GPS RECEIVER

JRC STANDARD DATA INPUT/OUTPUT FORMAT

Revision 2.01

(IEC1162 NMEA0183 Version 2.10)

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Japan Radio Co., LTD.

Document Revision History

Date	Revision	Description
06/11/00	R2.01 (TS-01X539)	First Edition
10/11/01	R2.01 (TS-01X539A)	Added Sections 4.4, 4.7 and 4.9. 4.4 High Resolution GGA 4.7 High Resolution RMC 4.9 High Resolution GLL

C O N T E N T S

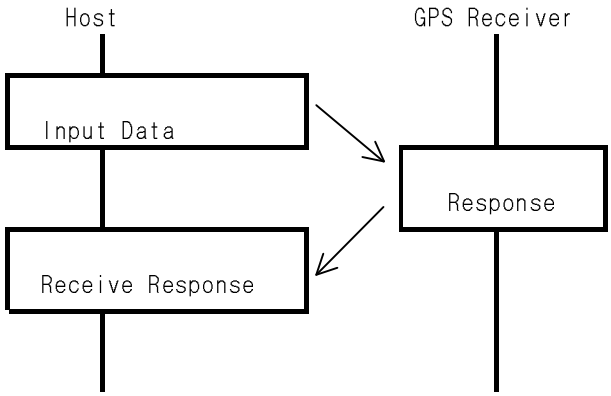
1. Data Transmission

(1) Asynchronous Serial Data Transfer
(2) Baud Rate: 4,800 bit/sec
(3) Data Bit: 8 bit (D7=0) Non Parity
(4) Stop Bit: 1 bit
(5) LSB First Transmission

2. Data Protocol

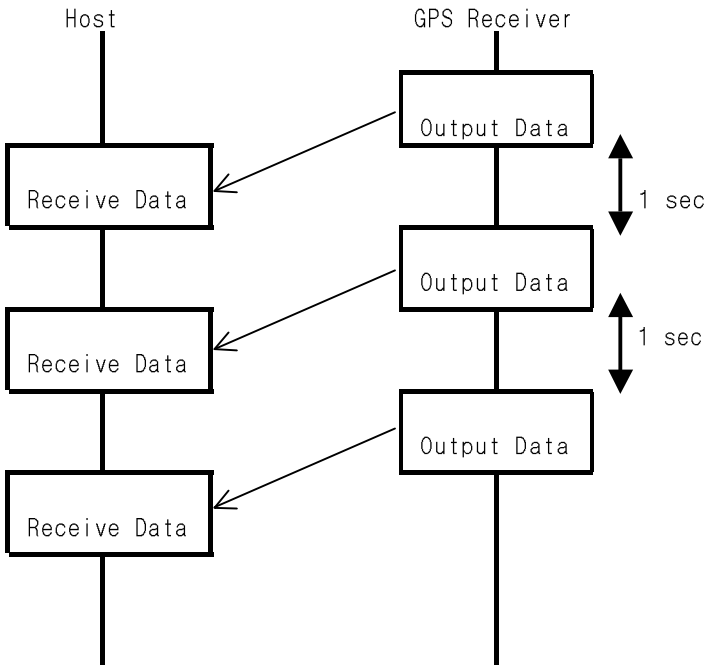
2.1 Protocol for Input Data

Protocol of data transmission from Host to GPS Receiver:



2.2 Protocol for Output Data

Protocol of data transmission from GPS Receiver to Host:



3. Input Data Format (Host → GPS Receiver)

3.1 PJRCI, GP - Initial Time & Position Set (71 byte)

```
$PJRCI,GP,1111.11,a,yyyyy.yy,a,uxxxx,hhmmss,xx,xx,xxxx,A,A,A,A,A,A*hh<CR><LF>
           1     2 3        4 5     6      7  8  9    101112131415
```

1,2: Latitude (Degree, Minute), N/S
3,4: Longitude (Degree, Minute), E/W
5: Antenna height above mean sea level (m), u: sign(+,-)
6: UTC (Hour, Minute, Second)
7: Day (UTC)
8: Month (UTC)
9: Year (UTC)
10: Flag of Lat/Long setting A=Set, V=No set
11: Flag of Antenna height setting A=Set, V=No set
12: Flag of Date/Time setting A=Set, V=No set
13: Flag of Master Reset A=Set, V=No set
14: Flag of Cold Start Fix A=Set, V=No set
15: Flag of Differential GPS fix A=Set, V=No set

Note 1: When this sentence is input, GPS receiver is initialized according to the items 10 to 15.

Note 2: Setting after power-on or master reset should be done after starting data output.
Note 3: Flag set is due to following priority. When high and low priority flagsare set at once, just high priority flag is effective. When the same priority flags are set, all flags are effective.

