25.Appendix E: Serial Data Output

Any of SkyView's five RS232 serial ports can be configured to output various types of serial data via SETUP MENU > SYSTEM SETUP > SERIAL PORT SETUP. Technical information on the installation and connection to the serial ports can be found in the Serial Devices section of the SkyView Installation Guide. To output serial data, you must select either DYNON EMS, ADAHRS, DYNON SYSTEM, DYNON ADAHRS + SYSTEM, DYNON ADAHRS + EMS, or DYNON ADAHRS + SYS + EMS, NMEA OUT (BASIC), or NMEA OUT (FULL) as a Serial Out device, select a baud rate, and connect the serial port to an external serial device such as a PC. The serial data can be logged using any standard serial terminal program, a data logger program, or dedicated data logger device. All numbers are output in decimal except where noted and are standard ASCII. To view the data using a terminal program, that program should be configured to receive data in the following format:

- Baud rate: Set baud rate to match the baud rate selected on SkyView's serial port
- Data: 8 bit
- Parity: none
- Stop: 1 bit
- Flow control: none

Multiple SkyView display systems: SkyView's serial ports are designed in a way that allows serial transmission to continue, uninterrupted, as long as at least one SkyView display is operational. SkyView accomplishes this by transmitting from only one display's serial ports in a multi-display system. SkyView manages which display is the "actual transmitter" automatically to avoid serial port conflicts. However, the display that transmits is not user-selectable. Therefore, for reliable serial reception in multi-display systems, a SkyView serial data output wire must be wired from each display, in parallel, to the external serial device that is being used to capture SkyView's serial data.

DYNON ADAHRS Serial Data Format

The following section details the format of DYNON ADAHRS serial output data:

Position	Width	Name	Description
1	1	Start Character/Data Type	'!'
2	1	Data Type	1 = ADAHRS data. Other Dynon Avionics formats look similar, and may be interleaved. This bit tells you what kind of data will follow.
3	1	Data Version	Currently 1. This is the version of the data represented below and will change if there is a future version that changes data. Has not changed to date.
4	8	System Time	HHMMSSFF, current Zulu time according to SkyView's internal clock which is synchronized with GPS time if GPS is available. HH is the hour from 00 to 23. MM is the minute from 00 to 59. SS is the second from 00 to 59. HHMMSS are '--------' if GPS time has never been available. FF is the 1/16-second fraction counter from 00 to 15, and may skip digits if baud rate is too low to send data at 16Hz.
12	4	Pitch (deg)	+/- then 000 to 900, pitch up or down from level flight in degrees * 10 (900 = 90°), positive meaning the aircraft is pitched up. XXXX when not available.
16	5	Roll (deg)	+/- then 0000 to 1800, roll left or right from level flight in degrees * 10 (1800 = 180°), positive meaning the aircraft is banked right. XXXXX when not available.
21	3	Magnetic Heading (deg)	000 to 359 in degrees. XXX when not available.
24	4	Indicated Airspeed (knots)	0000 to 9999, indicated airspeed in units of knots * 10 (1234 = 123.4 knots). XXXX when not available.
28	6	Pressure Altitude (ft.)	+/- then 00000 to 99999, altitude in units of feet, at a baro setting of 29.92" Hg, positive meaning altitude is above sea-level. XXXXXX when not available.

