RCL 04		
18				94	LASTX		
45	FS? 16			95	INT		
46	RTN		IF-H CMC ONLY	96	3		
47	LBL	05	EVENT TIME CALC	97	-		
48	SIGN			98	X<0?		
49	X=0?			99	DSE 18		YR-1 IF MONTH 1 OR 2
50	SF 15		IF ALPHA (NO EVENT)	100	X<0?		

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STEP/ LINE	KEY ENTRY	KEY CODE (67/97 only)	COMMENTS	STEP/ LINE	KEY ENTRY	KEY CODE (67/97 only)	COMMENTS
101	+		MONTH + 9 IF MONTH 1 OR 2 OTHERWISE MONTH - 3	151	XEQ 00		
102	4			152	XEQ 01		
103	+		MONTH + 1 OR +13 IF 10R2	153	STO 19		Γ 21 28 29 30
104	30.6			154	-		M
105	*			155	360		
106	INT			156	D-R		
107	RCL 19			157	MOD		
108	+			158	STO 23		M MOD 2 π
109	RCL 18			159	FIX 6		
110	RCL 22			160	RND		
111	/			161	LBL 02		
112	INT		EVERY 4 th	162	LASTX		
113	LASTX		CENTURY	163	SIN		
114	4		A LEAP YEAR	164	RCL 24		
115	/			165	*		
116	INT			166	RCL 23		
117	-			167	+		
118	-			168	RND		
119	0		INITIALIZE EVENT TIME CORRECTION & RECALL MODIFIED YEAR	169	X=Y?		
120	X<> 18			170	GTO 02		IF E NOT EXACT TO SIX PLACES
121	RCL 42			171	RCL 24		
122	ST* 22			172	ASIN		
123	*			173	COS		$\sqrt{1+E^2}$
124	INT			174	P-R		
125	+			175	LASTX		
126	RCL 41			176	/		$\cos E, \sqrt{1+E^2} \sin E$
127	-			177	RCL 24		$\cos E - E, \sqrt{1+E^2} \sin E$
128	RCL 44		CORRECTION TO DATE FOR LONGITUDE OF OBSERVER	178	-		
129	360			179	R-P		r, n
130	/			180	1/X		
131	+			181	RCL 26		
132	RCL 22			182	*		ABBREVIATION IN RADIAN
133	/			183	ST- 20		L-AB IN R20
134	STO 03		"EXACT" CORRECTION ENTRY POINT	184	-		
135	LBL 14			185	ST+ 19		$\odot = \Gamma \sin - AB$ IN RM
136	RCL 07			186	RCL 20		L-AB
137	STO 21			187	RCL 25		E
138	RAD			188	RCL 19		O
139	40		INITIAL ADDRESS FOR CONSTANT RECALL	189	1		
140	X<> 18			190	P-R		$\cos O, \sin O, E, L-AB$
141	RCL 03			191	RDN		
142	+			192	P-R		$\sin O \cos E, \sin O \sin E,$ $L-AB, \cos O$
143	STO 22			193	R↑		
144	XEQ 00		REGISTER HOLDING	194	R-P		
145	STO 24		C0 C1 C2 C3	195	RDN		$\odot, \sin O \sin E, L-AB, R$
146	XEQ 00		E 30 31 40	196	X<>Y		
147	XEQ 01			197	STO 19		SIN S IN R9
148	STO 25		E 34 35 36 37	198	ASIN		δ
149	XEQ 00			199	COS		
150	STO 20		L 31 32 33	200	STO 20		$\cos \delta$ IN R20