		Flag
High ↑ Priority ↓ Low	1	☐Master Reset
	2	☐Cold Start Fix
	3	☐Lat./Long. Setting ☐Antenna Height Setting ☐Date/Time Setting ☐Differential GPS Fix

3.2 PJRCE, GP, 0 - Receiver Mode Set (50 byte)

$PJRCE,GP,0,x,xx,x,x,x,xx,xx,xx,xx,xx,x,xx*hh<CR><LF>
1 2 3 4 5 6 7 8 9 10 1112 13

1: Position Calculation Mode
0 = 2 Dimension, 1 = 3 Dimension, 2 = AUTO
2: Minimum elevation angle enabling position calculation
Range from 1 to 89 degrees at 1° step
3: DOP threshold enabling position calculation
0 = less than 5, 1 = less than 10, 2 = less than 20
4: Smoothing level
0 = strong, 1 = middle, 2 = weak
5: Local geodetic systems.
Refer to table 1.
6-11: Not use : 00 fixed.
12: Output data sentence every second
0 = [GGA]→[VTG]→[RMC]→[GLL]
1 = [GGA]→[VTG]→[RMC]→[GLL]→[GSA]→[PJRCD,GP,3]
2 = [GSA]→[GSV]→[PJRCD,GP,3]
3 = [RMC]→[GSA]→[GSV]→[PJRCD,GP,3] *
4 = [High Resolution GGA]→[VTG]→[High Resolution RMC]→[High Resolution GLL]
5 = [High Resolution GGA]→[VTG]→[High Resolution RMC]→[High Resolution GLL]
→[GSA]→[PJRCD,GP,3]
6 = [High Resolution RMC]→[GSA]→[GSV]→[PJRCD,GP,3] *
9 = [PJRCD,GP,4]
*: There is the case where data is not output every second due to data length.
13: Additional datum Refer to table 2.

Table 1. No. of Datum

No.	Name
0	WGS-84
1	WGS-72
2	Tokyo Bessel
3	North American 1927 (America)
4	North American 1927 (Canada, Alaska)
5	European 1950 (Europe)
6	Australia Geodetic 1966 (Australia)
7	Ordnance Survey of Great Britain (England)
8	NAD-83
9	Other Datum specified by 13.

Note 1: Setting after power-on or master reset should be done after starting data output.

Table 2. No. of Additional Datum

No.	Name
11	Adindan (Ethiopia and Sudan)
12	ARC 1950 (Botswana)
13	Australian Geodetic 1984 (Australia)
14	Bermuda 1957 (Bermuda Islands)
15	Bogota Observatory (Colombia)
16	Campo Inchauspe (Argentina)
17	Chatham 1971 (Chatam Island)
18	Chua Astro (Paraguay)
19	Corrego Alegre (Brazil)
20	Djakarta (Vatavia) (Sumatra)
21	European 1979 (Europe)
22	Geodetic datum 1949 (New Zealand)
23	Guam 1963 (Guam)
24	Hayford 1910 (Finland)
25	Hjorsey 1955 (Iceland)
26	Indian (Indian and Nepal)
27	Ireland 1965 (Ireland)
28	Kertau 1948 (West Malaysia and Singapore)
29	L.C.5 Astro (Cayman Brac Island)
30	Liberia 1964 (Liberia)
31	Luzon (Philippines)
32	Merchich (Morocco)
33	Minna (Cameroon)
34	Nahrwan (Oman)
35	Naparima, BWI (Trinidad and Tobago)
36	Old Egyptian (Egypt)
37	Old Hawaiian (Hawaiian Islands)
38	Pico de las Nieves (Canary Islands)
39	Provisional South America 1956 (South America)
40	Provisional South Chilean 1963 (Southern Chile)
41	Puerto Rico (Puerto Rico and Virgin Islands)
42	Qornoq (South Greenland)
43	RT90 (Sweden)
44	Santa Braz (Sao Maguel, Santa Maria Islands)
45	South America 1969 (South America)
46	Southwest Base (Fail, Graciosa, Pico, Sao Jorge and Terceira Island)
47	Timbalai 1948 (Brunei and East Malaysia)

4. Output Data Format (GPS Receiver → Host)

4.1 PJRCI, GP - Initial Time & Position Set Response

Send back the same data which is input by Initial Time and Position Set.
Sentence itself is same as subclause 3.1.

4.2 PJRCE, GP, 0 - Receiver Mode Set Response

Send back the same data which is input by receiver mode set.
Sentence itself is same as subclause 3.2.