Position	Width	Name	Description
34	4	Turn Rate (deg/s)	+/- then 000 to 999, rate of yaw change in degrees/second * 10, positive meaning the aircraft is turning right. XXXX when not available.
38	3	Lateral Accel (g)	+/- then 00 to 99, lateral g's in units of g * 100 (99 = 0.99 g's), positive meaning the aircraft is experiencing leftward lateral acceleration (slip / skid ball is deflected to the right). XXX when not available.
41	3	Vertical Accel(g)	+/- then 00 to 99, vertical g's in units of g * 10 (99 = 9.9 g's), positive meaning the aircraft is experiencing upward vertical acceleration. XXX when not available.
44	2	Angle of Attack (%)	00 to 99, percentage of critical angle of attack. XX when not available.
46	4	Vertical Speed (ft./min)	+/- then 000 to 999, feet/minute / 10 (42 = 420 feet per minute), positive meaning the aircraft is climbing. XXX when not available.
50	3	OAT (deg C)	+/- then 00 to 99. Outside Air Temperature in Degrees C. XXX when not available.
53	4	True Airspeed (knots)	0000 to 9999, true airspeed in units of knots * 10 (1234 = 123.4 knots). XXXX when not available.
57	3	Barometer Setting (inHg)	000 to 400. Baro setting in inHg * 100, offset by 27.50 inHg. Total range is 27.50 inHg to 31.50 inHg. (242 = 29.92 inHg). XXX when not available.
60	6	Density Altitude (ft.)	+/- then 00000 to 99999, altitude in units of feet, positive meaning altitude is above sea-level. XXXXXX when not available.
66	3	Wind Direction (deg)	000 to 359. Wind direction in degrees magnetic. XXX if unknown.
69	2	Wind Speed (knots)	00 to 99. Wind Speed in Knots. XX if unknown.
71	2	Checksum	The 1 byte sum of all 70 preceding bytes. In ascii-hexformat, so 3A = 0x3A
73	2	CR/LF	Carriage Return, Linefeed = 0x0D, 0x0A.

Table 126 – SkyView ADAHRS Serial Data Output Format

As an example, the following is one line of DYNON ADAHRS serial output data:

!1121144703-014+00003310811+01736+003-03+1013-033+110831245+01650023176C

DYNON SYSTEM Serial Data Format

The following section details the format of DYNON SYSTEM serial output data:

Position	Width	Name	Description
1	1	Start Character	'!'
2	1	Data Type	2 = System Info. Other Dynon Avionics formats look similar, and may be interleaved, this bit indicates what kind of data will follow.
3	1	Data Version	Currently 2. This is the version of the data represented below and will change if there is a future version that changes data. Data version changed at SkyView Software v5.1.
4	8	System Time	HHMMSSFF, current Zulu time according to SkyView's internal clock which is synchronized with GPS time if GPS is available. HH is the hour from 00 to 23. MM is the minute from 00 to 59. SS is the second from 00 to 59. HHMMSS are '--------' if GPS time has never been available. FF is the 1/16-second fraction counter from 00 to 15, and may skip digits if baud rate is too low to send data at 16Hz.
12	3	Heading Bug (deg)	000 to 359 in degrees. XXX if heading bug is not displayed.
15	5	Altitude Bug (ft.)	+/- then 0000 to 9999, altitude in units of tens of feet (1234 = 12,340 ft.). XXXXX if altitude bug is not displayed.
20	4	Airspeed Bug (knots)	0000 to 9999, airspeed in units of knots * 10 (1234 = 123.4 knots). XXXX if airspeed bug is not displayed.
24	4	Vertical Speed Bug (ft./min)	+/- then 000 to 999, tens of feet/minute. (123 = 1230 ft./min), positive meaning climb. XXXX if vertical speed bug is not displayed.
28	3	Course (deg)	000 to 359 in degrees.
31	1	CDI Source Type	0-2. 0=GPS, 1=NAV, 2=LOC.
32	1	CDI Source Port	0-5. GPSX, NAVX, or LOCX.
33	2	CDI Scale (NM)	00-50. In tenths of NM, 50 = 5.0 NM. Output 'XX' when not in GPS mode as there is no scale in NAV or LOC
35	3	CDI Deflection (%)	+/- then 00 to 99 percent of deflection, + meaning deflected to right, 'XXX' w/o valid CDI.

