A8000

A8-X & A8-Y

GPS Time & Frequency Reference

OPERATION MANUAL

Contents

1 Safety Considerations

1.1 General

This product and related documentation must be reviewed for familiarisation before operation. If the equipment is used in a manner not specified by the manufacturer, the protection provided by the instrument may be impaired.

1.1.1 Before Applying Power

Verify that the product is set to match the available line voltage and the correct fuse is installed.

1.1.2 Before Cleaning

Disconnect the product from operating power before cleaning.

WARNING

Bodily injury or death may result from failure to heed a warning. Do not proceed beyond a warning until the indicated conditions are fully understood and met.

CAUTION

Damage to equipment, or incorrect measurement data, may result from failure to heed a caution. Do not proceed beyond a caution until the indicated conditions are fully understood and met.

1.1.3 This equipment must be earthed

An uninterruptible safety earth ground must be maintained from the mains power source to the product's ground circuitry.

WARNING

When measuring power line signals, be extremely careful and use a step down isolation transformer whose output is compatible with the input measurement capabilities of this product. The product's front and rear panels are typically at earth ground. Thus, never try to measure AC power line signals without an isolation transformer.

WARNING

Instructions for adjustments when covers are removed and for servicing are for use by service-trained personnel only. To avoid dangerous electrical shock, do not perform such adjustments or servicing unless qualified to do so.

WARNING

Any interruption of the protective grounding conductor (inside or outside the instrument) or disconnecting of the protective earth terminal will cause a potential shock hazard that could result in personal injury. Grounding one conductor of a two conductor out-let is not sufficient protection.

Whenever it is likely that the protection has been impaired, the instrument must be made inoperative and be secured against any unintended operation.

If the instrument is to be energised via an autotransformer (for voltage reduction) make sure the common terminal is connected to the earthed pole terminal (neutral) of the power source.

Instructions for adjustments while the covers are removed and for servicing are for use by service-trained personnel only. To avoid dangerous electrical shock, do not perform such adjustments or servicing unless qualified to do so.

For continued protections against fire, replace the line fuse(s) with fuses of the same current rating and type (for example, normal blow time delay). Do not use repaired fuses of short-circuited fuse holders.

1.2 Voltage, Frequency and Power Characteristics

Voltage 90 - 240V AC

Frequency 40 - 60Hz

Power characteristics 500mA Max

1.3 Environmental Conditions

1.3.1 Temperature

Operating (ambient)	-10°C to +55°C
Storage	-40°C to +85°C

1.3.2 Magnetic Field

Sensitivity	$\leq 2 \times 10^{-11}$/ Gauss
Atmospheric Pressure	-60m to 4000m
	$< 1 \times 10^{-13}$/ mbar

1.4 Replaceable Fusing Characteristics

800mA time lag HBC

1.5 Cleaning Instructions

To ensure long and trouble free operation, keep the unit free from dust and use care with liquids around the unit.

Be careful not to spill liquids onto the unit. If the unit does get wet, turn the power off immediately and let the unit dry completely before turning it on again.

Clean with a damp (with water) cloth.

Never spray cleaner directly onto the unit or let liquid run into any part of it. Never use harsh or caustic products to clean the unit.

1.6 Outdoor Antenna Mounting

The antenna needs as complete as possible a view of the whole of the sky which is >5 ° above the horizon. If part of the sky is obscured, the total time during which insufficient satellites are visible (normally an insignificantly small percentage of the time) will increase. If the horizon is raised to 30-40° then the number of visible satellites will drop to <4 quite often, significantly lengthening the time required for an accurate position to be obtained. A raised horizon will also worsen the geometry of the constellation, detracting from the accuracy in ways that can be difficult to accurately predict. It can also worsen the time taken for the unit to lock

Please ensure that all antenna connections are sealed with self-amalgamating tape.

2 GPS Time & Frequency Standard A8000

2.1 Description

Description

2.1.1 Applications

- Standards Labs; calibration of counters, timers, radio equipment and all quartz based instrumentation
- Telecoms synchronisation; Stratum I & IGSM, PCN base station commissioning
- Timescale correction to UTC, use with software clocks Time transfer Radio transmitter frequency referencing including quasi-sync systems.