4.3 GGA - Position Data (71 byte)

```
$GPGGA,hhmmss,1111.111,a,yyyyy,yyy,a,x,x,xx,uxxxx,M,uxxx,M,xx,xxxx*hh<CR><LF>
          1       2    3 4         5 6 7 8  9    10 11   1213 14
```

1: UTC (Hour, Minute, Second)
2,3: Latitude (Degree, Minute), N/S (the datum specified by user)
4,5: Longitude(Degree, Minute), E/W (the datum specified by user)
6: GPS Accuracy information
0: No positioning or invalid data,
1: GPS positioning, 2: Differential GPS positioning
7: Number of satellites for positioning(up to 9 satellites data)
8: HDOP
9,10: Antenna height above mean sea level (m) (the datum specified by user)
11,12:Geoidal height (m)
13: DGPS data correction lapsed time (second), 00 when non DGPS positioning.
14: DGPS Reference Station No., 0000 when non DGPS positioning.

4.4 High Resolution GGA - Position Data (75 byte)

The same information of the above 4.3 GGA is given, but output resolution of Latitude and Longitude is expanded to 1/100000 from 1/1000.
However, position accuracy depends on its receiver specifications.

```
$GPGGA,hhmmss,1111.11111,a,yyyyy.yyyyy,a,x,x,xx,uxxxx,M,uxxx,M,xx,xxxx*hh<CR><LF>
         1        2      3 4           5 6 7 8  9     1011   1213 14
```

Contents of field is the same as the above 4.3.

**** Note ****

High resolution position accuracy depends on its receiver specifications.
Confirm Type and ROM version.

Type	ROM Ver.	position accuracy[min]
CCA-370HZ1	RD0.02	1/1000
CCA-390VZ	RD0.02	1/1000
CCA-391VZ	RD0.02	1/1000
CCA-450JK	RF9.05	1/1000
CCA-450JZ	RF9.04	1/1000
CCA-450JZ1	RF9.04	1/1000
CCA-450JZA	RG7.00	1/1000
CCA-453JZ	RF9.04	1/1000

4.5 VTG - Forward Direction and Ground Speed Data (37 byte)

Information of direction and speed.

$GPVTG,xxx.x,T,,,xxx.x,N,xxx.x,K*hh<CR><LF>
1 2 3 4 5 6

1,2: Forward Direction (degree)
3,4: Speed (knot)
5,6: Speed (km/h)

4.6 RMC - Minimum Specific Data (61 byte)

$GPRMC,hhmmss,f,ddmm,mm,a,dddmm.mm,a,xxx.x,xxx.,xxxxxx,,*hh<CR><LF>
1 2 3 4 5 6 7 8 9

1: UTC (Hour, Minute, Second)
2: Data status A: Valid, V: Invalid
3,4: Latitude (degree, minute), N/S (the datum specified by user)
5,6: Longitude(degree, minute), E/W (the datum specified by user)
7: Speed (knots)
8: Forward Direction (degree)
9: UTC day, month, year

4.7 High Resolution RMC - Minimum Specific Data (67 byte)

The same information of the above 4.6 RMC is given, but output resolution of Latitude and Longitude is expanded to 1/100000 from 1/100.
However, position accuracy depends on its receiver specifications.

$GPRMC,hhmmss,f,1111.11111,a,yyyyy.yyyyy,a,xxx.x,xxx.,xxxxxx,,*hh<CR><LF>
1 2 3 4 5 6 7 8 9

Contents of field is the same as the above 4.6.

** Note **
High resolution position accuracy depends on its receiver specifications.
Confirm Type and ROM version.

Type	ROM Ver.	position accuracy[min]	Remarks
CCA-370HZ1	RD0.02	1/100	
CCA-390VZ	RD0.02	1/100	
CCA-391VZ	RD0.02	1/100	
CCA-450JK	RF9.05	1/10000	
CCA-450JZ	RF9.04	1/100	It will be renewed to RF9.05 in December, 2001.
CCA-450JZ1	RF9.04	1/100	It will be renewed to RF9.05 in December, 2001.
CCA-450JZA	RG7.00	1/100	
CCA-453JZ	RF9.04	1/100	It will be renewed to RF9.05 in December, 2001.

4.8 GLL - Geographic Time & Position Data (44 byte)

```
$GPGLL,ddmm.mm,a,dddmm.mm,a,hhmmss.ss,A*hh<CR><LF>
        1     2 3        4 5         6
```

1,2: Latitude (degree, minute), N/S
3,4: Longitude(degree, minute), E/W
5: UTC (hour, minute, second)
6: Status A=Valid V=Invalid

4.9 High Resolution GLL - Geographic Time & Position (50 byte)

The same information of the above 4.8 GLL is given, but output resolution of Latitude and Longitude is expanded to 1/100000 from 1/100.
However, output resolution depends on its receiver specifications.

```
$GPGLL,1111.11111,a,yyyyy.yyyyy,a,hhmmss.ss,A*hh<CR><LF>
        1        2 3           4 5         6
```

Contents of field is the same as the above 4.8.

**** Note ****

High resolution position accuracy depends on its receiver specifications.
Confirm Type and ROM version.