Position	Width	Name	Description
38	3	Glideslope (%)	+/- then 00 to 99 percent of deflection, + meaning deflected upward, 'XXX' w/o valid GS.
41	1	AP Engaged	0-7. 0=Off, 1= roll only, 2=pitch only, 3= roll+pitch, 4=yaw, 5=roll+yaw, 6=pitch+yaw, 7=pitch+roll+yaw (yaw doesn't currently exist, but format supports it). Will read 0 all the time if no AP is installed.
42	1	AP Roll Mode	0-4. 0=Heading, 1=Track, 2=NAV, 3=GPS Steering. Always reads zero when AP roll not engaged.
43	1	UNUSED	Reserved for future usage. Always reads 'X'. Parsers should not read this value.
44	1	AP Pitch Mode	0. 0=Altitude. Always reads zero when AP pitch not engaged.
45	1	UNUSED	Reserved for future usage. Always reads 'X'. Parsers should not read this value.
46	3	AP Roll Force	+/- then 00 to 80. Raw force number from servo, + meaning that a force is being exerted in the right-wing-downward direction against the servo. 80 is theoretical maximum before slipping. Always reads zero when AP roll not engaged.
49	5	AP Roll Position (steps)	+/- then 0000 to 9999. Position of servo output shaft relative to that at power-on, in steps, + meaning in the right-wing-downward direction. 800 steps represent a full rotation of the output shaft. Outputs "XXXXX" when not available.
54	1	AP Roll Slip (bool)	0 or 1. 0 = No slipping on this servo. 1 = At least one slip on this servo in the last 3 seconds. Always reads zero when AP roll not engaged.
55	3	AP Pitch Force	+/- then 00 to 80. Raw force number from servo, + meaning that a force is being exerted in the nose-upward direction against the servo. 80 is theoretical maximum before slipping. Always reads zero when AP pitch not engaged.
58	5	AP Pitch Position (steps)	+/- then 0000 to 9999. Position of servo output shaft relative to that at power-on, in steps, + meaning in the nose-upward direction. 800 steps represent a full rotation of the output shaft. Outputs "XXXXX" when not available.

Position	Width	Name	Description
63	1	AP Pitch Slip (bool)	0 or 1. 0 = No slipping on this servo. 1 = At least one slip on this servo in the last 3 seconds. Always reads zero when AP pitch not engaged.
64	3	AP Yaw Force	+/- then 00 to 80. Raw force number from servo, + meaning that a force is being exerted in the rightward direction against the servo. 80 is theoretical maximum before slipping. Always reads zero when AP yaw not engaged.
67	5	AP Yaw Position	+/- then 0000 to 9999. Position of servo output shaft relative to that at power-on, in steps, + meaning in the rightward direction. 800 steps represent a full rotation of the output shaft. Outputs “XXXXX” when not available.
72	1	AP Yaw Slip (bool)	0 or 1. 0 = No slipping on this servo. 1 = At least one slip on this servo in the last 3 seconds. Always reads zero when AP yaw not engaged.
73	1	Transponder Status	0-3. 0=SBY, 1= GND, 2=ON, 3=ALT.
74	1	Transponder Reply (bool)	0 or 1. 0 = No reply in last second, 1 = at least one reply within last second.
75	1	Transponder Identing (bool)	0 or 1. 0 = not IDENT’ing, 1 = IDENT active, as reported by Transponder.
76	4	Transponder Code (octal)	0000-7777
80	10	UNUSED	Reserved for future usage. Always reads ‘XXXXXXXXXX’. Parsers should not read this value.
90	2	Checksum	The 1 byte sum of all 73 preceding bytes. In 25-6sci-hexformat, so 3A = 0x3A
92	2	CR/LF	Carriage Return, Linefeed = 0x0D, 0x0A.

Table 127 – SkyView SYSTEM Serial Data Output Format

Note 1: Yaw axis AP does not exist at this time, but the serial output format supports it.