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STEP/ LINE	KEY ENTRY	KEY CODE (67/97 only)	COMMENTS	STEP/ LINE	KEY ENTRY	KEY CODE (67/97 only)	COMMENTS
201	RDN			251	STO 07		STORE TIME DIFFERENCE
202	-		L-AB-00	252	12		
203	SIN			253	STO 04		
204	DEG			254	ST+ 07		
205	ASIN		-90° ≤ -C ≤ 90°	255	8.017		INITIAL ADDRESS FOR EVENT TIMES
206	15			256	STO 01		
207	/			257	STO 02		
208	RCL 44			258	CLD		
209	LASTX			259	RCL 17		CALC COS δ COS φ, T-H, SIN δ SIN φ FOR DATE
210	/			260	XEQ 07		
211	ENTER↑		FOR NON-STANDARD TIME ZONES THESE LINES CAN BE REPLACED WITH THE ZONE STANDARD-TIME TIME DIFFERENCE FROM GMT	261	.5		
212	FIX 0			262	HR		
213	RND			263	STO 06		
214	-			264	SF 16		
215	-			265	XEQ 04		H 50' IN R25
216	ST- 21		T-H IN R21	266	6		
217	RCL 43			267	XEQ 04		H 6° IN R24
218	1			268	RCL 04		
219	P-R			269	XEQ 04		H 12° IN R23
220	ST* 20		COS δ COS φ IN R20	270	18		
221	RDN			271	STO 05		
222	ST* 19		SIN δ SIN φ IN R19	272	XEQ 04		H 10° IN R22
223	RTH			273	CF 16		
224	LBL 00		EPOCHERIS DATA CALCULATIONS	274	SF 17		
225	RCL IND			275	SF 18		APPROXIMATE EVENT TIMES FOR: MORNING ASTRONOMICAL
18				276	RCL 22		
226	DSE 18			277	XEQ 05		
227	XEQ 01			278	RCL 23		NAUTICAL
228	LBL 01			279	XEQ 05		
229	RCL 22			280	RCL 24		CIVIL TWILIGHT
230	*			281	XEQ 05		
231	RCL IND			282	RCL 25		SUNRISE
18				283	XEQ 05		
232	+			284	CF 17		
233	DSE 18			285	CLX		LOCAL NOON
234	RTH			286	XEQ 05		AFTERNOON
235	LBL A		FOR EVENT TIMES IN STANDARD TIME	287	RCL 25		SUNSET
236	SF 17			288	XEQ 05		
237	LBL C		FOR EVENT TIMES IN DAYLIGHT-SAVING TIME	289	RCL 24		CIVIL
238	CF 29			290	XEQ 05		
239	ADV			291	RCL 23		NAUTICAL
240	FC?C 22		IF NO DATE INPUT REVIEW EVENT TIMES OTHERWISE STORE DATE & CALCULATE TIMES	292	XEQ 05		
241	GTO 06			293	RCL 22		ASTRONOMICAL TWILIGHT
242	STO 17			294	XEQ 05		
243	FIX 1			295	FC? 01		
244	"DST"			296	GTO 03		IF APPROX TIMES ONLY FOR "EXACT" TIMES & ONE MORE ROUND
245	FS? 17			297	LBL 10		
246	"STND"			298	RCL 01		
247	1			299	STO 02		
248	FS?C 17			300	SF 01		
249	CLX						
250	XEQ 00		DISPLAY TIME MADE & TIME DIFFERENCE FROM STANDARD TIME-ZONE STANDARD TIME (INPUT ALTERNATE DIFFERENCE AT THE PAUSE, IF DESIRED)				

Note: Refer to "HP-41C OWNER'S HANDBOOK AND PROGRAMMING GUIDE" for specific information on keystrokes. Function index begins on page 262.
Refer to Appendix E in 67 or 97 "OWNER'S HANDBOOK AND PROGRAMMING GUIDE" for exact keystrokes.