2.2 Technology

Technology

2.2.1 Outputs: -

- Square wave 2.5V into 50Ω:
- (TTL compatible, 50% duty cycle) -10 MHz
- Sine wave 12dBm into 50Ω:
- 1pps 80% duty cycle (2.5V into 50Ω):

2.2.2 Special options (all models)

- Square (TTL compatible) or sinusoidal (+12dBm into 50Ω): 2.048MHz & 13MHz
- Square wave only 16kHz, 1kHz
- Serial interface
- Multiple (6x) sinusoidal outputs (internal distribution amplifier)

2.3 Power Supply Requirements

90-260v AC, 47-440 Hz or 12v DC, 8-10W typical

2.4 Physical Sizes:

- Rack Mounting: - 19" x 1U (44.5mm) x 220mm deep (excl connectors)

- Antenna: - Diameter 78mm Height 66mm

Quartzlock policy is of continuous product improvement and whilst the above specifications are correct at the time of going to press, they may be changed without prior notice.

3 Getting Started

3.1 Mounting the antenna

The antenna needs as complete as possible a view of the whole of the sky which is >5 ° above the horizon. If part of the sky is obscured, the total time during which insufficient satellites are visible (normally an insignificantly small percentage of the time) will increase. If the horizon is raised to 30-40° then the number of visible satellites will drop to <4 quite often, significantly lengthening the time required for an accurate position to be obtained. A raised horizon will also worsen the geometry of the constellation, detracting from the accuracy in ways that can be difficult to accurately predict. It can also worsen the time taken for the unit to lock. Please ensure that all external connections are sealed with self-amalgamating tape.

3.2 Connecting the unit

Connect the antenna to the TNC socket on the rear panel of the Model A8000.

Connect the Model A8000 to a suitable mains power source and switch on. Check that the display is illuminated and that no fault warnings are displayed after a few minutes.

Check that the Front Panel LED is illuminated.

On initial start up the front panel LED will be amber indicating that the unit is in an unlocked state, once the unit has found sufficient satellites and the output is controlled the LED will change to green.

3.3 Initial start up

NOTE: - If the antenna position is moved by more than a couple of meters then in order for the correct functioning of the system an Auto Survey must be initiated.

On initial installation or moving of the antenna position of more than a few metres the unit needs to complete a survey of its current position. To initiate this the 'Auto Survey' button needs to be pressed or the command GPS:POS:SURV:STAT ONCE sent via the RS232.

The initial survey takes approximately three hours however this can be up to twelve hours with poor antenna positioning. The auto survey time can be shortened by manually entering the current location via the RS232 or prematurely stopping Auto Survey however this is not recommended as this as it will reduce accuracy. Auto survey is active as long as the "lock" LED blinks at 1/2Hz (Desk Top Unit Only) or AS is present in the Time Display Screen. Auto Survey mode can be

queried with the “GPS?” command. “Survey State 1” will indicate Auto Survey to be active.

Once the unit has completed Auto Survey and locked the time to lock will be approximately 20 minutes.

Once the unit has locked, the receiver requires very little additional attention unless a fault is encountered.

3.3.1 RS232 INTERFACE

The unit is controlled via the Serial port at 9600 | 19200 | 38400 | 57600 | 115200 baud, 8, N, 1, but this only works if the LCD display shows "SCPI Mode". The RS-232 receiver is disabled outside of the "SCPI" display page. Swap through the pages by pressing the Display switch on the rear panel. The Desktop Unit is permanently set into SCPI mode.

A list of the commands are shown in remote signalling section of this manual or displayed by typing in HELP?

The unit can be configured to output the GPGGA NMEA String. This string is only output after the initial 12 minute warm time.

3.4 Display screens

3.4.1 Main Screen

This initially displays the current time in the units memory which is maintained via an internal battery. Once satellites have been found then the GPS/UTC time is shown.

The Date and Time are shown on line 1 and the number of satellites in view and the instrument status are shown on line 2.

2	7	J	u	l	0	7		0	3	:	4	6	:	0	5
S	A	T	:		9				S	t	a	t	:	O	K

Unit locked to GPS

2	7	J	u	l	0	7		0	3	:	4	6	:	0	5
S	A	T	:		9				S	t	a	t	:	A	S

Unit in **A**uto **S**urvey Mode

2	7	J	u	l	0	7		0	3	:	4	6	:	0	5
S	A	T	:		9				S	t	a	t	:	U	L

Unit has been locked but now **U**n**L**ocked

2	7	J	u	l	0	7		0	3	:	4	6	:	0	5
S	A	T	:		9				S	t	a	t	:	A	Q

Unit is **A**c**Q**uiring Satellites

3.4.2 Instrument status

3.4.2.1 OK

Instrument is working correctly and has found sufficient satellites to maintain 3-D Position Fix, Frequency error estimate, electronic frequency control, OCXO temperature and voltage are within range.

