



# Wi-Fi Terminus NT-220LT Terminal

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**JANUS** REMOTE  
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## 1 DESCRIPTION

### 1.1 Introduction

The Wi-Fi Terminus NT-220LT (Wi-Fi Terminus) combines GPS technology with Wi-Fi transport. Incorporating sister company, NavSync's CW20 module with ultra sensitive GPS receiver, the NT220-LT provides an 802.11b/g transmission containing NMEA streams giving device location (longitude and latitude) and UTC time. The 802.11b/g supports WPA2 encryption and is fully configurable to a specific network.

### 1.2 Global Positioning System (GPS)

The Global Positioning System (GPS) is a military satellite based navigation system developed by the U.S. Department of Defense and made freely available to civil users. Civilian use of GPS is available at the user's own risk, subject to the prevailing DOD policy or limitations, and to individuals understanding of how to use the GPS.

In today's satellite constellation there are a minimum of 24 operational satellites (plus several operational spares) in 6 orbital planes, at an altitude of approximately 22,000 km. The GPS system can give accurate 3-D position, velocity, time, and frequency, 24 hours a day, anywhere in the world. GPS satellites transmit a code for timing purposes, and also a 'navigation message' that includes their exact orbital location and system integrity data. Receivers use this information, together with data from their internal almanacs, to establish the precise satellite location. The receiver determines position by measuring the time taken for these signals to arrive. At least three satellites are required to determine latitude and longitude if the altitude is known (e.g. a ship at sea), and at least a fourth to obtain a 3-D fix.

### 1.3 GPS Positioning and Navigation

The Wi-Fi Terminus needs to be able to see at least 4 satellite vehicles (SV's) to obtain an accurate 3-D position fix. When traveling in a valley or built-up area, or under heavy tree cover, the Wi-Fi Terminus may experience difficulty acquiring and maintaining a coherent satellite lock. Complete satellite lock may be lost, or only enough satellites (3) tracked to be able to compute a 2-D position fix, or even a poor 3D fix due to insufficient satellite geometry (i.e. poor DOP). Note, inside a building or beneath a bridge, it probably will not be possible to update a position fix. The receiver can operate in 2-D mode if it goes down to seeing only 3 satellites by assuming its height remains constant. But this assumption can lead to errors, especially when a change in height does occur. A 2-D position fix is not to be considered a good or accurate fix – it is simply a "better than nothing" fix.

The receiver's antenna must have a clear view of the sky to acquire satellite lock. It is the location of the antenna which will be given as the position fix. The antenna is located under the Wi-Fi Terminus label and should face upwards for best signal reception. If the antenna faces downwards, it may not be possible to successfully track any satellites. Mounting the Wi-Fi Terminus in a vertical position is also acceptable, but the antenna may not be able to receive the satellite signals from those satellites out of line-of-sight from the front of the enclosure, making this a less than ideal position. Please also note that any obstructions (dense foliage, tall buildings) can obstruct the line-of-sight to the satellites and make tracking more difficult.

To measure the range from the satellite to the receiver, two criteria are required: signal transmission time and signal reception time. All GPS satellites have several atomic clocks to keep precise time. These are used to time-tag the message (i.e. code the transmission time onto the signal) and to control the transmission sequence of the coded signal. The receiver has an internal clock to precisely identify the arrival time of the signal. Transit speed of the signal is a known constant (the speed of light), therefore:  $\text{time} \times \text{speed of light} = \text{distance}$ .

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## 1 DESCRIPTION continued

### 1.3 GPS Positioning and Navigation continued

Once the receiver calculates the range to a satellite, it knows that it lies somewhere on an imaginary sphere with a radius equal to this range. If a second satellite is then found, a second sphere can again be calculated from this range information. The receiver now knows it lies somewhere on the circle of points produced by the intersection of these two spheres. When a third satellite is detected and a range determined, a third sphere intersects the area formed by the other two. This intersection occurs at just two points. The correct point is apparent to the user, who has a rough idea of position. A fourth satellite is then used to synchronize the receiver clock to the satellite clocks. In practice, 4 satellite measurements are sufficient for the receiver to determine a position, as one of the two points will be totally unreasonable (possibly many kilometers out into space).

This assumes the satellite and receiver timing to be identical. In reality, when the Wi-Fi Terminus compares the incoming signal with its own internal copy of the code and clock, the two will no longer be synchronized. Timing error in the satellite clocks, the Receiver, and other anomalies, means the measurement of the signals transit time is in error. This effectively is a constant for all satellites, since each measurement is made simultaneously on parallel tracking channels. Because of this, the resultant ranges calculated are known as “pseudo-ranges”.

To overcome these errors, the Wi-Fi Terminus matches or “skews” its own code to become synchronous with the satellite signal. This is repeated for all satellites in turn, thus measuring the relative transit times of individual signals. By accurately knowing all satellite positions, and measuring the signal transit times, the user’s position can be accurately determined. Utilizing its considerable processing power, the Wi-Fi Terminus rapidly updates these calculations from satellite data to provide a real time position fix.

The following DOP terms are computed by the Wi-Fi Terminus:

**HDOP** Horizontal Dilution of Precision (Latitude, Longitude)

**VDOP** Vertical Dilution of Precision (Height)

**PDOP** Position Dilution of Precision (3-D positioning)

**Estimated accuracy** = DOP x measurement accuracy

While each of these terms can be individually computed, they are formed from covariances and are not independent of each other. Horizontal accuracy figure of 95% is the equivalent to 2RMS (twice root-mean-square) or twice the standard deviation radial error. Similarly, for vertical and time errors, a figure of 95% is the value of 2 standard-deviations of vertical or time error.

- Root-mean-square (RMS) error is the value of one standard deviation (67%) of error.
- Circular Error Probability (CEP) is the value of the radius of a circle, centered at a position containing 50% of the position estimates.
- Spherical Error Probability (SEP) is the spherical equivalent of CEP, which is centered at a position containing 50% of the position estimates.

CEP and SEP are not affected by large errors, which could make the values an overly optimistic measurement. These probability statistics are not suitable for use in a high accuracy positioning system. The Wi-Fi Terminus reports all accuracies in the form of a standard deviation (RMS) value.

## 1 DESCRIPTION continued

### 1.4 Operation

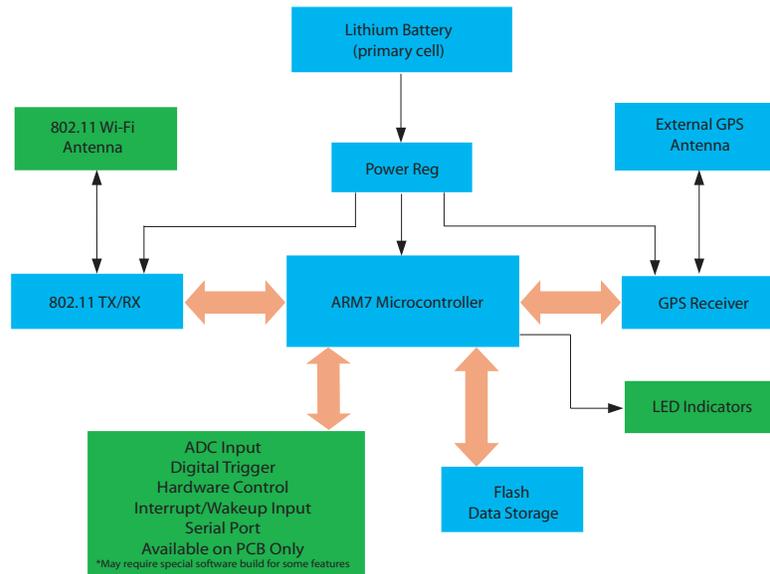


Figure 1 Wi-Fi Terminus NT-220LT Block Diagram

The default 802.11 network settings of the NT-220LT are as follows:

Topology: Infrastructure Mode

Source IP: 192.168.1.3

Source Port: Varies

Channel: 6

Network SSID: CW85\_Setup (higher priority) or LTRX\_IBSS (lower priority)

Data Rate: 1 Mbps

WPA2 Security Passphrase: GSDemo123

*Note: The unit will also transmit on a network with security disabled even though the phrase is configured.*

Packet type: UDP

Destination IP: 192.168.1.2

Destination Port: 9999

Upon power up, the Wi-Fi Terminus will scan for 802.11b/g networks and attempt to associate with the configured SSIDs. During this time, the GPS receiver is turned on and the Wi-Fi Terminus will attempt to obtain a valid GPS fix. Once the GPS receiver is turned on, Power LED will blink once per second indicating that the Wi-Fi Terminus unit is fully operational.

*Note: The Power LED blinks with each GPS update, which is 1s by default. Changing the GPS fix rate will change the Power LED blink rate. The Status LED will give an indication of network status and GPS status as indicated in Table 1.*

## 1 DESCRIPTION continued

### 1.4 Operation continued

#### Status LED

Condition	Status LED
No network detected and no GPS fix	OFF
Network detected but no GPS fix	Blinks once every 2.5 seconds
No network detected but GPS fix	Blinks once every 5 seconds
Network detected and GPS fix	Blinks once every 0.5 seconds

Table 1: Status LED

As soon as the Wi-Fi Terminus associates with the network it will try to resolve the destination IP. Once this has been accomplished, the Wi-Fi Terminus will begin sending UDP packets to the destination IP. Data from the GPS receiver is saved to flash memory until the destination IP is resolved. This default behavior may be changed by the user via SNMP (Simple Network Management Protocol) – see Section 3 – Device Configuration.

The NT-220LT becomes active at intervals. These intervals are configured via SNMP command:

NTAPPINTERVAL (OID .1.3.6.1.4.1.28295.99.1.2.1.10.5).

This default value is 10 minutes. This means that every 10 minutes, the NT-220LT will become active and attempt to associate with the network and acquire a GPS fix. If a unit is unable to associate with a network in the first (approximately) 15 seconds of an active period, it will stop trying to associate until the beginning of the next active period in order to preserve power.

During this active period, the unit is attempting to obtain a GPS fix. Once it has a fix, it sends it out (if associated with a network) or saves it to flash memory and returns to standby mode until the next activation period. The start of a new activation period is a cold-start for the on-board GPS receiver, which means it does not have recent GPS ephemeris, almanac, or time information.

To enable the longest possible battery life, no battery backup is provided for GPS information from the previous fix. Due to this, the accuracy of the first GPS fix can vary greatly. To improve the quality of the GPS fix, the unit needs to wait until sufficient satellites are in view and updated ephemeris is obtained. The time this can require can be up to 10 minutes, although generally it is much quicker. To help each user configure the necessary performance for their application, variables have been provided, accessible via SNMP, to help control the criteria for a “good” GPS fix. Please see Appendix 2 for more information on using these configurable parameters. Once a “good” fix has been obtained, the NT-220LT goes into standby mode until the expiry of the timer.

