NGA GNSS Division SP3 Format

SP3 Format Description

NGA products use the format finalized by the National Geodetic Survey. The SP3 format provide ephemeris data in either position (P) mode or velocity (V) modes. The SP3 format is precise to 1 mm and 1 picosecond. Velocity, when included, is precise to 10^{-4} mm/sec and 10^{-4} picoseconds/s.

The following is the format for the "enhanced" SP3:

```
                 1         2         3         4         5         6
        1234567890123456789012345678901234567890123456789012345678901234567890

1       #aV2012 10  1  0  0  0.00000000     288 DD+AD WGS84 FIT   NGA
2       ## 1708   86400.00000000   300.00000000 56201 0.0000000000000
3       +   31   1  2  3  4  5  6  7  8  9 10 11 12 13 14 15 16 17
4       +        18 19 20 21 22 23 25 26 27 28 29 30 31 32  0  0  0
5       +         0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
6       +         0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
7       +         0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
8       ++        2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2
9       ++        2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  0  0
10      ++        0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
11      ++        0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
12      ++        0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
13      %c cc cc ccc ccc cccc cccc cccc cccc ccccc ccccc ccccc ccccc
14      %c cc cc ccc ccc cccc cccc cccc cccc ccccc ccccc ccccc ccccc
15      %f  0.0000000  0.000000000  0.00000000000  0.000000000000000
16      %f  0.0000000  0.000000000  0.00000000000  0.000000000000000
17      %i    0    0    0    0      0      0      0      0         0
18      %i    0    0    0    0      0      0      0      0         0
19      /*       NGA, ST. LOUIS,MO.
20      /*    EPHEMERIS COMPUTED FROM  1 DAYS OF DATA
21      /*    EPOCHA SMOOTHER
22      /*  CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
```