Type	ROM Ver.	Position accuracy[min]
CCA-370HZ1	RD0.02	1/100
CCA-390VZ	RD0.02	1/100
CCA-391VZ	RD0.02	1/100
CCA-450JK	RF9.05	1/100
CCA-450JZ	RF9.04	1/100
CCA-450JZ1	RF9.04	1/100
CCA-450JZA	RG7.00	1/100
CCA-453JZ	RF9.04	1/100

4.10 GSA - DOP and Visible Satellites Data (66 byte)

```
$GPGSA,a,x,xx,xx,xx,xx,xx,xx,xx,xx,xx,xx,xx,xx,xx.x,xx.x,xx.x*hh<CR><LF>
       1 2 3  4  5  6  7  8  9  10 11 12 13 14 15   16   17
```

1: Positioning mode M = Manual (2 or 3 dimension). A = AUTO
2: Positioning Calculation Mode
1 = not positioning, 2 = 2 dimension, 3 = 3 dimension
3~14: Satellite PRN No. ("00" for no satellite in case of less than 12 satellites)
15: PDOP
16: HDOP
17: VDOP

4.11 GSV - Visible Satellites Data (70 byte)

Visible satellites data such as PRN, elevation angle, direction angle and SNR is available.

```
$GPGSV,x,x,xx,xx,xx,xxx,xx,xx,xx,xxx,xx,xx,xx,xxx,xx,xx,xx,xxx,xx*hh<CR><LF>
       1 2 3  4  5  6   7  8  9  10  11 12 13 14  15 16 17 18  19
```

1: Total of GSV message (1 ~ 3)
2: Serial number of GSV message (1 ~ 3)
3: Number of visible satellites
4: PRN No. of 1st satellite (01 ~ 32)
5: Elevation angle of 1st satellite (00 ~ 90 degree)
6: Direction angle of 1st satellite (000 ~ 359 degree)
7: SNR signal strength C/No of 1st satellite (00 ~ 99 dB)
8 ~ 11: Data of 2nd satellite (same order as 4 ~ 7)
12 ~ 15: Data of 3rd satellite (same order as 4 ~ 7)
16 ~ 19: Data of 4th satellite (same order as 4 ~ 7)

* "00" and "000" for no satellite in case of less than 4 satellites.
  In case of more than 5 satellites, 2 sentences are employed and in case of more than 9 satellites, 3 sentences are employed.

4.12 PJRCD, GP, 3 - Visible Received Satellite Data (78 byte)

```
$PJRCD,GP,3,xx,x,xx,x,xx,x,xx,x,xx,x,xx,x,xx,x,xx,x,xx,x,xx,x,xx,x,x*hh<CR><LF>
           1  2 3  4 5  6 7  8 9  1011 121314 1516 1718 1920 212223 2425
```

1: PRN No. of 1st satellite
2: Receiving Status of 1st satellite (*1)
...
...
23: PRN No. of 12th satellite
24: Receiving Status of 12th satellite (*1)
"00" and "0" for no satellite in case of less than 12 satellites.
25: DGPS Reference Station Status
7 = under suspended
6 = not monitored
5 ~ 0 = reserved

*1 Receiving Satellite Status
0: Visible Satellite, but out of searching (due to 8 channel receiver)
1: Searching
2: Tracking completion
3: Data demodulation completion
4: Used for positioning

4.13 PJRCD,GP,4 - Receiver Specific Data (25 byte)

Software version of programmed ROM is given.

```
$PJRCD,GP,4,cccccccc*hh<CR><LF>
            1
```

1: Letter and number indicating ROM version. (ex. RF9.05)

ADDENDUM 1. Bytes of output sentence data

(1) The setup value of the output data designation and data length

Set Val	Output Sentence	Byte	Note
0	[GGA]+[VTG]+[RMC]+[GLL]	213	
1	[GGA]+[VTG]+[RMC]+[GLL]+[GSA]+[PJRCD,GP,3]	357	
2	[GSA]+[GSV]+[PJRCD,GP,3]	354	Max
3	[RMC]+[GSA]+[GSV]+[PJRCD,GP,3]	415	Max
4	[High Resolution GGA]+[VTG]+[High Resolution RMC]+[High Resolution GLL]	229	
5	[High Resolution GGA]+[VTG]+[High Resolution RMC]+[High Resolution GLL]+[GSA]+[PJRCD,GP,3]	373	
6	[High Resolution RMC]+[GSA]+[GSV]+[PJRCD,GP,3]	421	Max
9	[PJRCD,GP,4]	25	

(2)Each Sentence Data Length

Sentence	Byte
GGA	71
High Resolution GGA	75
VTG	37
RMC	61
High Resolution RMC	67
GLL	44
High Resolution GLL	50
GSA	66
GSV	70
PJRCD,GP,3	78
PJRCD,GP,4	25