*Note: The accuracy numbers quoted in the specifications section assume that the unit has valid ephemeris and almanac information.*

The operation of the Wi-Fi Terminus unit is highly user configurable. Not only can the network settings be configured via the SNMP interface, but the operational parameters can be changed. Appendix 1 lists the parameters that are configurable, as well as their default values. By default, the device will send out all of the NMEA sentences via UDP. However, individual sentences can be turned off, and the rate at which these sentences can be sent out can vary (see Section 1.6). Additionally, the user can choose to send out packets via TCP/IP instead of UDP/IP for both the current GPS data, and for the logged data in flash memory.

Changes to the connection type (TCP/UDP) will not take effect until the device is either restarted or the next activation period following the change. Changes to the TCP port or destination IP will also take effect after the device is either restarted or the next activation period. Alternatively, because UDP is a ‘connectionless’ protocol, any changes to the port or destination IP will take effect on the next transmission. Additionally, changes to most of the other network settings require a restart to take effect. This allows the user to fully configure the device before those changes take effect.

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## 1 DESCRIPTION continued

### 1.4 Operation continued

The Wi-Fi Terminus will check for association prior to sending out NMEA sentences at the configured transmission rate. With each activation period, the device will try to associate with one of the configured networks for about 15 seconds. If unsuccessful, it will not attempt to associate until the next active period. This is done for power conservation. There are three different SSIDs that the unit can be configured to scan, each one with its own channel. These networks can be used for either Infrastructure mode or Ad Hoc mode (*Note: to utilize Ad Hoc mode for normal situations, do not use the Security options that can be set per SSID.*) Available security options in Infrastructure mode are NONE, WEP64, WEP128, WPA, or WPA2-PSK. In Ad Hoc mode, only the WEP or open security options are available. Each SSID can support all of these security options, or a subset. This is selectable through the SNMP interface. By default, all security options are supported. It is recommended to enable only those security options that are necessary to enable the most secure operation. It is important to note that although different security options may be enabled for each SSID, only one security type for each SSID is expected to be used at any one time and it is not intended that the Wi-Fi Terminus switch between these security options during operation. The Wi-Fi Terminus needs to have its power cycled if the security type is changed on the network. Failure to do so can lead to undefined operation.

The Wi-Fi Terminus utilizes flash memory for saving the NMEA streams in case the unit is unable to transfer the data. This can occur if a network is not present, if the unit is unable to associate with the network, or if there is a TCP socket problem (if TCP has been set as the default for transmission). The user can control how often the messages are saved to flash memory. For example, the unit can be configured to transmit every 10 minutes, while at the same time the unit may only save to flash memory every sixth period (every hour) to maintain the longest history possible in memory. Once the Wi-Fi Terminus unit has re-associated with the network (or with TCP, has re-established the socket connection), it will send out the contents of its flash memory, starting with the oldest data and ending with the newest. The memory will be erased once the entire contents has been successfully transmitted. As long as the Wi-Fi Terminus is able to detect that it is on the network, it will continue its normal operation of sending out the selected NMEA streams at the selected rate.

If the Wi-Fi Terminus is configured for TCP rather than UDP communications, any socket error on the TCP connection causes the data to be saved to flash memory. If the socket connection is closed, it will attempt to restart it.

Additional functionality has been built into the Wi-Fi Terminus to enhance the data logging feature. There are commands to save all data, even if there is no network issue. The rate at which the data is saved is controlled in the same way as when it is saving only unsuccessful transmissions. A command to force a log dump over the configured IP/Port is available in this mode, as well as a command to erase the entire log. Because the data is saving continuously to the flash memory, a dump of the flash memory will not occur automatically. The user must tell the unit to dump its memory. As the log becomes full, the oldest data is erased and overwritten with the newest data. If the device is powered down with data in its memory, it will recover the beginning and end of the lost data when it is powered on again. New data will be saved in a continuous fashion right after the newest data in memory. If no data is in memory when the dump command is given, an internal flag in volatile RAM will remain set until the first data bytes are stored in memory. The unit will then attempt to send out this data. Since this is a volatile flag, it will not remain set following a power cycle, but is preserved during standby.

After a data log is sent out, the ASCII characters "log complete" will be sent out at the end of the transmission, signaling that all of the data has been retrieved from memory. At that point, the flash memory is given the command to erase the data log. Erases are done in the spare time of the system, and a full log erase can take up to 2 minutes, although typical time is about 1 minute. New data will still be saved to memory during the log erase. If a unit is powered off during the erase cycle, it will not continue to erase on the next power up. Instead, the new data being stored into the flash will be appended to whatever data remained in memory. If the NT-220LT has started the memory erase, it will finish the erase before entering standby mode.

When a Wi-Fi Terminus is associated with a network, there are many options that can be used to control how and when data will be sent. These include:

NTGPSUPDATERATE (OID .1.3.6.1.4.1.28295.99.1.2.1.16.5)

This specifies the rate at which the GPS data will be sent.

NTNUMSEND (OID .1.3.6.1.4.1.28295.99.1.2.1.23.5)

This will configure the device to repeat each transmission the specified number of times.

Other options can be used to control the transmission of data based upon the availability and quality of the GPS fix. For more information, see Appendix 2.

---

## 1 DESCRIPTION continued

### 1.5 Safe Mode

The Wi-Fi Terminus has been configured with a Safe Mode. If the unit cannot associate with any of the three configured SSIDs, or it loses its association and cannot re-associate, it will enter a mode that will search for the Ad Hoc network Wi-Fi Terminus\_ADHOC on channel 11, with no security. In this mode, the IP address of the device changes to 192.168.1.50 and it searches for an SNMP manager at 192.168.1.51. It will search for approximately 25-30 seconds, after which time it will go back to its normal search for the three configured SSIDs. *This behavior will only be displayed once per power on, not once per activation period.*

Safe Mode has been implemented for situations where a Wi-Fi Terminus may have been configured incorrectly and no network connection can be established. The recommended method for entering this mode is to power the device off, and turn off any of the networks it is configured to associate with. Then start the Wi-Fi Terminus\_ADHOC network, using the IP 192.168.1.51 and turn the Wi-Fi Terminus on. Once the Wi-Fi Terminus sees the Ad Hoc network, configuration via SNMP is available. If the NT-220LT has associated with an Ad Hoc network and goes into standby mode, when it activates it will no longer have the IP/SNMP manager of 192.168.1.50/192.168.1.51. Rather it will maintain the Ad Hoc connection settings (NT\_ADHOC, Channel 11) but search for the configured SNMP manager and use its configured IP. Due to this, the unit SHOULD be configured during a single active period and should be power cycled following the correct configuration. It is STRONGLY recommended to increase the activation interval time and the GPS Safety Timeout right after entering this mode, then cycling the power, and then configuring the unit after again associating with the Ad Hoc network. Please allow plenty of time to change all necessary parameters before the unit enters standby. Please note, this mode occurs during the normal operational mode, so the device is still obtaining GPS data during this time. If the Wi-Fi Terminus is able to resolve the destination IP, it will attempt to send packets.

The Wi-Fi Terminus also supports a setting for returning to its original factory configuration. This command will reset the device to the defaults in Appendix 1. However, the MAC address **will be reset** to the value 00 50 C2 9B A0 00. The MAC address **must** be reset to its initial value (written on the label on the backside of the unit) after using this command. Failure to do so may result in an unusable unit. After receiving the command to reset the MAC address, the Wi-Fi Terminus should have the power cycled.

### 1.6 Special Considerations when Modifying GPS Update Rate/Messages

NTGPSUPDATERATE - (OID .1.3.6.1.4.1.28295.99.1.2.1.16.5)

Changes to this take effect when the internal counters controlling each GPS message reach 0. For example, if the message rate is 100 seconds, and then changed to 10, the Wi-Fi Terminus waits until the 100 second period is up before the 10 second period takes effect. Also note, all messages that are to be enabled should be occurring at a common interval prior to changing this rate or changing them may result in different GPS messages reporting at different epochs.

NTFLASHUPDATERATE - (OID .1.3.6.1.4.1.28295.99.1.2.1.19.5)

Changes to this take effect when the internal counters controlling the GPS save rate reach 0. If the data transmission rate is set to 3, and this rate is set to 1, then data will save every 3 seconds if the network is not detected. If the data transmission rate is set to 3, and this is set to 2, then this would save every 6 seconds if the network is not detected.

NTMSGENABLE - (OID .1.3.6.1.4.1.28295.99.1.2.1.21.5)

This OID controls which GPS messages are enabled. The bit map of the binary representation of the number configured is as follows:

Bit 0 - GPGGA, Bit 1 - GPGLL, Bit 2 - GPGSA, Bit 3 - GPGSV, Bit 4 - GPRMC, Bit 5 - GPZDA, Bit 6 - GPVTG

For example: 127 is 0111 1111b, which enables all messages (the default) 3 is 0000 0011b, which enables GPGGA and GPGLL

Note that if the current transmission rate is not 1 second intervals, then messages that are newly enabled could be on a different epoch than previously enabled messages. The recommended method of changing the messages is to set the transmission rate to 1 second, enable the required messages, wait until all messages are appearing on 1 second intervals together, and then change the data rate to the desired number. At least one of the enabled sentences must have the FS (fix status) or Status fields in order for the Wi-Fi Terminus to indicate fix status appropriately. The GPGSV, GPZDA, and GPVTG sentences do not have an FS or a Status field. Thus, these should be enabled in conjunction with the GPGGA, GPGLL, GPGSA, or GPRMC for appropriate fix indicator operation.

Failure to follow the above can result in messages being sent that are not from the same epoch, as each message runs on its own counter and updating the interval does not update the counter for a message until that counter = 0. The GPGSV sentence (enabled by default) does not transmit prior to having satellite data, and thus the counter for that message is not active until it has data. If the message rate is changed before the GPGSV sentence is sent, it is possible for the GPGSV sentence(s) to be out of sync with the rest of the sentences when they do begin. This is a condition that could occur on a power cycle if the message rate is other than 1 second and the GPGSV sentence is enabled. If this occurs, the message rate should be set back to 1 second until all messages are on the same epoch, and then the new message rate can be changed.

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## 1 DESCRIPTION continued

### 1.7 Diagnostic Messages

NTTESTVAR - (OID .1.3.6.1.4.1.28295.99.1.2.1.11.5)

A diagnostic message containing the received signal strength (RSSI) and battery level (VBAT) is available to be sent out on command. Each time a value is written to NTTESTVAR, a NMEA message will be sent in the following form:

<MAC ADDRESS>,\$PNVTC, RSSI, VBAT\*<checksum>

This VBAT value is not the actual battery voltage at the battery, but a value as measured on board the ARM processor. Currently, this number corresponds to the levels where the unit goes into 'forever standby' mode. These limits may vary based on the specific hardware. Please refer to GSNBATTERYWARNINGLEVEL, GSNBATTERYSTANDBYLEVEL and GSNBATTERYFIRSTBOOTSTANDBYLEVEL in Appendix 1.

If a value is written to the NTTESTVAR, the GPS receiver will also send out a string with software version information over the wireless connection AND perform a cold start. This sentence may be delayed for a second or more after the PNVTC sentence.