3.4.2.2 AS

This is the initial start up status to establish the exact position of the instrument after the antenna has been installed or moved.

3.4.2.3 UL

One of the following parameters is outside of the permissible range to ensure guaranteed performance: -

Frequency Error Estimate

Electronic Frequency Control

OCXO Temperature

OCXO Voltage

Insufficient satellites in view

3.4.2.4 AQ

Acquiring satellites this is only displayed if the antenna or cable are disconnected and reconnected to the unit during normal (locked) operation

3.4.3 Electronic Frequency Control

Line 1 displays the Electronic Frequency Control (EFC) output value of the internal reference oscillator as a percentage and line 2 the Frequency Error Estimate

E	F	C	;			1	0	.	3	3	5	5	0	%	
F	E	E	:		-	5	.	7	7	E	-	1	1		

3.4.4 Internal Oven Controlled Crystal Oscillator Status

Line 1 displays the temperature of the sensor next to the OCXO and line 2 shows the Voltage applied to the OCXO (around 10.5V) and the current drawn by the OCXO this will vary in order to maintain a stable temperature inside the OCXO

O	C	X	O		:		4	5	.	2	5	°	C	
1	0	.	4	5	V		0	.	1	5	3	9	7	A

3.4.5 UTC Offset

U	T	C		O	F	F	S	E	T	:				
							-	1	.	7	5	n	s	

3.4.6 GPS Position

This displays the position North (N) South (S) in degrees, minutes and seconds on line 1 and East (E) West (W) in degrees, minutes and seconds on line 2

N		5	0	°	2	5	.	8	5	1	4			
W		3	°	4	1	.	6	5	8	5				

3.4.7 Height

This displays the height in meters in line 1 and if the unit is in Auto survey mode SURV on line 2

H	e	i	g	h	t	:		1	0	3	.	6	8	m

Normal operation

H	e	i	g	h	t	:		1	0	3	.	6	8	m
S	U	R	V											

Auto survey mode

3.4.8 Standard Commands for Programmable Instrumentation SCPI Mode

In order to communicate with the GPS the unit must be displaying this screen. Line 2 displays the current baud rate the unit is configured to communicate via the RS232

S	C	P	I		M	o	d	e						
1	1	5	2	0	0		B	a	u	d				

4 Remote Signalling

The following commands are available to either interrogate or configure the units operation.

The following are Quartzlock specific to tune the GPS and are factory set: -

SERVo:COARSeDac <int> [0,225]
SERVo:EFCScale <float>[0.0 , 500.0]
SERVo:EFCDamping <float>[0.0 , 4000.0]
SERVo:SLOPe <NEG | POS >
SERVo:TEMPCOmpensation <float> [-1000.0, 1000.0]
SERVo:AGINGcompensation <float> [-10.0, 10.0]
SERVo:PHASECOrrection <float> [-100.0, 100.0]
SERVo:1PPSoffset <int> ns
SERVo:QUIet <ON | OFF>
SERVo:TRACe <int > [0,255]

NOTE: - Quartzlock cannot be responsible for the operation of the unit if the above parameters are changed.

The following commands can be used to interrogate the unit: -

SYNChronisation:HOLDover:DURation?

This query returns the duration of the present or most recent period of operation in the holdover and holdover processes. This is the length of time the reference oscillator was not locked to GPS. The time units are seconds. Response The first number in the response is the holdover duration. The duration units are seconds, and the resolution is 1 second. If the Receiver is in holdover, the response quantifies the current holdover duration. If the Receiver is not in holdover, the response quantifies the

previous holdover. The second number in the response identifies the holdover state. A value of 0 indicates the Receiver is not in holdover; a value of 1 indicates the Receiver is in holdover.

SYNChronisation**:TINT**erval

This query returns the difference or timing shift between the Fury 1 PPS and the GPS 1 PPS signals. Resolution is 1E-10 seconds.