As an example, the following is one line of DYNON SYSTEM serial output data:

!2221144704359XXXXX1600+010XXX00XXXXXXXX00X0X+00-
99990+00+99990+00XXXXX00104543XXXXXXXXXX3A

DYNON EMS Serial Data Format

The following section details the format of EMS data output to the serial port:

Position	Width	Name	Pin	Description
1	1	Start Character		'!'
2	1	Data Type		3 = EMS Data. Other Dynon Avionics formats look similar, and may be interleaved, this bit indicates what kind of data will follow.
3	1	Data Version		Currently 2. This is the version of the data represented below and will change if there is a future version that changes data. Data version changed at SkyView Software v5.1.
4	8	System Time		HHMMSSFF, current Zulu time according to SkyView's internal clock which is synchronized with GPS time if GPS is available. HH is the hour from 00 to 23. MM is the minute from 00 to 59. SS is the second from 00 to 59. HHMMSS are '--------' if GPS time has never been available. FF is the 1/16-second fraction counter from 00 to 15, and may skip digits if baud rate is too low to send data at 16Hz.
12	3	Oil Pressure (PSI)	Varies (see note 1)	000 to 999 or XXX. Oil pressure in PSI. There must be a pressure sensor named "OIL" for this to work. See note 2.
15	4	Oil Temp (deg C)	Varies (see note 1)	+/- then 000 to 999 or XXX. Oil temperature in C. There must be a temperature sensor named "OIL" for this to work. See note 2.
19	4	RPM L	C37 P32/34	0 to 9999. RPM from Left input.
23	4	RPM R	C37 P33/35	0 to 9999. RPM from Right input.
27	3	Manifold Pressure (inHg)	C37 P26	0 to 600. Manifold Pressure in 0.1 inHg. 299 = 29.9 inHg. There must be a pressure sensor named "MAP" for this to work. See note 2.
30	3	Fuel Flow 1 (gal/hr.)	C37 P14	000 to 999. Fuel flow in 1/10th Gallons Per Hour. 086 = 8.6 GPH. See note 2.
33	3	Fuel Flow 2 (gal/hr.)	C37 P19	000 to 999. Fuel flow in 1/10th Gallons Per Hour. 086 = 8.6 GPH. This is usually return flow. See note 2.

Position	Width	Name	Pin	Description
36	3	Fuel Pressure (PSI)	Varies	000 to 999 or XXX. Fuel pressure in 1/10th PSI. 274 = 27.4 PSI. There must be a pressure sensor named "FUEL" for this to work. See note 2.
39	3	Fuel Level L (gal)	Varies	000 to 999 or XXX. Fuel level in 1/10th Gallons. 128 = 12.8 Gallons. There must be a Level sensor named "LEFT" for this to work. If there is no "LEFT" OR "RIGHT" but there is a "MAIN", this will be MAIN. See note 2.
42	3	Fuel Level R (gal)	Varies	000 to 999 or XXX. Fuel level in 1/10th Gallons. 128 = 12.8 Gallons. There must be a Level sensor named "RIGHT" for this to work. See note 2.
45	3	Fuel Remaining (gal)	Fuel Computer	000 to 999 or XXX. Fuel level in 1/10th Gallons. This is derived from the fuel computer and is based on the fuel on board added set by the user and the decremented by fuel flow. See note 2.
48	3	Volts 1	C37 P1	000 to 360 in 1/10th Volts. 284 = 28.4 volts. See note 2.
51	3	Volts 2	C37 P2	000 to 360 in 1/10th Volts. 284 = 28.4 volts. See note 2.
54	4	Amps	C37 P24/25	+/- then 000 to 999. 1/10th Amps. -083 = -8.3A. See note 2.
58	5	Hobbs Time	Calculated	00000 to 99999. In 1/10 hours. 12345 = 1234.5 hours.
63	5	Tach Time	Calculated	00000 to 99999. In 1/10 hours. 12345 = 1234.5 hours.
68	4	Thermocouple 1 (deg C)	C25 P2/14	+/- then 000 to 999. In degrees C. See note 2.
72	4	Thermocouple 2 (deg C)	C25 P3/15	+/- then 000 to 999. In degrees C. See note 2.
76	4	Thermocouple 3 (deg C)	C25 P4/16	+/- then 000 to 999. In degrees C. See note 2.
80	4	Thermocouple 4 (deg C)	C25 P5/17	+/- then 000 to 999. In degrees C. See note 2.
84	4	Thermocouple 5 (deg C)	C25 P6/18	+/- then 000 to 999. In degrees C. See note 2.
88	4	Thermocouple 6 (deg C)	C25 P7/19	+/- then 000 to 999. In degrees C. See note 2.