### 1.8 SNMP Traps

The Wi-Fi Terminus unit is designed to send out three different types of SNMP traps, which are unsolicited messages from the intrinsic SNMP agent. The traps are sent to port 162 from port 161 (default values). The community name for these messages is GSN\_TRAP (see Section 3 for more information on SNMP).

The first type of trap is a linkup trap. This is a message designed to help maintain a network connection when used with the standby mode of operation. Because some access points will force a station to re-join if a sufficient period of inactivity has elapsed, this trap sends brief messages to help make sure the NT-220LT stays associated, even during long periods of standby. This rate can be configured and should be set to be shorter than the inactivity interval of the AP. It can be turned off if it is not necessary using GSNTRAPLINKUPINTNEWTMR - (OID .1.3.6.1.4.1.28295.1.1.4.14.0.)

The second type of trap is a configuration trap. When the unit is in standby, this interval controls how often the unit will activate to check for updates from the SNMP manager. Reducing the frequency of this message is possible using GSNTRAPCONFIGINTNEWTMR - (OID .1.3.6.1.4.1.28295.1.1.4.13.0). Setting the value of this to 0 disables traps, and also disables the ability to configure most SNMP variables. The SNMP message for setting the config trap frequency does work even if this rate is 0.

The third type of trap is a low battery warning trap. This trap is designed to warn the system that the battery will soon reach an unsafe level, causing a system shutdown. The levels are set to start sending warning messages at least 30 minutes prior to the unit going into shutdown mode. Shutdown mode will occur when the battery voltage reaches an unsafe level to prevent any memory corruption issues from a brown-out condition during transmission. The values for this limit are factory calibrated, but are user accessible at GSNBATTERYWARNINGLEVEL - (OID .1.3.6.1.4.1.28295.1.1.1.8.0) and GSNBATTERYSTANDBYLEVEL - (OID .1.3.6.1.4.1.28295.1.1.1.9.0). Any user is strongly advised AGAINST changing these levels without first contacting the factory. Changing these levels can result in an unusable device.

### 1.9 Key Features of the Wi-Fi Terminus

- Sensitive GPS Receiver with Tracking as Low as -150dBm
- 802.11b/g Compliant
- WPA2 Encryption
- Integrated Lithium Primary Battery
- User Programmable Update Rates
- Internal Flash Memory for Saving GPS Data

The specifications in the following sections refer to the standard software builds of the Wi-Fi Terminus. The performance and specification of the Wi-Fi Terminus can be modified through the user configuration and additional I/O capabilities may be available with special software builds. Please contact the factory for more details.

Please refer to Section 4 – NMEA Messages for detailed information on the available NMEA messages.

## 2 SPECIFICATIONS

### 2.1 Performance Specifications

Physical		Notes
Module Dimensions (without external antenna)	4.27" (W) x 3.36" (H) x 1.77" (D) 108.50mm (W) x 85.45mm (H) x 45.00mm (D)	
<b>GPS Performance</b>		
GPS Channels	16	
Frequency	1575.42 MHz – L1 C/A Code	
TTFF Cold Start @ -135 dBm	46 seconds	1, 6
Re-Acquisition Time @ -147 dBm	< 3 seconds	2
Acquisition Sensitivity	-147 dBm	4
Tracking Sensitivity	-150 dBm	5
Static Accuracy 50% Confidence (CEP)	2 m	6, 15
95% Confidence (CEP)	4 m	6, 15
Maximum Horizontal Speed	515 m/s	7
Maximum Vertical Speed	15 m/s	8
Maximum Altitude	18 Km	7
Maximum Acceleration (g)	2 g	
GPS Fix Rate Maximum	Once per second	
<b>Wi-Fi Performance</b>		
Maximum Transmit Power	15 dBm	
Frequency Band	2.4GHz ISM	
Transmission Speed	1Mbps default, contact factory for 2Mbps	
Modulation	Direct-Sequence Spread Spectrum (DSSS)	
Protocol	802.11b/g compatible	
Security	802.11i (WPA2-PSK), WPA-PSK, WEP128, WEP649	
AES Encryption/Decryption	Hardware implemented	
Wireless Transmission Period	Default is once per second, user configurable via SNMP	
<b>Data Memory Specifications</b>		
Size	8Mbit / 1Mbyte	
Type	Circular buffer	
Data Retention	20 years	

## 2 SPECIFICATIONS continued

### 2.1 Performance Specifications continued

General Specifications		Notes
Power (Avg.) When Transmitting	~1.1W	
Power When Not Transmitting	<0.5W	10
Standby Mode	<50 uA	11
Internal Lithium Primary Battery	14 AH	
Battery Life (activation interval)	30 days (3 minutes) Over 1 year (1 hour) Over 2 years (1 day)	12
Operating Temperature Range	-30°C to 60°C	13
Storage Temperature Range	-20°C to 45°C	14
Humidity	5% - 95%, Non-Condensing	
<b>Antenna Requirements</b>		
802.11 Antenna	N-type, 6.0 dBi maximum	
GPS Antenna	External Antenna Provided	

The specifications refer to the standard software builds of the NT-220LT. The performance and specification of the NT-220LT can be modified with the use of customized software builds.

Table 2 NT-220LT Specification

Notes:

1. These are RMS values.
2. Maximum sensitivity -147 dBm.
3. Simulator test, all signals at specified power level.
4. Estimated.
5. Simulator test, continuous fix with all signals at specified power level.
6. Open sky. No sky-view obstructions. Accuracy relative to actual surveyed position, not self-relative survey.
7. Limited by International Traffic in Arms Regulation (ITAR).
8. Defined by navigation integrity check.
9. WEP encryption is by key only. Passphrases are supported only for WPA/WPA2 security.
10. 0.5W is for Infrastructure mode, which implements a polling mode to conserve power. Ad Hoc mode current draw is ~0.78W.
11. Available on NT-220LT models ONLY. Does not include self-discharge of the battery itself which is 10% first month, 20% first year.
12. GPS fix within 60 seconds; configuration traps up to 1 hour; 27°C; preliminary estimates.
13. Although the battery will continue to function from -30° to 60°C, the battery lifetime is reduced if temperature is maintained above 45°C for long periods.
14. Exceeding the specifications for storage range will decrease the life and capacity of the lithium battery  
The unit will continue to operate above the storage temperature, but the battery life will be significantly shorter.
15. Based on continuous fix data, with up-to-date ephemeris and almanac, not valid for the first fix. Presented for comparison purposes only.

## 2 Specifications continued

### 2.2 Transmission Distance

Estimation of maximum transmission distance on 802.11b/g signal versus transmission rate:

	Open Plan Building	Semi Open Office	Closed Office
2.0 Mbps	400 m (1300 ft)	90 m (300 ft)	40 m (130 ft)
1.0 Mbps	550 m (1750 ft)	115 m (375 ft)	50 m (165 ft)

The Wi-Fi Terminus transmits at 1.0 Mbps. Contact factory if 2.0 Mbps is desired.

Table 3 Wi-Fi Transmission Distance

The above estimates may not apply to many situations and the typical performance in most situations is probably about 50-60% of the above values. Factors such as antenna polarization, electronic noise, obstructions in line-of-site between device and access point, multipath errors as well as reflections from the ground play an immense role in degrading the signal. These variables can vary tremendously from site to site. The above numbers are maximum estimates based on specific setups. The best way to determine transmission distance in a given environment is to set up a network and take empirical data.

The transmit power and receive sensitivity of the access point plays a role equal to the power/sensitivity of the Wi-Fi Terminus device and therefore must be considered in any calculations for maximum transmit distance. The Friis Transmission Equation may be used to calculate transmission distance in an ideal way, but it does not take into account signal reduction due to electrical noise, multipath errors, obstructions, and antenna polarization mis-match. There is no 'one size fits all' equation for this; often the best way to estimate is to use empirical data.

That being said, the Friis Transmission Equation can be used to estimate the relative change in transmission distance due to modifying parameters such as antenna gain or receiver sensitivity. This information, coupled with empirical data collected from the deployment site, can be used to help determine necessary modifications to a setup to help achieve desired distances. Therefore, the Friis Transmission Equation is given here for reference:  $\frac{P_r}{P_t} = G_t G_r \left( \frac{\lambda}{4 \pi R} \right)^2$ , where  $P_r$  is the power at the receiver antenna,  $P_t$  is the power supplied to the transmitting antenna,  $G_t/G_r$  are the transmitter and receiver antenna gains, respectively, in watts.

Manipulations of this equation give the following form which is more applicable to the information generally available in device datasheets. By substituting for the power and gain (in watts) in the previous paragraph with  $P(W) = 10^{\frac{PdB}{10}}$ , and by front controls and indicators using  $3 \times 10^8$  m/s for the speed of light, we can solve for R, the distance in km:  $R(km) = \frac{10^{(gt + gr + pt - pr)/20}}{41.88 * 2442 \text{ Mhz}}$

Using typical receiver sensitivity at -90 dB, receiver antenna gain of 2 dBi, Wi-Fi Terminus power of 15 dBm, and Wi-Fi Terminus antenna gain at 0 dBi gives over 2 km transmission distance, which is unachievable in anything but a completely ideal situation. However, using the same numbers with a Wi-Fi Terminus 5 dBi antenna shows a distance of over 3.8 km. This indicates that in a given situation, replacing the 0 dBi antenna on the Wi-Fi Terminus with a 5 dBi antenna could give nearly a 2x change in transmission distance.