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```
23      *   2012 10  1  0  0   0.00000000
24      P  1  -1677.901589   16285.584053 -20920.350325      275.849218
25      V  1 -25096.728698    8665.572021   8818.525202        0.015870
26      P  2  20801.130436  -14268.541598   7587.240521      404.556632
27      V  2  10280.136019    -147.845949 -29536.235333        0.011634
28                     .              .             .               .
29                     .              .             .               .
30                     .              .             .               .
31                     .              .             .               .
32                     .              .             .               .
33                     .              .             .               .
34      *   2012 10  1 23 55   0.00000000
35      P  1  -1545.870613   16240.292187 -20966.016107      275.985617
36      V  1 -25177.862925    8604.994335   8581.662169        0.015774
37                     .              .             .               .
38                     .              .             .               .
39                     .              .             .               .
40                     .              .             .               .
41                     .              .             .               .
42                     .              .             .               .
43      P 32   -143.412125   18718.631715 -18837.924362     -493.864143
44      V 32 -18157.215193  -16024.551820 -15137.882157       -0.039374
45      EOF
```

Line and Column Descriptions

Line 1: ('#aV',i4,4i3,f12.8,6x,'96 DD+AD WGS84 FIT NGA')

Column	Description	Allowed or Sample value
1	Symbol	#
2	Version Identifier	a
3	Position/Velocity Mode Flag	P or V
4-7	Year Start	2012
8	Unused	
9-10	Month Start	10
11	Unused	
12-13	Day of Month Start	1
14	Unused	
15-16	Hour Start	0
17	Unused	
18-19	Minute Start	0
20	Unused	

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Column	Description	Allowed or Sample value
21-31	Second Start	0.00000000
32	Unused	
33-39	Number of Epochs	288
40	Unused	
41-45	Data Used	DD+AD
46	Unused	
47-51	Coordinate System	WGS84
52	Unused	
53-55	Orbit Type	FIT
56	Unused	
57-60	Agency	NGA

Line 2: ('##',i5,f16.8,f15.8,i6,f16.13)

Column	Description	Allowed or Sample value
1-2	Symbol	##
3	Unused	
4-7	GPS Week	1708
8	Unused	
9-23	Seconds of Week	0.00000000
24	Unused	
25-38	Epoch Interval	300.0000000
39	Unused	
40-44	Modified Julian Day Start	56201
45	Unused	
46-60	Fractional Day	0.00000000

Line 3: ('+',i5,3x,17i3)

Column	Description	Allowed or Sample value
1-2	Symbol	+
3-4	Unused	
5-6	Number of Satellites	31
7-9	Unused	
10-12	Satellite ID for the 1st satellite	1
13-15	Satellite ID for the 2nd satellite	2
*	*	*
*	*	*
*	*	*
58-60	Satellite ID for the 17th satellite	18

Lines 4 to 7:   ('+',8x,17i3)

Column	Description	Allowed or Sample value
1-2	Symbol	+
3-9	Unused	
10-12	Satellite ID for the next satellite	19
*	*	*
*	*	*
*	*	*
58-60	Satellite ID for the last satellite	0

Line 8 to 12:   ('++',7x,17i3)

Column	Description	Allowed or Sample value
1-2	Symbol	++
3-9	Unused	
10-12	Satellite Accuracy for the 1st satellite	0
13-15	Satellite ID for the next satellite	0
*	*	*
*	*	*
*	*	*
58-60	Satellite ID for the last satellite	0

Lines 13 to 14:   ('%c cc cc ccc ccc cccc cccc cccc cccc ccccc ccccc ccccc ccccc')

Column	Description	Allowed or Sample value
1-2	Symbol	%c
3	Unused	
4-5	Characters	cc
6	Unused	
7-8	Characters	cc
9	Unused	
10-12	Characters	ccc
13	Unused	
14-16	Characters	ccc
17	Unused	
18-21	Characters	cccc
22	Unused	
23-26	Characters	cccc
27	Unused	
28-31	Characters	cccc
32	Unused	

Column	Description	Allowed or Sample value
33-36	Characters	cccc
37	Unused	
38-42	Characters	ccccc
43	Unused	
44-48	Characters	ccccc
49	Unused	
50-54	Characters	ccccc
55	Unused	
56-60	Characters	ccccc

Lines 15 and 16: ('%f 0.0000000 0.000000000 0.00000000000 0.000000000000000')

Column	Description	Allowed or Sample value
1-2	Symbol	%f
3	Unused	
4-13	Common Float	0.0000000
14	Unused	
15-26	Common Float	0.000000000
27	Unused	
28-41	Common Float	0.00000000000
42	Unused	
43-60	Common Float	0.000000000000000

Lines 17 and 18: ('%i 0 0 0 0   0   0   0   0   0')

Column	Description	Allowed or Sample value
1-2	Symbol	%i
3	Unused	
4-7	Integer	0
8	Unused	
9-12	Integer	0
13	Unused	
14-17	Integer	0
18	Unused	
19-22	Integer	0
23	Unused	
24-29	Integer	0
30	Unused	
31-36	Integer	0
37	Unused	

Column	Description	Allowed or Sample value
37	Unused	
38-43	Integer	0
44	Unused	
45-50	Integer	0
51	Unused	
52-60	Integer	0

Lines 19 to 22:   ('/* CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC')

Line 23 (The Epoch Header Record):   ('*',i6,4i3,f12.8)

Column	Description	Allowed or Sample value
1-2	Symbol	*
3	Unused	
4-7	Year Start	2012
8	Unused	
9-10	Month Start	10
11	Unused	
12-13	Day of Month Start	1
14	Unused	
15-16	Hour Start	0
17	Unused	
18-19	Integer	0
20	Unused	
21-31	Integer	0
32-60	Unused	

Epoch Headers in Line 23 repeat for each new epoch with vehicle position and velocity records following.

Line 24 (The Position and Clock Record):   ('P',i3,4f14.6)

Column	Description	Allowed or Sample value
1	Position	P
2-4	Vehicle ID	1
5-18	x coordinate (km)	-1577.901589
19-32	y coordinate (km)	16285.584053
33-46	z coordinate (km)	-20920.350325
47-60	Clock time (µs)	275.849218

Line 24 will include an 'E' in column 75 to designate an Event in the Position and Clock Record.
('P',i3,4f14.6,14x,'E')

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Line 25 (The Velocity Record): ('V',i3,4f14.6)

Column	Description	Allowed or Sample value
1	Velocity	V
2-4	Vehicle ID	1
5-18	x coordinate (dm/s)	-25096.728698
19-32	y coordinate (km)	8665.572021
33-46	z coordinate (km)	8818.525202
47-60	Clock correction rate of change (µs/s)	0.015870

***Lines Twenty-four and Twenty-five repeat for each vehicle in the epoch. ***

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