SYNChronisation**:IMME**diate

Initiates a near-instantaneous alignment of theGPS 1 PPS and Receiver output 1 PPS if the command is issued during recovery from holdover.

SYNChronisation**:FEE**stimate**?**

This query returns the Frequency Error Estimate

DIAGnostic**:ROSC**illator**:EFC**ontrol**:REL**ative**?**

This query returns the Electronic Frequency Control (EFC) output value of the internal reference oscillator. It returns a percentage value. Response Range is -100% to +100%.

DIAGnostic**:ROSC**illator**:EFC**ontrol**:ABS**olute**?**

DIAGnostic**:ROSC**illator**:LIF**etime**:COUN**t**?**

GPS:INITial**:DATE** <yyyy:mm:dd>

Used to set the GPS receivers initial date at start up

GPS:INITial**:TIME** <hour:min:sec>

Used to set the GPS receivers initial time at start up

GPS:INITial**:POS**ition <N|S>,<deg,min,sec>,<E|W>,<deg,min,sec>,<height in meters>

Set initial position. This command sets an approximate position for faster initial GPS acquisition. Following power up, the Receiver refines its position from the satellite data. This process occurs automatically. This command is most effective when the retained position differs significantly from the Receiver s true position.

GPS:REFerence**:ADEL**ay <float> <s | ns >

Sets the GPS antenna delay value in seconds.

GPS:REFerence**:ADEL**ay**?**

Returns the GPS antenna delay value in seconds.

GPS:REFerence**:TRAIM** <ON | OFF>

GPS:REFerence**:TRAIM:RSVID**s**?**
32 bit field to indicate which SVIDs were removed by TRAIM.

GPS:REFerence**:PUL**se**:SAW**tooth**?**
Negative saw tooth time error of next 1 PPS coming from the GPS receiver (-128, +127 ns)

GPS:REFerence**:PUL**se**:ACC**uracy**?**
Time solution 1 sigma accuracy estimate.

GPS:REFerence**:PUL**se**?**
Pulse status (0 or 1)

GPS:GPGGA <int> [0,255]
Turn on/off the NMEA Global Positioning System Fix Data output string

GPS:GPGGA?
NMEA Output String Status 0 = Off or 1 – 255 = seconds between output strings

GPS:SATellite**:TRAC**king**:EMAN**gle <int> [0,89]
Sets the GPS elevation mask angle value.

GPS:SATellite**:TRAC**king**:EMAN**gle**?**
Returns the GPS elevation mask angle value.

GPS:SATellite**:TRAC**king**:COUNT?**
Returns a list of all satellites being tracked.

GPS:SATellite**:VIS**ible**:PRED**icted**:COUNT?**
Returns the number of satellites (PRN) that the almanac predicts should be visible, given date, time, and position.

GPS:POSition **SURV**ey**?**
Returns the Auto Survey Status (1 = Auto Survey Active)

GPS:POSition **HOLDSURV**ey
Prematurely stop the Auto Survey (not recommended as this reduces accuracy).

GPS:POSition **LAST**
LAST denotes the last specified position. This parameter is provided to cancel surveying (automatic position computation) and restore the last position setting.

GPS:POSition **LAST?**
This query returns the last position-hold setting, which is restored when the GPS:POSition LAST command is sent.

GPS:POSition <N|S>,<deg,min,sec>,<E|W>,<deg,min,sec>,<height in meters>

GPS:POSition**:SURV**ey**:STAT**e **ONCE**
Set the GPS Receiver in Auto-Survey

GPS:POSition**:HOLD:LAST?**

MEASure**:TEMP**erature
This query returns the temperature of the sensor located next to the OCXO

MEASure**:VOLT**age
This query returns the voltage applied to the OCXO (around 10.5 V)

MEASure**:CURR**ent
This query returns the current drawn by the OCXO. This current varies in order to keep a stable temperature inside the OCXO.

PTIMe**:TZON**e <hour,min> [-12,12],[0,59]
Sets the time zone local time offset to provide an offset from UTC to serve as the basis for all reported time.

PTIMe**:TZON**e**?**
Returns the local time zone offset in hours and minutes.

PTIMe**:DATE?**
This query returns the current calendar date. The local calendar date is always referenced to UTC time, offset by any local time zone value that has been provided by the user. The year, month, and day are returned. The three fields are separated by commas: <year>,<month>,<day>. " The <year> range is 1994 to 2077. " The <month> range is 1 to 12. " The <day> range is 1 to 31.