### 2.3 Mechanical Dimensions

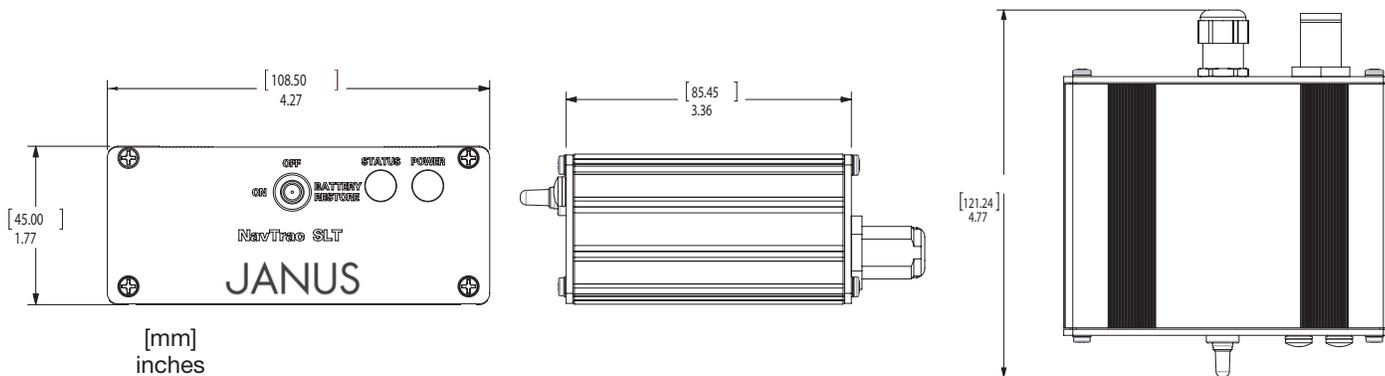


Figure 2 Wi-Fi Terminus NT-220LT Dimensions

## 2 SPECIFICATIONS continued

### 2.4 Front Controls and Indicators

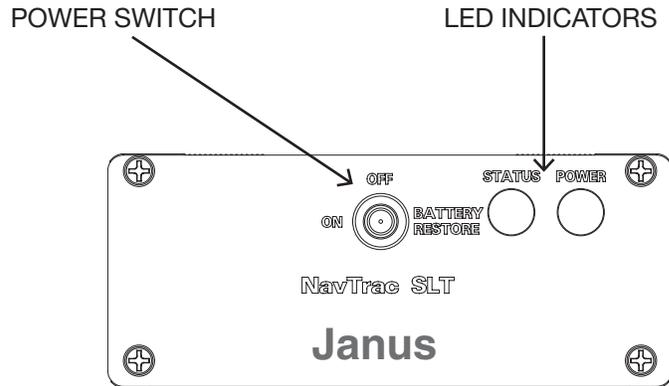


Figure 3 Front Controls and Indicators

### 2.5 Rear Connections

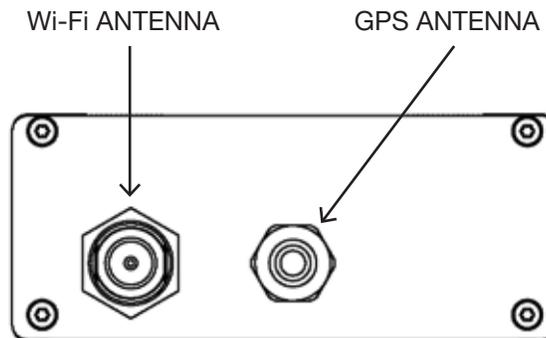


Figure 4 Rear Connections

---

## 3 DEVICE CONFIGURATION via SNMP

### 3.1 General Information

The Wi-Fi Terminus parameters are configured via a Simple Network Management Protocol (SNMP) manager. SNMP is an industry standard protocol for networked devices. It defines the messaging protocol and the structure (but not the content) of an information database, called the Management Information Base (MIB), which is contained in managed network devices. There are several versions of SNMP. The Wi-Fi Terminus supports version 1 (SNMPv1).

The structure of the MIB is hierarchical in nature with several well defined levels of parameters and the ability to define more parameters at the device level. An SNMP agent and the MIB reside in the device, giving access to read-only and configurable parameters. Each parameter has a unique object identifier (OID), a dotted decimal notation which describes its location in the SNMP hierarchy.

Managed devices in an SNMP network also have specified 'community names'. These are used to group managers and devices and help identify where information is sent. A managed device can have different community names for reading and writing operations.

We recommend using Net-SNMP software as an easy method to understand and manage the Wi-Fi Terminus parameters using SNMP. The Net-SNMP homepage is [www.net-snmp.org](http://www.net-snmp.org). The latest version can be downloaded free of charge from SourceForge.net at <http://sourceforge.net>.

Once installed, the net-SNMP software can be used to read (get) and write (set) to the Wi-Fi Terminus parameter database using the "snmpget" and "snmpset" commands.

The format of a snmpget command is:

```
snmpget [OPTIONS] AGENT OID
```

Desired options include:

The SNMP version specifier, '-v 1'. The Wi-Fi Terminus uses SNMPv1.

An output format specifier, '-O a', which requests string values to be printed as ASCII text.

The community name, '-c GSN\_GET'. The community name for reading a Wi-Fi Terminus device is "GSN\_GET".

The output format specifier (-O) is followed by a single character which will control how the response string is formatted. See Table 4: Data Type for available output options.

The agent for the Wi-Fi Terminus is the IP address of the unit, which is configured to 192.168.1.3 by default. Please see Section 1.4 and Section 6 for the default network settings and details on how to bring the device up on a network.

The OID's for the Wi-Fi Terminus parameters are given in the Wi-Fi Terminus OID Table (See Appendix 1). Each OID is prefixed with .1.3.6.1.4.1.28295.1 -or- .1.3.6.1.4.1.28295.99.1. Using the 1st table entry "GSNSENSORSERVERIP" as an example, the SNMP data read request would be:

```
snmpget -v 1 -O a -c GSN_GET 192.168.1.3 .1.3.6.1.4.1.28295.99.1.2.1.6.5
```

A typical response string would look like:

```
SNMPv2-SMI::enterprises.28295.99.1.2.1.6.5 = IpAddress: 192.168.1.2
```

Writing to parameter database is accomplished using the snmpset command.

The format of a snmpset command is:

```
snmpset [OPTIONS] AGENT OID TYPE VALUE
```

Necessary options are the same as snmpget, although the '-O' output specifier is not used. The type of the value parameter must be specified in a single character, as shown in the following Data Type Table 4. The data type for each Wi-Fi Terminus parameter appears in the in the Wi-Fi Terminus OID Table.

## 3 DEVICE CONFIGURATION via SNMP continued

### 3.2 Data Type Table

Type	TypeSpecifier	Description
INTEGER	i	A whole number
STRING	s	Character string
IpAddress	a	Four-octet string of hexadecimal data
HEX	x	Hexadecimal string

Table 4: Data Type

The parameter value itself should be enclosed in quotations. It is not always necessary to enclose the parameter in quotations, but it is required if the parameter value has spaces. It is recommended to always use quotations and to verify that the response string on a set matches the intended input type and value. If the response shows the parameter in brackets, then the Wi-Fi Terminus will not use the parameter.

Using the same example as above, writing to the 1st table entry "GSNSENSORSERVERIP" would look like:

```
snmpset -v 1 -c GSN_SET 192.168.1.102 .1.3.6.1.4.1.28295.99.1.2.1.6.5 a "192.168.1.4"
```

In this example, the Wi-Fi Terminus sensor server IP address is being set to "192.168.1.4". The response string should be:

```
SNMPv2-SMI::enterprises.99.1.2.1.6.5 = IpAddress: 192.168.1.4
```

If the response string was of the form: SNMPv2-SMI::enterprises.99.1.2.1.6.5: (192.168.1.4), this indicates a problem with the formation of the SNMPSET command and the Wi-Fi Terminus will not set the parameter appropriately.

For security purposes, all WEP/WPA/WPA2 security settings are read disabled by default. The Wi-Fi Terminus will respond to a read of the security settings with "Read-Disabled" if it is a string or hex string, and with 255 if it is an integer. To confirm a settings change, please note the SNMP response string that is sent with an SNMPSET command. If the new value is set appropriately, you will see the new value in the response string in the form "INTEGER = XXXX" or "STRING = XXXX". If the value is returned in parenthesis, it was not acknowledged properly.

*There is additional information on the format and use of these and many other operations available in the documentation that accompanies the Net-SNMP software package.*

### 3.3 Configuring Timers

There are several timers that have a large variable size (64 bit) and whose value must be entered in reverse-byte order. These include:

- NTAPPERIOD
- GSNTRAPCONFIGINTNEWTMR
- GSNTRAPLINKUPINTNEWTMR

The timer in the Wi-Fi Terminus runs at 33,554,432 MHz. So one second requires 33,554,432 counts, or a hexadecimal value of 0x2000000. The BYTES of the timer value MUST BE ENTERED IN REVERSE ORDER. Some examples, using the 8-byte timer value format:

Timer Period	Hexadecimal Value	Reverse-Byte String
1 second	0x000000002000000	0x0000000200000000
1 minute	0x0000000078000000	0x0000007800000000
10 minutes	0x00000004b0000000	0x000000b004000000
1 hour	0x0000001c20000000	0x000000201c000000
1 day	0x000002a300000000	0x00000002a30200000

If you READ the default NTAPPERIOD using Net-SNMP, make sure you use the output option "-Ox" to properly format the hexadecimal value. To WRITE a string, use the reverse-byte hexadecimal format. For a 10 minute setting:

```
snmpset -v1 -c GSN_SET 192.168.1.3. 1.3.6.1.4.28295.99.1.2.1.10.1 x 00x000000b004000000
```

---

## 4 NMEA MESSAGES

### 4.1 General NMEA Information

Each NMEA message is preceded by the ASCII value of the MAC address. This is separated from the NMEA message by a comma, and intended to be used as a unique identifier for each message. All messages start with \$, have fields delimited by commas and end with <CR><LF>. Approved NMEA messages are recognized by the first 5 characters after the \$ which define both the kind of talker providing the information (2 characters, GP in the case of a GPS) and the type of information (3 characters).

#### EXAMPLE OUTPUT – no FIX

```
0050C29BA003,$GPGGA,195713.000,0000.0000,S,00000.0000,W,0,00,00.0,0.0,M,0.0,M,,*5A
0050C29BA003,$GPGLL,0000.0000,S,00000.0000,W,195713.000,V,A*49
0050C29BA003,$GPGSA,A,1,,,,,,,,,,,,,0.0,0.0,0.0*30
0050C29BA003,$GPRMC,195713.000,V,0000.0000,S,00000.0000,W,0.00,0.00,281008,,,A*7D
0050C29BA003,$GPZDA,000000.000,22,08,1999,01,00*57
0050C29BA003,$GPVTG,0.00,T,,0.00,N,0.00,K,A*70
```

*Note: The GPGSV sentence is not sent out on start up until it contains non-zero data.*

#### EXAMPLE OUTPUT – with a FIX

```
0050C29BA003,$GPGGA,193927.070,4154.8388,N,08845.3577,W,1,08,00.9,279.1,M,-34.9,M,,*59
0050C29BA003,$GPGLL,4154.8388,N,08845.3577,W,193927.070,A,A*43
0050C29BA003,$GPGSA,A,3,04,08,09,11,17,20,28,32,,,,,1.7,0.9,1.4*32
0050C29BA003,$GPGSV,2,1,08,4,38,201,40,8,13,177,33,9,21,314,31,11,22,051,34*4C
0050C29BA003,$GPGSV,2,2,08,17,73,333,47,20,23,088,37,28,66,115,47,32,16,062,24*7C
0050C29BA003,$GPRMC,193927.070,A,4154.8388,N,08845.3577,W,0.00,134.12,281008,,,A*72
0050C29BA003,$GPZDA,193927.070,28,10,2008,01,00*56
0050C29BA003,$GPVTG,134.12,T,,0.00,N,0.00,K,A*75
```

The following approved NMEA messages are available from the Wi-Fi Terminus NT-220LT:

Message	Section
GPGGA	4.2
GPGLL	4.3
GPGSA	4.4
GPGSV	4.5
GPRMC	4.6
GPZDA	4.7
GPVTG	4.8

---

## 4 NMEA MESSAGES continued

### 4.2 GPGGA, GPS Fix Data

Time and position, together with GPS fixing related data.