Position	Width	Name	Pin	Description
92	4	Thermocouple 7 (deg C)	C25 P8/20	+/- then 000 to 999. In degrees C. See note 2.
96	4	Thermocouple 8 (deg C)	C25 P9/21	+/- then 000 to 999. In degrees C. See note 2.
100	4	Thermocouple 9 (deg C)	C25 P10/22	+/- then 000 to 999. In degrees C. See note 2.
104	4	Thermocouple 10 (deg C)	C25 P11/23	+/- then 000 to 999. In degrees C. See note 2.
108	4	Thermocouple 11 (deg C)	C25 P12/24	+/- then 000 to 999. In degrees C. See note 2.
112	4	Thermocouple 12 (deg C)	C25 P13/25	+/- then 000 to 999. In degrees C. See note 2.
116	4	Thermocouple 13 (deg C)	C37 P27/28	+/- then 000 to 999. In degrees C. See note 2.
120	4	Thermocouple 14 (deg C)	C37 P36/37	+/- then 000 to 999. In degrees C. See note 2.
124	6	GP Input 1	C37 P4	+/- then 0000 to 9999, then units. See notes. Example: +1234C = 123.4 degrees C.
130	6	GP Input 2	C37 P22	+/- then 0000 to 9999, then units. +YYYYZ. See note 3.
136	6	GP Input 3	C37 P23	+/- then 0000 to 9999, then units. +YYYYZ. See note 3.
142	6	GP Input 4	C37 P8	+/- then 0000 to 9999, then units. +YYYYZ. See note 3.
148	6	GP Input 5	C37 P9	+/- then 0000 to 9999, then units. +YYYYZ. See note 3.
154	6	GP Input 6	C37 P10	+/- then 0000 to 9999, then units. +YYYYZ. See note 3.
160	6	GP Input 7	C37 P11	+/- then 0000 to 9999, then units. +YYYYZ. See note 3.
166	6	GP Input 8	C37 P12	+/- then 0000 to 9999, then units. +YYYYZ. See note 3.
172	6	GP Input 9	C37 P20	+/- then 0000 to 9999, then units. +YYYYZ. See note 3.
178	6	GP Input 10	C37 P21	+/- then 0000 to 9999, then units. +YYYYZ. See note 3.

Position	Width	Name	Pin	Description
184	6	GP Input 11	C37 P6	+/- then 0000 to 9999, then units. +YYYYZ. See note 3.
190	6	GP Input 12	C37 P7	+/- then 0000 to 9999, then units. +YYYYZ. See note 3.
196	6	GP Input 13	C37 P31	+/- then 0000 to 9999, then units. +YYYYZ. See note 3.
202	16	Contacts	Not used in SkyView	Z*16 (ZZZZZZZZZZZZZZZZ).
218	3	Percent Power		000 to 199 in percentage of engine reference power. XXX when not determined or invalid.
221	1	EGT Leaning State		The state of EGT leaning. L: Lean of peak, P: Peak, R: Rich of peak. X when not determined or invalid.
222	2	Checksum		The 1 byte sum of all 217 preceding bytes. In 25-10sci-hexformat, so 3A = 0x3A.
224	2	CR/LF		Carriage Return, Linefeed = 0x0D, 0x0A.