PTIMe**:TIME?**
This query returns the current 24-hour time. The local time is always referenced to UTC time, offset by any local time zone value that has been provided by the user. The hour, minute, and second is returned. The three fields are separated by commas: <hour>,<minute>,<second>. "The <hour> range is 0 to 23. " The <minute> range is 0 to 59. " The <second> range is 0 to 60. The value of 60 only occurs as the UTC leap second.

PTIMe**:TIME:STR**ing**?**
This query returns the current 24-hour time suitable for display (for example, 14:22:34).

PTIMe**:LEAP**second**:PEND**ing**?**
This query identifies if a leap second is pending. This query looks ahead to indicate a pending leap second. A value of 0 indicates no leap second is pending. A value of 1 indicates a leap second is pending. The leap second

adjustment can be either the addition of a second or the subtraction of a second.

PTIMe:LEAPsecond**:ACC**umulated**?**

Returns the leap second difference accumulated between GPS time and UTC time since the beginning of GPS time. The time units are seconds.

PTIMe:LEAPsecond**:DATE?**

Returns the date of the future the leap second (usually UTC June 30 or UTC December 31)

PTIMe:LEAPsecond**:DUR**ation**?**

This query identifies whether a leap second is pending, distinguishes between leap seconds which extend the minute, and leap seconds which shorten the minute. This query returns the duration of the minute corrected by the next leap second. The duration units are seconds. Returns a value of 59, 60 or 61: " A value of 59 indicates subtraction of 1 second is pending. " A value of 60 indicates no leap second pending. " A value of 61 indicates addition of 1 second is pending. Returns the duration of the minute corrected by the next leap second. ± dd

PTIMe:TINTerval**?**

SYSTem**:COMM**unicate**:SER**ial**:ECHO** <ON | OFF>

Enable echo on RS-232

SYSTem**:COMM**unicate**:SER**ial**:PRO**mpt <ON | OFF>

Enable SCPI prompt

SYSTem**:COMM**unicate**:SER**ial**:BAUD** <9600 | 19200 | 38400 | 57600 | 115200>

Setup RS-232 serial speed The serial configuration is always 8 bit , 1 stop bit, no parity, no hardware control

SYSTem**:STAT**us?

Displays the current status of the unit as shown below

```
AQUISITION .....................................................
Tracking: 5      Not Tracking: 2
PRN  El  Az   SS   PRN  El  Az
 5  58 239   45    22  19 263
 9  63 101   48    30  39 238
12  79 224   48
14  35 308   38
17  14  37   33

                              UTC     15:01:01   6 Aug 2007
                              LAT     N  50:25:51.060
                              LON     W   3:41:39.519
ELEV MASK 10 deg   ANTENNA DELAY   0 ns     HGT    101.24 m (GPS)
HEALTH MONITOR.....................................................
GPS Selftest: OK       OCXO Voltage: OK       EFC: OK
GPS Receiver Status: Position Hold
GPSDO Status: Locked
```

SYSTem:**FACT**oryReset **ONCE**

HELP?

5 Specification

Description	Specification	
Outputs		
Sine wave Output Frequency	10 MHz +7 dBm ±2 dBm	
Square wave Output	10 MHz	
Square wave Output	1 PPS	
Phase Noise Response (typical for standard OXCO)		
1 Hz offset	-90 dBc /Hz	(-92 dBc /Hz)
10 Hz Offset	-120 dBc /Hz	(-123 dBc /Hz)
100 Hz Offset	-140 dBc /Hz	(-143 dBc /Hz)
1 kHz Offset	-150 dBc /Hz	(-157 dBc /Hz)
10 kHz Offset	-157 dBc /Hz	(-162 dBc /Hz)
100 kHz Offset	-157 dBc /Hz	(-162 dBc /Hz)
Allan Variance when locked to GPS Satellites (typical)		
1s	$< 1 \times 10^{-11}$	
10s	$< 8 \times 10^{-12}$	
100s	$< 3 \times 10^{-11}$	
1 week	$< 7 \times 10^{-13}$	
Output Drift when NOT Locked to GPS Satellites (Holdover)		
Drift due to aging	$< 5 \times 10^{-9}$ per day	
Drift due to temperature	$< 5 \times 10^{-8}$	

GPS Receiver

Number of Channels	12 parallel
Frequency	1575.42 MHz
Acquisition Time	< 50s typical
Positioning Accuracy	< 25m
Jamming Immunity	-79 dBm @ 1575.42 MHz
Antenna	Active micro strip patch
Datum	WGS-84

Miscellaneous

Operating Temperature	0°C to +40°C
Storage Temperature	-20°C to +60°C

6 GLOSSARY

Terms, acronyms and unusual words as used in this handbook

ADC Analogue to Digital Converter (used in the model 8 to read the analogue outputs of the sine and cosine carrier detectors).