`$GPGGA,hhmmss.sss,Latitude,N,Longitude,E,FS,NoSV,HDOP,Altref,M,msl,M,DiffAge,DiffStation*cs`

Field	Description
\$GPGGA	NMEA sentence header (position data)
hhmmss.sss	UTC Time in hours, minutes, seconds. and decimal second format.
Latitude	User datum latitude degrees, minutes, decimal minutes format (ddmm.mmmmmm)
N	Hemisphere: 'N'= North, 'S' = South
Longitude	User datum longitude degrees, minutes, decimal minutes format (dddmm.mmmmmm)
E	Longitude direction: 'E'= East, 'W' = West
FS	Fix status: 0 No fix 1 Standard GPS 2 Differential GPS
NoSv	Number of satellites used in the position solution
HDOP	2-D Horizontal Dilution of Precision
AltRef	Altitude (meters) above user datum ellipsoid.
M	Units of height (meters)
msl	Mean Sea Level
M	Units of Mean Sea Level (meters)
DiffAge	Age of differential correction
DiffStation	Differential base station ID
cs	Message checksum in hexadecimal

### 4.3 GPGLL, Geographic Position, Lat/Lon

Latitude and longitude, with time of position fix and status.

`$GPGLL,Latitude,N,Longitude,E,hhmmss.sss,Status,Mode*cs`

Field	Description
\$GPGLL	NMEA sentence header (position data)
Latitude	User datum latitude degrees, minutes, decimal minutes format (ddmm.mmmmmm)
N	Hemisphere: 'N'= North, 'S' = South
Longitude	User datum longitude degrees, minutes, decimal minutes format (dddmm.mmmmmm)
E	Longitude direction: 'E'= East, 'W'= West
hhmmss.sss	UTC time in hours, minutes, seconds. and decimal second format.
Status	Status: V=navigation receiver warning, A=data valid
Mode	Mode indicator: D = Differential A = Autonomous
cs	Message checksum in hexadecimal

---

## 4 NMEA MESSAGES continued

### 4.4 GPGSA, GPS DOP and Active Satellites

GPS receiver operating mode, satellites used for navigation, and DOP values.

`$GPGSA,Smode,FS,sv,sv,sv,sv,,,,,,,,,PDOP,HDOP,VDOP*cs`

Field	Description
\$GPGSA	NMEA sentence header (satellite data)
Smode	A= Automatic switching 2D/3D; M=Manually fixed 2D/3D
FS	Fix Status: 1 No fix 2 2D GPS fix 3 3D GPS fix
sv	Satellites in use, null for unused fields (12 available fields)
PDOP	3-D Position Dilution of Precision
HDOP	2-D Horizontal Dilution of Precision
VDOP	Vertical Dilution of Precision
cs	Message checksum in hexadecimal

### 4.5 GPGSV, GPS Satellites in View

The number of satellites in view, together with each PRN, elevation and azimuth, and C/No value. Up to four satellite details are transmitted in one message, with up to four messages used as indicated in the first field.

`$GPGSV,NoMsg,MsgNo,NoSv,sv,elv,az,cno,sv,elv,az,cno,sv,elv,az,cno,sv,elv,az,cno*cs`

Field	Description
\$GPGSV	NMEA sentence header (satellite data)
NoMsg	Total number of GPGSV messages being output
MsgNo	Number of this message
NoSv	Number of satellites in view
sv	Satellites ID
elv	Satellite elevation angle (degrees)
az	Satellite azimuth angle (degrees)
cno	Satellite signal/Noise ration (dB/Hz)
cs	Message checksum in hexadecimal

---

## 4 NMEA MESSAGES continued

### 4.6 GPRMC, Recommended Minimum Data

The 'Recommended Minimum' sentence defined by NMEA for GPS/Transit system data.

\$GPRMC,hhmmss.sss,status,latitude,Hemisphere,longitude,E,spd,cmg,ddmmyy,mv,mvd,Mode\*cs

Field	Description
\$GPRMC	NMEA sentence header (recommended minimum sentence)
hhmmss.sss	UTC Time in hours, minutes, seconds
status	Status: V=navigation receiver warning, A=data valid
Latitude	User datum latitude degrees, minutes, decimal minutes format (ddmm.mmmmmm)
N	Hemisphere: 'N'= North, 'S' = South
Longitude	User datum longitude degrees, minutes, decimal minutes format (dddmm.mmmmmm)
E	Longitude direction: 'E'= East, 'W'= West
spd	Speed over ground (knots)
cmg	Course made good
ddmmyy	Date in day, month, year format
mv	Magnetic variation
mvd	Magnetic variation direction
Mode	Mode indicator: D = Differential A = Autonomous
cs	Message checksum in hexadecimal

### 4.7 GPZDA UTC Time and Date

This message transfers UTC time and date. Since the latency of preparing and transferring the message is variable, and the time does not refer to a particular position fix, the seconds' precision is reduced to 2 decimal places.

\$GPZDA,hhmmss.sss,dd,mm,yyyy,Int,Unsigned\*cs

Field	Description
\$GPZDA	NMEA sentence header (time and date)
hhmmss.sss	UTC time in hours, minutes, seconds
dd	UTC day
mm	UTC month
yyyy	UTC year
Int	Local zone hours
Unsigned	Local zone minutes
cs	Message checksum in hexadecimal

---

## 4 NMEA MESSAGES continued

### 4.8 GPVTG, Course Over Ground and Ground Speed

Velocity is given as Course Over Ground (COG) and ground speed

\$GPVTG,cogt,T,cogm,M,knots,N,kph,K,Mode\*cs

Field	Description
\$GPVTG	NMEA sentence header (speed and heading)
cogt	Course over ground (true)
T	True - fixed field
cogm	Course over ground (magnetic)
M	Magnetic - fixed field
knots	Speed over ground (knots)
N	Knots - fixed field
kph	Speed over ground (kph)
K	Kilometers per hour – fixed field
Mode	Mode indicator: D = Differential A = Autonomous
cs	Message checksum in hexadecimal

## 5 LITHIUM BATTERY

The Wi-Fi Terminus NT-220LT contains a 14Ah primary lithium battery. It provides one of the highest energy densities available for practical use with the Wi-Fi Terminus. The Wi-Fi Terminus is tested prior to shipment and is ready for immediate use. However, after several months of storage, the lithium battery used with the Wi-Fi Terminus can develop a passivation layer on the internal anode, which can lead to a low battery voltage. The internal circuitry of the Wi-Fi Terminus will sense this low voltage and prevent the Wi-Fi Terminus from operating. The “Battery Restore” position on the power switch provides a means to remove the passivation layer and restore the battery to its normal service voltage. If the Wi-Fi Terminus has been un-powered for an extended period of time (several months or more) and is not starting properly, placing the power switch in the “Battery Restore” position for a short period (10-20 seconds) can return the battery to normal operating conditions. The “Battery Restore” position places a low value resistor across the battery as a means to remove any passivation layer that might have formed during storage. If the battery reaches the end of its service life, please contact the manufacturer concerning replacement.

## 6 INSTALLATION INSTRUCTIONS FOR INITIAL SETUP

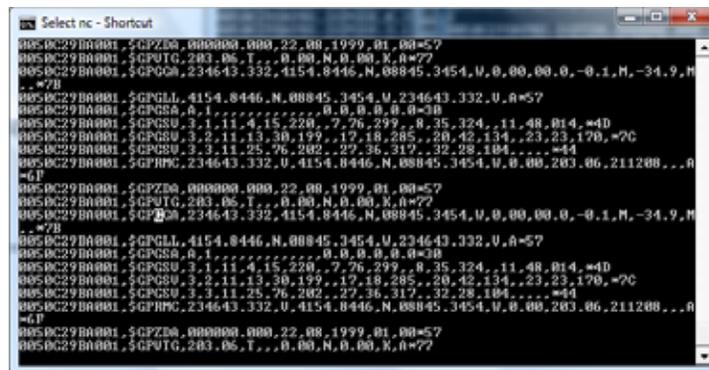
1. Power the Wi-Fi Terminus by turning the power switch to the 'ON' position. Make sure a Wi-Fi antenna is properly connected and the external GPS antenna is oriented upwards towards an open view of the sky.

Proceed with 2a for an Infrastructure network and with 2b for an Ad Hoc network.

2. a. Provide a wireless router or a network access point  
The SSID should be set to 'CW85\_Setup' and configured for channel 6 with wireless encryption disabled.  
The recommended settings are to have the router at 192.168.1.X (Please do not use 192.168.1.2 or 192.168.1.3 – those addresses are pre-configured for the data server and the Wi-Fi Terminus respectively) and to use the 255.255.255.0 Subnet.  
If this is not the first time that you have installed the Wi-Fi Terminus unit and you have altered the SSID and channel settings in the device, please use your altered settings.
- b. Create an Ad Hoc network with IP 192.168.1.2 using SSID 'CW85\_Setup' and channel 6. Go to Step 4.
3. Provide the host computer(s) IP settings to match those of the Wi-Fi Terminus GSNPRIMARYSNMPMGRIP address (for SNMP parameter management) and the GSNSENSORSERVERIP address (for GPS data). The default values for these are 192.168.1.2. Please note that if this computer is connected wirelessly to the network, then it must have the same SSID/channel/encryption settings as above.
4. Obtain and install a copy of Net-SNMP on the host computer configured with the GSNPRIMARYSNMPMGRIP as the IP address (default: 192.168.1.2); see [www.net-snmp.org](http://www.net-snmp.org). Use the Net-SNMP commands to read (snmpget) and write (snmpset) the Wi-Fi Terminus configurable parameters. See Section 3 – Configuration via SNMP.
5. If you don't already have server software that is listening for the incoming data stream, or if you would like an easy-to-setup program for viewing the NMEA streams/debugging, we suggest using NetCat; see <http://netcat.sourceforge.net/>. Netcat can be used to display the ASCII GPS data being sent from the Wi-Fi Terminus. Once the unit has associated with the network and resolved 192.168.1.2, it will begin transmitting UDP packets to 192.168.1.2, port 9999.
6. Monitoring the GPS data using Netcat:  
Netcat is a utility that can be used to read the UDP packets containing the GPS data from the Wi-Fi Terminus. The netcat utility is freely available at <http://netcat.sourceforge.net/>.  
The Wi-Fi Terminus GPS receiver communicates on port 9999. A simple netcat command line to display the GPS data would look like:

```
nc -l -p 9999 -u
```