Table 128 – SkyView EMS Serial Output Format

Note 1: These sensors can be connected to various pins on the EMS D37M connector. See the SkyView Installation Guide for more information.

Note 2: If the value is invalid, or out of range for the sensor, or the sensor is not configured, or if the sensor is configured but not calibrated, then an 'X' is output for each character in the field instead of a value.

Note 3: Units for each GP input depends on the type of sensor that is connected to the pin. See GP Inputs

Rotax 912 iS Note: When the engine type is 912iS, the following fields in the serial output source their data from the 912 iS' computer instead of conventional sensors: Oil Pressure, Oil Temp, RPM L, RPM R, Manifold Pressure, Fuel Flow 1, Fuel Flow 2 (always 0).

GP Inputs

The output for GP input pins is:

- Each output is in the format +YYYYZ
  - o + is the +/- sign for the value
  - o YYYY is the value of the signal
  - o Z is the units for the signal
    - C if the signal is in temperature, and the units are 1/10th degrees C
      - YYYY is 1/10th degrees C, so 1234 = 123.4 C
      - XXXX if the signal is out of range (red X on ems page)

        - ZZZZ if the input is not configured
    - P if the signal is in pressure, and the units are 1/10 PSI
        - YYYY is 1/10th PSI, so 0123 = 12.3 PSI
        - XXXX if the signal is out of range (red X on ems page)
        - ZZZZ if the input is not configured
    - G if the signal is in volume, and the units are 1/10th Gallons
        - YYYY is 1/10th gallons, so 0183 = 18.3 Gallons
        - XXXX if the signal is out of range or not calibrated (red X on ems page)
        - ZZZZ if the input is not configured
    - V if the signal is in volts (contact input)
        - YYYY is 1/100th volts, so 3852 = 38.52V
        - ZZZZ if the input is not configured
    - T if the signal is position
        - If elevator, rudder, and aileron trim, YYYY is percent travel, so 0047 = 47%
        - If flaps, this is the angle shown on the screen, so 0038 = 38 degrees
        - XXXX if the signal is out of range or not calibrated (red X on ems page)
        - ZZZZ if the input is not configured

As an example, the following is one line of DYNON EMS serial output data:

!3221144705060+093236323632720570571642632630002802801200001300020+197+592+197+592+197+592+197+592+197+592+197+197-0012T+0013T+0001T+0164P+1990P+0928C+0001T+0000G+0263G+0263G+0599P+0928C+0928CZZZZZZZZZZZZZZZZZ045L26

DYNON ADAHRS / SYSTEM / EMS Serial Data Output Combinations

DYNON ADAHRS + SYSTEM Serial Data Format

DYNON ADAHRS+SYSTEM output data alternates between DYNON ADAHRS data and DYNON SYSTEM data. For example, the following is one cycle of DYNON ADAHRS+SYSTEM serial output data where the first line is ADAHRS output and the next line is SYSTEM output:

!1121144703-014+00003310811+01736+003-03+1013-033+110831245+01650023176C

!2221144704359XXXXX1600+010XXX00XXXXXXXX00X0X+00-99990+00+99990+00XXXXX00104543XXXXXXXXXX3A

DYNON ADAHRS + EMS Serial Data Format

DYNON ADAHRS+EMS output data alternates between DYNON ADAHRS data and DYNON EMS data. For example, the following is one cycle of DYNON ADAHRS+EMS output data where the first line is ADAHRS output and that is followed by EMS output:

!1121144703-014+00003310811+01736+003-03+1013-033+110831245+01650023176C

!3221144705060+093236323632720570571642632630002802801200001300020+197+592+197+592+197+592+197+592+197+592+197+197-0012T+0013T+0001T+0164P+1990P+0928C+0001T+0000G+0263G+0263G+0599P+0928C+0928CZZZZZZZZZZZZZZZZZ045L26