Almanac Orbital Information broadcast by all Navstar satellites and stored locally by a GPS receiver to enable rapid location after power application.

Antenna Cable

Antenna Obscuration Obstruction between antenna and (part of) sky, sufficient to hinder satellite reception from that part of the sky.

Apparent GPS Time calculated realisation of GPS time and subject to errors, particularly SA, atmospheric aberrations and position used.

Azimuth Direction of observed satellite relative to true North from position of receiver.

Baud Rate Transmission rate of data and signalling overheads via aerial link expressed in bits per second.

Constellation Group of satellites either currently observable by a receiver or currently included in the system; dependent on context.

Control Time Constant integration time of negative feedback applied to local reference oscillator.

DAC Digital to Analogue Converter (used in the model 8 to steer the frequency of the local reference oscillator under micro-processor control).

Delay Nominal difference between UTC and time as signalled by the 1pps output of the receiver.

DGPS	Differential GPS; GPS with enhanced accuracy due to separate reception of pseudorange corrections determined nearby.
Doppler	Shift observed shift in frequency (in this context; of a radio carrier) caused by relative movement between transmitter and receiver.
Elevation	Angle of a particular satellite above the horizontal as observed from the antenna.
Ellipsoid	Simple solid as an approximation to the shape of Earth, used in preference to the geoid to simplify certain calculations.
Ephemerides	Orbital data with limited currency due to high level of precision, may be superseded within one orbital period.
GDOP	Geometrical Dilution Of Precision; increased uncertainty of a position estimate due to non-ideal location of satellites.
Geoid	Approximation of true shape of Earth, closer (although more complex) than simple ellipsoid and very close to mean sea level.
GPS time	Timescale used by the Navstar GPS system; close to UTC but without the leap seconds, which are added to UTC to maintain approximation to sidereal time.
HDOP	Horizontal Dilution Of Precision.
Hexadecimal	Numbering system to base 16 (e.g. 0123456789ABCDEF). Hexadecimal numbers used in this handbook are prefixed with a "$" symbol to avoid ambiguity.
IF	Intermediate Frequency (used within a radio receiver)
LED	Light Emitting Diode; primarily used as front panel indicator(s) and display illumination.
NMEA	National Maritime Engineering Association
OCXO	Oven Controlled X (Crystal) Oscillator, sometimes referred to as temperature controlled; used as a considerably more stable alternative to a quartz crystal at ambient temperature.
PLL	Phase Locked Loop; method of controlling an oscillator to have a fixed phase (or frequency) relationship to another.
Position averaging	Calculation of an average of a number of separate position estimates intended to remove certain types of error.

PRN	Pseudo-Random Noise/Number (sequence); used by the satellites to distinguish the signals and to provide part of the timing signal.
RMS	Root Mean Square; means of expressing time-averaged energy content of varying signal, noise or error.
Rubidium	Chemical element with certain advantageous properties for use in an atomic clock.
Selective Availability (SA)	Deliberate errors imposed on the signals from the satellites to deny the full accuracy of the system to unauthorised users Sub-horizontal below the horizon; coined in this handbook to describe satellites, which the stored almanac suggests, should be below the horizon.
SV	Space Vehicle (satellite); in the constellation of Navstar GPS satellites.
TTFF	Time To First Fix; the time between switching a receiver on and it making its first position estimate (for which four satellites are needed).
UPS	Uninterruptible Power Supply; power supply usually incorporating rechargeable batteries to mitigate the effects of mains power failures.
URA	User Range Accuracy; reasonable estimate of time and position (pseudo range) accuracy broadcast by and relating to each satellite.
UTC	Universal Co-ordinated Time (internationally agreed and maintained) referred to GPS time by USNO.
WGS84	World Geodetic System 1984; internationally agreed datum and co- ordinate system used by GPS system.