An example of the output that would be seen in a NetCat window:



```
Select nc - Shortcut
RRSBC29BA001.$GPZDA,000000.000,22.00,1999.01.00=57
RRSBC29BA001.$GPUTG,203.06,T,,0.00,N,0.00,K,A*77
RRSBC29BA001.$GPGGA,2.34643,332,4154.8446,N,08845.3454,U,0.00,00.0,-0.1,M,-34.9,M,0.0,0000.0000,0.0,0.0
RRSBC29BA001.$GPGLL,4154.8446,N,08845.3454,U,234643.332,U,A*57
RRSBC29BA001.$GPRSA,A,1,,,,,,,,,,,,,0.0,0.0,0.0=3B
RRSBC29BA001.$GPGSV,3,1,11,4,15,220,7.76,299,8.35,324,11.48,014,*4D
RRSBC29BA001.$GPGSU,3,2,11,13,30,199,17.18,285,20.42,134,23,23,170,*7C
RRSBC29BA001.$GPRMB,3,3,11,25,76,202,27.36,317,32.28,104,.,.,,*44
RRSBC29BA001.$GPRMC,2.34643,332,U,4154.8446,N,08845.3454,U,0.00,203.06,211200,.,.,A*6P
RRSBC29BA001.$GPZDA,000000.000,22.00,1999.01.00=57
RRSBC29BA001.$GPUTG,203.06,T,,0.00,N,0.00,K,A*77
RRSBC29BA001.$GPGGA,2.34643,332,4154.8446,N,08845.3454,U,0.00,00.0,-0.1,M,-34.9,M,0.0,0000.0000,0.0,0.0
RRSBC29BA001.$GPGLL,4154.8446,N,08845.3454,U,234643.332,U,A*57
RRSBC29BA001.$GPRSA,A,1,,,,,,,,,,,,,0.0,0.0,0.0=3B
RRSBC29BA001.$GPGSV,3,1,11,4,15,220,7.76,299,8.35,324,11.48,014,*4D
RRSBC29BA001.$GPGSU,3,2,11,13,30,199,17.18,285,20.42,134,23,23,170,*7C
RRSBC29BA001.$GPRMB,3,3,11,25,76,202,27.36,317,32.28,104,.,.,,*44
RRSBC29BA001.$GPRMC,2.34643,332,U,4154.8446,N,08845.3454,U,0.00,203.06,211200,.,.,A*6P
RRSBC29BA001.$GPZDA,000000.000,22.00,1999.01.00=57
RRSBC29BA001.$GPUTG,203.06,T,,0.00,N,0.00,K,A*77
```

---

## 6 INSTALLATION INSTRUCTIONS FOR INITIAL SETUP *continued*

### 7. Configuring the device for the new network

#### a. Configuring the new IP settings

These network settings take effect on a power cycle, so they should all be changed (including encryption, if necessary) and then the unit should be rebooted for these settings to take effect. It is HIGHLY recommended to change just the settings for SSID1 so that if something is not right, it is easy to go back into the device using the CW85\_Setup on SSID2. IMPORTANT - once the network settings are modified and the Wi-Fi Terminus is ready to be rebooted - bring down the CW85\_Setup network so that the device can no longer see it and try to connect.

These are the settings that will most likely need to be changed for the new network:

GSNIPADDRESS

GSNSUBNETADDRESS

GSNGATEWAYIPADDRESS

STATIC IP ENABLED

GSNPRIMARYSNMPMGRIP

GSNAPSSID1

GSNAPCHANNEL1

Details follow below for specific information on changing each OID:

- GSNIPADDRESS - .1.3.6.1.4.1.28295.1.1.3.1.0  
This changes the IP address of the Wi-Fi Terminus.  
Use the form  
snmpset -v1 -Oa -c GSN\_SET 192.168.1.3 .1.3.6.1.4.1.28295.1.1.3.1.0 a "new IP address"  
The new IP address should be in decimal-dot notation, enclosed in quotes.
- GSNSUBNETADDRESS - .1.3.6.1.4.1.28295.1.1.3.2.0  
This changes the subnet address of the Wi-Fi Terminus.  
Use the form  
snmpset -v1 -Oa -c GSN\_SET 192.168.1.3 .1.3.6.1.4.1.28295.1.1.3.2.0 a "new subnet"  
The new subnet should be in decimal dot notation, enclosed in quotes.
- GSNGATEWAYIPADDRESS - .1.3.6.1.4.1.28295.1.1.3.3.0  
This changes the gateway IP address of the Wi-Fi Terminus.  
Use the form  
snmpset -v1 -Oa -c GSN\_SET 192.168.1.3 .1.3.6.1.4.1.28295.1.1.3.3.0 a "new gateway"  
The new gateway should be in decimal dot notation, enclosed in quotes.
- STATIC IP ENABLED - .1.3.6.1.4.1.28295.1.1.3.4.0  
To set the device for DHCP, leave the above OIDs as they are and set this OID to 0 (default is 1).  
Use the form  
snmpset -v1 -Oa -c GSN\_SET 192.168.1.3 .1.3.6.1.4.1.28295.1.1.3.4.0 i 0  
This will enable DHCP.

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## 6 INSTALLATION INSTRUCTIONS FOR INITIAL SETUP *continued*

- GSNPRIMARYSNMPMGRIP - .1.3.6.1.4.1.28295.1.1.4.3.0  
Change the SNMP manager to the machine on the new network that you want to control the Wi-Fi Terminus on. Leave the GSNSECONDARYSNMPMGRIP at 192.168.1.2 so that you can still go back to the CW85\_Setup SSID if you need to. Once the unit has been brought up on the new network, you can change the GSNSECONDARYSNMPMGRIP to the new IP, set it to 0.0.0.0 to disable it, or leave it at the default.  
Use the form  
snmpset -v1 -Oa -c GSN\_SET 192.168.1.3 .1.3.6.1.4.1.28295.1.1.4.3.0 a "new IP address"  
The new IP address should be in decimal-dot notation, enclosed in quotes.
- GSNAPSSID1 - .1.3.6.1.4.1.28295.1.1.4.5.1.2.1  
Use this OID to change SSID1.  
Use the form  
snmpset -v1 -Oa -c GSN\_SET 192.168.1.3 .1.3.6.1.4.1.28295.1.1.4.5.1.2.1 s "new ssid"  
Please be sure to enclose the new SSID in quotes or it may be truncated.
- GSNAPCHANNEL1 - .1.3.6.1.4.1.28295.1.1.4.5.1.3.1  
Use this OID to change the channel for SSID1.  
Use the form  
snmpset -v1 -Oa -c GSN\_SET 192.168.1.3 .1.3.6.1.4.1.28295.1.1.4.5.1.3.1 i channelNumber  
Channel number can be 1-11.

### b. Configuring the new security settings

Encryption may need to be added for the new network. Please note that these options are read-disabled. Close attention must be paid to the response string when setting these options for confirmation that they are set appropriately for the network.

WEP Settings for SSID1 (note that there is no passphrase option - only hex key):

GSNWEPKEYIDSSID1

GSNWEPKEYLENSSSID1

GSNWEPKEYAUTHMODESSID1

GSNENCRYPTIONMODESSID1

GSNAPWEPKEYVALSSID1

- GSNWEPKEYIDSSID1 - .1.3.6.1.4.1.28295.1.1.4.5.1.4.1  
This sets which key to use - 0-3, 0 is default  
Use the form  
snmpset -v1 -Oa -c GSN\_SET 192.168.1.3 .1.3.6.1.4.1.28295.1.1.4.5.1.4.1 i key
- GSNWEPKEYLENSSSID1 - .1.3.6.1.4.1.28295.1.1.4.5.1.5.1  
This sets WEP64 or WEP128 - default is WEP64. 13 sets to WEP128  
Use the form  
snmpset -v1 -Oa -c GSN\_SET 192.168.1.3 .1.3.6.1.4.1.28295.1.1.4.5.1.5.1 i 13
- GSNWEPKEYAUTHMODESSID1 - .1.3.6.1.4.1.28295.1.1.4.5.1.8.1  
Default is open key (1), can be changed to shared key (2)  
Use the form  
snmpset -v1 -Oa -c GSN\_SET 192.168.1.3 .1.3.6.1.4.1.28295.1.1.4.5.1.8.1 i keyMode

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## 6 INSTALLATION INSTRUCTIONS FOR INITIAL SETUP *continued*

- GSNENCRYPTIONMODESSID1 - .1.3.6.1.4.1.28295.1.1.4.5.1.9.1  
This OID controls which encryption types are allowed on SSID1. By default, all possible encryption types are enabled. This should be reduced to only the appropriate type - eg for WEP - set to integer value 1.  
Use the form  
snmpset -v1 -Oa -c GSN\_SET 192.168.1.3 .1.3.6.1.4.1.28295.1.1.4.5.1.9.1 i encryptionMode
- GSNAPWEPKEYVALSSID1 - .1.3.6.1.4.1.28295.1.1.4.5.1.6.1  
This OID sets the encryption key, in hex. There is no passphrase option for WEP.  
Use the form  
snmpset -v1 -Oa -c GSN\_SET 192.168.1.3 .1.3.6.1.4.1.28295.1.1.4.5.1.6.1 x hexKey  
Example1: use 0x0102030405060708090a0b0c0d for the WEP-128 hex key: 0102030405060708090a0b0c0d  
Example2: use 0x0102030405 for the WEP-64 hex key: 0102030405  
WEP128 keys have 26 digits (0-9, A-F) and WEP64 keys have 10 digits.

\*\*It is important to note that the device does not expect to have identical SSIDs configured for different security options, ex SSID1 configured for WEP and SSID2 configured as OPEN with identical SSID/channel numbers. This can cause issues with association.

WPA/WPA2 settings for SSID1:  
GSNAPPSKPASSPHRASESSID1  
or  
GSNPSKKEY1  
GSNENCRYPTIONMODESSID1

- GSNAPPSKPASSPHRASESSID1 - .1.3.6.1.4.1.28295.1.1.4.5.1.7.1  
This OID will change **ONLY** the passphrase for SSID1... GSNPSKPASSPHRASE changes all three and is deprecated.  
Use the form  
snmpset -v1 -Oa -c GSN\_SET 192.168.1.3 .1.3.6.1.4.1.28295.1.1.4.5.1.7.1 s "passphrase"  
Be sure to enclose the passphrase in quotes or it may be truncated.
- GSNPSKKEY1 - .1.3.6.1.4.1.28295.1.1.2.10.0  
Use this OID to set the key **INSTEAD** of using a passphrase. It is not necessary to use this if you use the passphrase.  
Use the form  
snmpset -v1 -Oa -c GSN\_SET 192.168.1.3 .1.3.6.1.4.1.28295.1.1.2.10.0 x 0x(64digits)  
Where the 64 digits are 0-9 and A-F
- GSNENCRYPTIONMODESSID1 - .1.3.6.1.4.1.28295.1.1.4.5.1.9.1  
This OID changes which encryption options are enabled per SSID. By default, all possible encryption modes are enabled. This should be reduced to only the appropriate type - for WPA2 - set to integer value 16, for WPA set to integer value 2  
Use the form  
snmpset -v1 -Oa -c GSN\_SET 192.168.1.3 .1.3.6.1.4.1.28295.1.1.4.5.1.9.1 i encryptionMode  
Binary of 16 (00010000b) -- so 16 corresponds with bit 4 in the OID Table - See Appendix I for more details  
Binary of 2 (00000010b) -- so 2 corresponds to bit 1 in the OID Table

Once all of the appropriate settings have been changed, bring the CW85\_Setup network down and reboot the Wi-Fi Terminus device. You should see the status indicator flash appropriate that is able to associate with the new network. You should also be able to communicate with the device with the newly configured SNMP manager. If the device fails to associate with the new network, bring that network down and restore the CW85\_Setup network and double check the settings. For the security settings, you need to pay close attention to the SNMP response when you set them as this is the only way to confirm that it used the right values. You cannot read them back over SNMP for protection.