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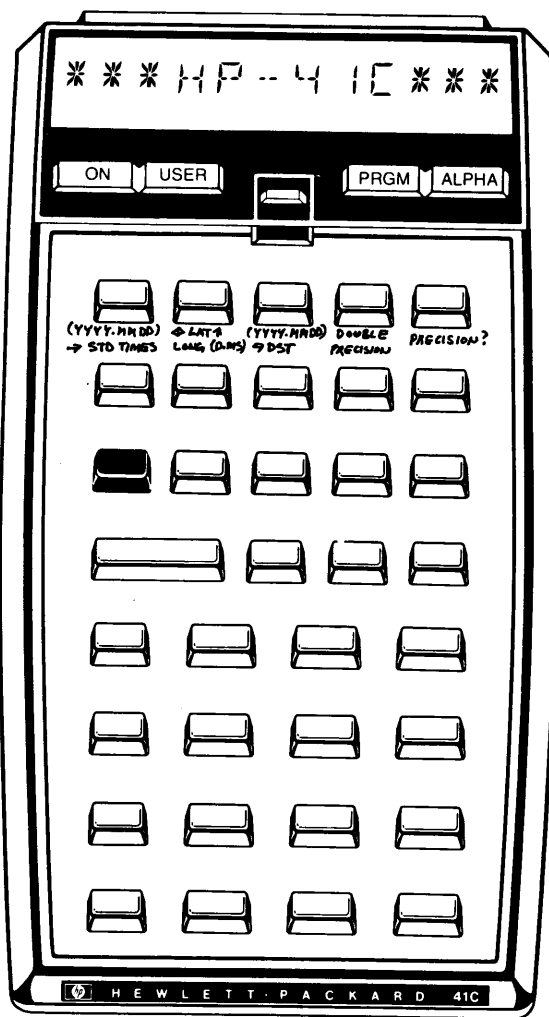
STEP/ LINE	KEY ENTRY	KEY CODE (67/97 only)	COMMENTS	STEP/ LINE	KEY ENTRY	KEY CODE (67/97 only)	COMMENTS
301	SF 17			351	"ASTRO"		
302	CF 18			352	LBL 11		
303	XEQ 14		CORRECT DATE FOR AM ASTRO	353	RCL IND		RECALL EVENT TIME
304	RCL 05			02			
305	XEQ 04		AM ASTRO & DATE FOR NAUT	354	ISG 02		
306	RCL 04			355	SIGN		
307	XEQ 04		AM NAUT & DATE FOR CIVIL	356	X=0?		
308	6			357	SF 15		IF ALPHA
309	XEQ 04		AM CIVIL & DATE FOR RISE	358	LASTX		
310	RCL 06			359	FS?C 15		
311	XEQ 04		RISE & DATE FOR NOON	360	GTO 00		
312	CF 17			361	6		IF NOT ALPHA
313	CLX			362	*		ROUND TIME TO
314	XEQ 05		NOON & DATE FOR SET	363	FIX 1		NEXT MINUTE
315	RCL 06			364	RND		
316	XEQ 04		SET & DATE FOR CIVIL	365	FIX 2		
317	6			366	6		
318	XEQ 04		CIVIL & DATE FOR NAUT	367	/		
319	RCL 04			368	"F "		
320	XEQ 04		NAUT & DATE FOR ASTRO	369	LBL 08		
321	RCL 05			370	HMS		LATITUDE,
322	SF 18			371	10		LONGITUDE
323	XEQ 04		ASTRO	372	X<>Y		& EVENT TIMES
324	FS?C 19			373	X<Y?		RIGHT JUSTIFIED
325	GTO 10		IF DOUBLE PRECISION	374	"F "		AS WELL AS LEFT
326	LBL 03		EVENT DISPLAY	375	LBL 00		JUSTIFIED
327	BEEP		WITH BEEP	376	"F "		
328	LBL 06		WITHOUT BEEP	377	ARCL X		
329	CF 17			378	AVIEW		
330	FIX 4			379	FC? 21		
331	RCL 01			380	PSE		
332	STO 02			381	RTN		
333	VIEW 17		DATE	382	LBL 12		
334	FC? 21		PAUSE ONLY IF	383	"NAUT "		
335	PSE		PRINTER NOT USED	384	GTO 11		
336	XEQ 06		DISPLAY PRECISION	385	LBL 13		
337	FC? 21			386	"CIVIL"		
338	PSE			387	GTO 11		
339	XEQ 03		AM ASTRO	388	LBL D		SELECT DOUBLE PRECISION
340	XEQ 12		NAUT	389	CF 01		
341	XEQ 13		CIVIL	390	SF 19		
342	"RISE "			391	LBL E		PRECISION}
343	XEQ 11		RISE	392	ADV		
344	"NOON "			393	FC?C 01		
345	XEQ 11		NOON	394	SF 01		
346	"SET "			395	LBL 06		
347	XEQ 11		PM SET	396	"APPROX"		EXACT → APPROX
348	XEQ 13		CIVIL	397	FS? 01		
349	XEQ 12		NAUT	398	"EXACT"		APPROX → EXACT
350	LBL 03		ASTRO	399	AVIEW		
				400	RTN		
				401	END		