DYNON ADAHRS + SYS + EMS Serial Data Format

DYNON ADAHRS+SYS+EMS output data alternates between DYNON ADAHRS data, DYNON SYSTEM data, and DYNON EMS data. For example, the following is one cycle of DYNON ADAHRS+SYS+EMS serial output data where the first line is ADAHRS output, the second is SYSTEM output, and that is followed by EMS output:

!1121144703-014+00003310811+01736+003-03+1013-033+110831245+01650023176C

!2221144704359XXXXX1600+010XXX00XXXXXXXX00X0X+00-99990+00+99990+00XXXXX00104543XXXXXXXXXX3A

!3221144705060+093236323632720570571642632630002802801200001300020+197+592+197+592+197+592+197+592+197+592+197+197-0012T+0013T+0001T+0164P+1990P+0928C+0001T+0000G+0263G+0263G+0599P+0928C+0928CZZZZZZZZZZZZZZZZZ045L26

NMEA OUT Serial Data Formats

NMEA output data consists of industry standard NMEA 0183 Version v4.00 sentences. A reference for Version 4.00 of the standard can be found here:

www.nmea.org/content/nmea_standards/nmea_083_v_400.asp

NMEA OUT (BASIC)

NMEA OUT (BASIC) serial output data consists of GGA, GSA, GSV, RMC, and VTG sentences nominally output at a rate of 1 Hz. The rate is reduced if necessary to transmit the entire set of data at the selected baud rate. This format outputs GPS data for position, speed, altitude, and heading.

For example, the following is one cycle of NMEA OUT (BASIC) serial output data:

```
$GPGGA,214921,3121.6199,N,00000.0000,E,1,04,1.90,3000.0,M,33.9,M,,0000
*62
$GPGSA,A,3,01,02,03,04,00,00,00,00,00,00,00,00,1.00,1.90,1.90*07
$GPGSV,1,1,04,01,20,100,10,02,30,200,56,03,45,300,32,04,62,045,05*7A
$GPRMC,214921,A,3121.6199,N,00000.0000,E,82.07,1.00,300811,0.51,W,A*01
$GPVTG,1.00,T,0.51,M,82.07,N,151.99,K,A*1E
```

NMEA OUT (FULL)

NMEA OUT (FULL) data consists of all of the NMEA OUT (BASIC) sentences followed by RMB, GLL, BWC, XTE, BOD, and APB sentences nominally output at a rate of 1 Hz. The rate is reduced if necessary to transmit the entire set of data at the selected baud rate. This format outputs navigation information derived by SkyView, and is similar to the output that many handheld portable aviation GPS navigators generate.

For example, the following is one cycle of NMEA OUT (FULL) serial output data:

```
$GPGGA,221755,3157.4430,N,00000.0000,E,1,04,1.30,3000.0,M,33.9,M,,0000
*66
$GPGSA,A,3,01,02,03,04,00,00,00,00,00,00,00,00,1.00,1.30,1.40*00
$GPGSV,1,1,04,01,20,100,10,02,30,200,56,03,45,300,32,04,62,045,05*7A
$GPRMC,221755,A,3157.4430,N,00000.0000,E,82.07,1.00,300811,0.49,W,A*06
$GPVTG,1.00,T,0.49,M,82.07,N,151.99,K,A*17
$GPRMB,A,9.99,L,FHAW,TUPJ,1826.7333,N,06432.4998,W,999.9,273.6,005.1,V
,A*41
$GPGLL,3157.4430,N,00000.0000,E,221755,A,A*42
$GPBWC,221755,1826.7333,N,06432.4998,W,273.6,T,274.1,M,999.9,N,TUPJ,A*
67
$GPXTE,A,A,9.99,L,N,A*0A
$GPBOD,299.3,T,299.8,M,TUPJ,FHAW*4F
$GPAPB,A,A,9.99,L,N,V,V,299.8,M,TUPJ,274.1,M,274.1,M,A*4E
```