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## 6 INSTALLATION INSTRUCTIONS FOR INITIAL SETUP *continued*

### 8. Configuring the device for desired operation - basic settings

To send data to the new server, you may need to change the IP and port for the real-time GPS data stream.

GSNSENSORSERVERIP

GSNSENSORDATAPORTNUM

- GSNSENSORSERVERIP - .1.3.6.1.4.1.28295.99.1.2.1.6.5  
This OID sets the destination IP for the real-time GPS data.  
Use the form  
snmpset -v1 -Oa -c GSN\_SET <Device IP addr> .1.3.6.1.4.1.28295.99.1.2.1.6.5 a "destination"  
Please use decimal dot notation for the IP addresses, eg - 192.168.1.3
- GSNSENSORDATAPORTNUM - .1.3.6.1.4.1.28295.99.1.2.1.9.5  
This OID sets the destination port for the real-time GPS data.  
Use the form  
snmpset -v1 -Oa -c GSN\_SET <Device IP address> .1.3.6.1.4.1.28295.99.1.2.1.9.5 i newPort

To change the IP and port for the logged GPS data use

NTLOGSERVERIPADDR

NTLOGSERVERPORTNUM

- NTLOGSERVERIPADDR - .1.3.6.1.4.1.28295.99.1.2.1.6.3  
This OID sets the destination IP for the logged GPS data.  
Use the form  
snmpset -v1 -Oa -c GSN\_SET <Device IP addr> .1.3.6.1.4.1.28295.99.1.2.1.6.3 a "destination"  
Please use decimal dot notation for the IP addresses, eg - 192.168.1.3
- NTLOGSERVERPORTNUM - .1.3.6.1.4.1.28295.99.1.2.1.9.3  
This OID sets the destination port for the logged GPS data.  
Use the form  
snmpset -v1 -Oa -c GSN\_SET <Device IP address> .1.3.6.1.4.1.28295.99.1.2.1.9.3 i newPort

No change is required to the packet type if you want to use UDP. To use TCP for either the real time data or the data log, use one or both of the following:

NTDATASERVERPORTTYPE

NTLOGSERVERPORTTYPE

- NTDATASERVERPORTTYPE - .1.3.6.1.4.1.28295.99.1.2.1.7.5  
This OID sets the data server port type (real-time data).  
Use the form  
snmpset -v1 -Oa -c GSN\_SET <Device IP address> .1.3.6.1.4.1.28295.99.1.2.1.7.5 i 2  
For this OID, 2 is TCP and 1 is UDP. No other options are valid.
- NTLOGSERVERPORTTYPE - .1.3.6.1.4.1.28295.99.1.2.1.7.3  
This OID sets the log server port type (logged GPS data)  
Use the form  
snmpset -v1 -Oa -c GSN\_SET <Device IP address> .1.3.6.1.4.1.28295.99.1.2.1.7.3 i 2  
For this OID, 2 is TCP and 1 is UDP. No other options are valid.

---

## 6 INSTALLATION INSTRUCTIONS FOR INITIAL SETUP *continued*

To configure which data is sent and how often it is sent, use the following:

NTGPSUPDATERATE  
NTMSGENABLE

NTGPSUPDATERATE - .1.3.6.1.4.1.28295.99.1.2.1.16.5

This OID controls the rate at which the GPS gives real-time updates to position.

Use the form

```
snmpset -v1 -Oa -c GSN_SET <Device IP address> .1.3.6.1.4.1.28295.99.1.2.1.16.5 i rate
```

The rate is in seconds. Setting rate as 2 sets the device to report every other second, 3 sets the device to report every three seconds... etc.

- NTMSGENABLE - .1.3.6.1.4.1.28295.99.1.2.1.21.5  
This OID controls the enabling of the GPS messages by the bitwise binary representation of the integer msgs.

Use the form

```
snmpset -v1 -Oa -c GSN_SET <Device IP address> .1.3.6.1.4.1.28295.99.1.2.1.21.5 i msgs
```

Order of the bitwise binary representation (MSB to LSB):

0, GPVTG, GPZDA, GPRMC, GPGSV, GPGSA, GPGLL, GPGGA

Examples:

GPRMC only is 0001 0000b, which is the integer 16

GPGLL only is 0000 0010b, which is the integer 2

GPGGA only is 0000 0001b, which is the integer 1

For GPRMC, GPGLL and GPGGA, you would send 19 (16+2+1) in this string.

If all of the messages are disabled, the power indicator will no longer flash... the flash interval is based on the GPS update rate and if the rate is 0 or the messages are all disabled, this light will no longer flash. If the rate changes, the rate that this LED flashes will also change. The duration of the flash is based on the number of messages that are enabled - a longer flash indicates more messages are being sent.

Unlike the network settings, which need a reboot to take effect, these changes are all immediate EXCEPT for packet type. Also, if the TCP connection is already established, the new IP/Port won't take effect until a new socket connection is made.

Please see Appendix 1 for more configuration options for the Wi-Fi Terminus.

## APPENDIX 1

### OID relative to .1.3.6.1.4.1.28295.99.1.2.1

NAME	OID <sup>1</sup>	Access	Type	Default	Range	Comments
GSSENSORSERVERIP	6.5	R/W	IP ADDRESS	192.168.1.2	All possible values	IP address of the sensor data server for the Wi-Fi Terminus NT-220LT
GSSENSORDATAPORTNUM	9.5	R/W	INTEGER	9999	All possible values	Port number of the sensor data server for the Wi-Fi Terminus NT-220LT
NTLOGSERVERIPADDR	6.3	RW	IP ADDRESS	192.168.1.2	All possible	IP for the data log server. Changes for UDP are automatic, changes for TCP take effect following a reboot
NTLOGSERVERPORTNUM	9.3	RW	INTEGER	9998	All possible	Port for the data log. Changes for UDP are automatic, changes for TCP take effect following a reboot
NTLOGSERVERPORTTYPE	7.3	RW	INTEGER	1(UDP)	1-2(TCP is 2)	Packet type for the log. Change to this take effect following a reboot.
NTDASERVERPORTTYPE	7.5	RW	INTEGER	1(UDP)	1-2(TCP is 2)	Packet type for the data. Changes to this take effect following a reboot.
NTAPPERIOD	10.5	RW	HEX			0x0000000040000000 (byte reversed HEX string = 10 minutes). Activation interval for GPS Application. CAUTION: Setting to 0 will disable. See Section 3.3 - Configuring Timers. For proper operation, this value must be at least 2 <sup>16</sup> NTGPSUPDATEPERIOD + 5
NTTESTVAR	11.5	RW	INTEGER	0	0-1	Writing a 0 or 1 to this will cause a diagnostic sentence to be sent containing RSSI and battery status. A 1 also causes a GPS cold start.
NTGPSUPDATEPERIOD	16.5	RW	INTEGER	1	0-86399	Data transmission rate in seconds.
NTFLASHUPDATEPERIOD	19.5	RW	INTEGER	1	0-86399	Data save rate as a multiple of the transmission rate.
NTSENDFIX	20.5	RV	INTEGER	0	0-86399	0 causes continual sending of all GPS data until a 'valid fix' is received. 1 or larger causes no data to be sent until a 'valid fix' is received and then the specified number of solutions will be sent. For example, setting this value to 2 will cause 2 solutions to be sent, the first 'valid fix' and then the next solution. See 24.3 and 24.5 for more detail on a 'valid fix'.
NTMSGENABLE	21.5	RW	INTEGER	127	Meaningful range currently 0 - 127	The binary representation of this integer number controls which GPS messages are enabled. See Section 1.6 for individual message details
NTGPSSTIMEOUT	22.5	RW	INTEGER	590	7-86399	Safety timeout for GPS. Limits the time, in seconds, that the GPS will attempt to get a fix each active period. Once this time expires, the Wi-Fi Terminus will send out the next position information it has (fix or not) via the selected protocol. The Wi-Fi Terminus will then go into standby mode. This value is internally limited to the GPS activation interval (set in 10.5) minus the quantity: 5 seconds plus 2x the interval selected in 16.5 (default 1). Values smaller than this will be automatically set to the above value within the code. NTGPSWAIT (referenced on page 29) must be smaller than this internally limited value or it will be internally ignored and set to 0.

#### Notes

1. The OID column includes the ending 'instance identifier' which must be included in the MIB variable.

Table 5: Wi-Fi Terminus NT-220LT OID Table

APPENDIX 1 continued

OID Relative to .1.3.6.1.4.1.28295.1.

NAME	OID <sup>1</sup>	Access	Type	Default	Range	Comments
NTNUMSEND	23.5	RW	INTEGER	1	0-5	Controls the number of times the unit attempts to send out data. Refreshed each transmission.
NTGPShDOP	24.3	RW	INTEGER	0	0-65535	Additional option for selecting fix quality. If this value is >0, then this value is used to verify that HDOP is adequate for a fix. A value of 1 means that only HDOP of 1.9 or less is considered "valid", a value of 2 means 2.9 or less. 0 ignores HDOP and only relies on any fix as a 'valid' fix. May be used in conjunction with 24.5 to verify a number of fixes of sufficient HDOP quality in order to consider a 'valid' fix.
NTGPSNUMFIX	24.5	RW	INTEGER	1	0-86399	Active only when 20.5 is non-zero. Controls the number of fixes that must be acquired prior to considering a fix to be 'valid'. Once this number of fixes has been acquired, then the Wi-Fi Terminus will begin sending fix data the number of times specified in 20.5. Refreshed each boot.
NTGPSWAIT	25.5	RW	INTEGER	0	0-86399	Wait time (in seconds) for unit to remain in a power saving state (saves ~30% power) while GPS acquires satellite information. No data is parsed or transmitted during this time – this is just a wait state to allow the GPS time to get a fix. This number should be less than the (internally limited) NTGPSTIMEOUT as it is included in this window. If this value is larger than (the internally limited) NTGPSTIMEOUT, it is internally forced to 0.
NTFLASHALWAYS SAVE	27.5	RW	INTEGER	0	0-1	Setting this bit enables the Always Save feature. This will cause data to be saved to flash memory at the configured rate even if the network is detected and the data transmits. Note that if this is set to 1, data will not be sent out the data log until given command 28.5.
NTFLASHDUMP	28.5	RW	INTEGER	0	0-1	Data log dump command. Writing a 0 or 1 to this bit provides a one time successful dump of the data log. Reading this bit returns the last value set. This bit does not have to be cleared or set specifically, writing either will cause the dump operation.
NTFLASHERASE	29.5	RW	INTEGER	0	0-1	Data log erase command. Writing a 0 or 1 to this bit forces the data log to erase. Reading this bit returns the last value set. This bit does not have to be cleared or set specifically, writing either will cause the erase operation.