RÉGISTERS, STATUS, FLAGS, ASSIGNMENTS

[illegible]

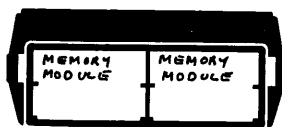
THE DATA IN REGISTERS 26 TO 44 INCLUSIVE SHOULD BE RECORDED ON A DATA CARD WITH LAT & LONG BEING THE OBSERVER'S USUAL POSITION. THE CONTENTS OF THE OTHER REGISTERS ARE GENERATED BY THE PROGRAM. MP67/97 PROGRAMS CAN BE RUN WITHOUT DISTURBING THE PERMANENT DATA IF SIZE IS LEFT AT 45. TO RECORD THE PERMANENT DATA INPUT 26.045 AND EXECUTE WDTAX WITH THE PROGRAM MODE OFF.

KEYBOARD CARD LABELING

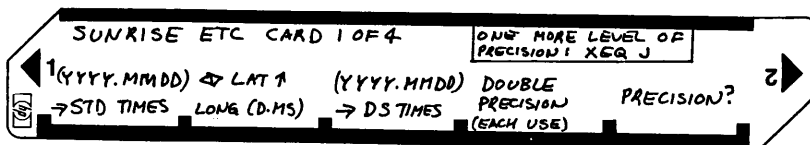


KEYBOARD

SYSTEM CONFIGURATION



CARD



ROW 1 (1 : 4)



ROW 2 (5 : 14)



ROW 3 (14 : 18)



ROW 4 (18 : 21)



ROW 5 (22 : 26)



ROW 6 (26 : 34)



ROW 7 (35 : 44)



ROW 8 (45 : 53)



ROW 9 (54 : 61)



ROW 10 (62 : 71)



ROW 11 (72 : 79)



ROW 12 (80 : 87)



ROW 13 (88 : 97)



ROW 14 (98 : 106)



ROW 15 (107 : 116)



ROW 16 (117 : 126)



ROW 17 (126 : 134)



ROW 18 (135 : 143)



ROW 19 (144 : 148)

ROW 20 (149 : 153)

ROW 21 (154 : 162)

ROW 22 (163 : 171)

ROW 23 (172 : 182)

ROW 24 (183 : 190)

ROW 25 (191 : 201)

ROW 26 (202 : 212)

ROW 27 (212 : 221)

ROW 28 (222 : 229)

ROW 29 (229 : 237)

ROW 30 (237 : 244)

ROW 31 (244 : 248)

ROW 32 (249 : 255)

ROW 33 (255 : 262)

ROW 34 (263 : 269)

ROW 35 (269 : 275)

ROW 36 (276 : 281)

ROW 37 (281 : 286)

ROW 38 (287 : 292)

ROW 39 (292 : 296)

ROW 40 (299 : 305)

ROW 41 (305 : 311)

ROW 42 (312 : 318)

ROW 43 (318 : 324)

ROW 44 (325 : 333)

ROW 45 (334 : 340)

ROW 46 (340 : 343)

ROW 47 (343 : 346)

ROW 48 (346 : 350)

ROW 49 (351 : 356)

ROW 50 (357 : 365)

ROW 51 (365 : 374)

ROW 52 (374 : 381)

ROW 53 (382 : 386)

ROW 54 (386 : 391)

ROW 55 (392 : 396)



ROW 56 (397 : 401)