Notes

1. The OID column includes the ending 'instance identifier' which must be included in the MIB variable.

Table 5: Wi-Fi Terminus NT-220LT OID Table

APPENDIX 1 continued

OID Relative to 1.3.6.1.4.1.28295.1.					
NAME	OID <sup>1</sup>	Access	Type	Default Range	Comments
GSNFWVERSION	1.1.2.0	R	INTEGER	All possible values Example: 67108867 = ID: 0x00040003 (Version 4.0 sample)	Integer returned, convert to hex for firmware version.
GSNPLATFORMVERSION	1.1.3.0	R	INTEGER	All possible values	Platform version
GSNRESTOREFACTORYCFG	1.1.4.0	RW	INTEGER	Send a '1' to reset	<b>Please consult factory prior to use. This will reset the MAC address. Use 1.3.5.0 to re-set the MAC to original state.</b>
GSNLASTERROR	1.1.5.0	RW	STRING	-	Last error occurred
GSNREBOOTNODE	1.1.6.0	RW	INTEGER	-	Restart network
GSNBATTERYWARNINGLEVEL	1.1.8.0	RW	INTEGER	Varies <sup>2</sup>	Battery warning level - <b>Do Not Change</b>
GSNBATTERYSTANDBYLEVEL	1.1.9.0	RW	INTEGER	Varies <sup>2</sup>	Battery Standby Level - <b>Do Not Change</b>
GSNBATTERYREADFREQ	1.1.10.0	RW	INTEGER	Varies <sup>2</sup>	Controls frequency of battery reading. Do not change without contacting factory.
GSNBATTERYFIRSTBOOTSTANDBYLEVEL	1.1.11.0	RW	INTEGER	Varies <sup>2</sup>	Battery standby level for cold boot only (expected to be higher than the normal standby level). Prevents operation on a nearly dead battery.
GSNSCANTYPE	1.2.1.0	RW	INTEGER	1(Active) 0(Passive)-1(Active),	DO NOT CHANGE FOR NORMAL OPERATION
GSNADHOCSSID	1.2.2.0	RW	STRING	"<null>" -	SSID in ad hoc mode. This is used for a special mode when you need to create an Ad Hoc network. Use GSNAPSSID1-3 for normal operation when wanting to join an existing Ad Hoc network. If this is configured, the unit will continue to try and create this Ad Hoc network rather than continuing to search for the other SSIDs.
GSNADHOCCHANNEL	1.2.3.0	RW	INTEGER	6	Channel in ad hoc mode
GSNAUTHALGO	1.2.4.0	R	INTEGER		Auth algo used - <b>Do Not Change</b>
GSNPSKPASSPHRASE	1.2.5.0	W	STRING	GSDDemo123	Deprecated. Use 1.3.6.1.4.1.28295.1.1.4.5.1.7 (1-3) GSNAPPSKPASSPHRASE SSID (1-3)
GSNOUTERAUTHTYPE	1.2.6.0	R	INTEGER	-	DOES NOT EXIST FOR WPA2_PSK VERSION
GSNINNERAUTHTYPE	1.2.7.0	R	INTEGER	-	DOES NOT EXIST FOR WPA2_PSK VERSION
GSNUSERNAME	1.2.8.0	RW	STRING	-	DOES NOT EXIST FOR WPA2_PSK VERSION
GSNPASSWD	1.2.9.0	RW	STRING	-	DOES NOT EXIST FOR WPA2_PSK VERSION
GSNPSKEY1	1.2.10.0	W	HEX	"<null>"	256-bit pseudo-random sequence. Pre computed PSK key. This key is derived from SSID1 and the pass phrase. Enter as 'Ox', followed by 64 digits using 0-9 and a-f
GSNPSKEY2	1.2.11.0	W	HEX	"<null>"	256-bit pseudo-random sequence. Pre computed PSK key. This key is derived from SSID1 and the pass phrase. Enter as 'Ox', followed by 64 digits using 0-9 and a-f
GSNPSKEY3	1.2.12.0	W	HEX	"<null>"	256-bit pseudo-random sequence. Pre computed PSK key. This key is derived from SSID1 and the pass phrase. Enter as 'Ox', followed by 64 digits using 0-9 and a-f

Notes  
 1. The OID column includes the ending 'instance identifier' which must be included in the MIB variable.  
 2. Hardware calibrated number. Subject to change.  
 3. For security purposes, all WEP/WPA/WPA2 security settings are read disabled by default. The Wi-Fi Terminus will respond to a read of the security settings with "Read Disabled" if it is a String or Hex String, and with 255 if it is an integer. To confirm a settings change, please note the SNMP response string that is sent with an SNMPSET command. If the new value is set appropriately, you will see the new value in the response string in the form "INTEGER = XXXX" or "STRING = XXXX". If the value is returned in parenthesis, it was not acknowledged properly.

Table 5: Wi-Fi Terminus NT-220LT OID Table

APPENDIX 1 continued

OID Relative to .1.3.6.1.4.1.28295.1.

NAME	OID'	Access	Type	Default	Range	Comments
GSNPADDRESS	1.3.1.0	RW	IP ADDRESS	192.168.1.3	All possible values	IP address of the Wi-Fi Terminus
GSNSUBNETADDRESS	1.3.2.0	RW	IP ADDRESS	255.255.255.0	All possible values	Subnet of Wi-Fi Terminus
GSNGATEWAYIPADDRESS	1.3.3.0	RW	IP ADDRESS	"<null>"	All possible values	Gateway IP in infrastructure mode.
STATICIPENABLED	1.3.4.0	RW	INTEGER	1	0-1	Set to 1 to enable static IP. Set to 0 to enable DHCP.
GSNMACADDRESS	1.3.5.0	RW	HEX	0x0050C29BAYYY	All possible values	Mac address. Read with -O t option To be used only in conjunction with GSN Restore Factory CFG
GSNPRIMARYSNMPMGRIIP	1.4.3.0	RW	IP ADDRESS	192.168.1.2	All possible values,	IP of SNMP manager
GSNSECONDARYSNMPMGRIIP	1.4.4.0	RW	IP ADDRESS	192.168.1.2	All possible values,	IP of backup SNMP manager
GSNAPSSID1	1.4.5.1.2.1	R/W	STRING	"CW85_Setup"	All possible values	SSID's of the access point to be used in infrastructure
GSNAPSSID2	1.4.5.1.2.2	R/W	STRING	"CW85_Setup" <sup>3</sup>	All possible values	mode. They will be searched in order.
GSNAPSSID3	1.4.5.1.2.3	R/W	STRING	"LTRX_IBSS" <sup>3</sup>	All possible values	
GSNAPCHANNEL1	1.4.5.1.3.1	R/W	INTEGER	6	1-11	Access point channel number for the corresponding SSID.
GSNAPCHANNEL2	1.4.5.1.3.2	R/W	INTEGER	6	1-11	
GSNAPCHANNEL3	1.4.5.1.3.3	R/W	INTEGER	6	1-11	
GSNAPWEPKEYIDSSID1	1.4.5.1.4.1	RW	INTEGER	0	0-3	WEP Key ID
GSNAPWEPKEYIDSSID2	1.4.5.1.4.2	RW	INTEGER	0	0-3	WEP Key ID
GSNAPWEPKEYIDSSID3	1.4.5.1.4.3	RW	INTEGER	0	0-3	WEP Key ID
GSNAPWEPKEYLENSSID1	1.4.5.1.5.1	RW	INTEGER	5 (WEP64)	5 or 13 (WEP128)	WEP Key Length
GSNAPWEPKEYLENSSID2	1.4.5.1.5.2	RW	INTEGER	5 (WEP64)	5 or 13 (WEP128)	WEP Key Length
GSNAPWEPKEYLENSSID3	1.4.5.1.5.3	RW	INTEGER	5 (WEP64)	5 or 13 (WEP128)	WEP Key Length
GSNAPWEPKEYVALSSID1	1.4.5.1.6.1	RW	HEX	0x00, 0x00, 0x00,	5 Bytes or 13 Bytes	WEP Key Value
				0x00, 0x00	using O-F and 0-9	Enter as 0x000000000000, using 10 or 26 digits after "0x".
GSNAPWEPKEYVALSSID2	1.4.5.1.6.2	RW	HEX	0x00, 0x00, 0x00,	5 Bytes or 13 Bytes	WEP Key Value
				0x00, 0x00	using O-F and 0-9	Enter as 0x000000000000, using 10 or 26 digits after "0x".
GSNAPWEPKEYVALSSID3	1.4.5.1.6.3	RW	HEX	0x00, 0x00, 0x00,	5 Bytes or 13 Bytes	WEP Key Value
				0x00, 0x00	using O-F and 0-9	Enter as 0x000000000000, using 10 or 26 digits after "0x".
GSNAPPSKPASSPHRASESSID1	1.4.5.1.7.1	RW	STRING	"<null>"	-	AP Pass Phrase
GSNAPPSKPASSPHRASESSID2	1.4.5.1.7.2	RW	STRING	"<null>"	-	AP Pass Phrase
GSNAPPSKPASSPHRASESSID3	1.4.5.1.7.3	RW	STRING	"<null>"	-	AP Pass Phrase

Notes

1. The OID column includes the ending 'instance identifier' which must be included in the MIB variable.

Table 5: Wi-Fi Terminus NT-220LT OID Table

APPENDIX 1 continued

OID Relative to .1.3.6.1.4.1.28295.1.						
NAME	OID <sup>1</sup>	Access	Type	Default	Range	Comments
GSNWEKEYAUTHMODESSID1	1.4.5.1.8.1	RW	INTEGER	1 (Open)	1-2 (Shared)	Authentication
GSNWEKEYAUTHMODESSID2	1.4.5.1.8.2	RW	INTEGER	1 (Open)	1-2 (Shared)	Authentication
GSNWEKEYAUTHMODESSID3	1.4.5.1.8.3	RW	INTEGER	1 (Open)	1-2 (Shared)	Authentication
GSNENCRYPTIONMODESSID1	1.4.5.1.9.1	RW	INTEGER	219(DBh)	All possible Values	Encryption control for SSIDX. Bitmap of the binary equivalent controls which encryption methods are allowed. Note: Bit 3 and 6 are not available on WPA2-PSK version. Not available on version 4.0 and prior.
GSNENCRYPTIONMODESSID2	1.4.5.1.9.2	RW	INTEGER	219(DBh)	All possible Values	Bit 0 WEP Bit 1 WPA-Personal Bit 2 RESERVED - Set to 0 Bit 3 WPA-Enterprise (N/A) Bit 4 WPA2-Personal Bit 5 RESERVED - Set to 0 Bit 6 WPA2-Enterprise (N/A) Bit 7 Open Encryption (none)
GSNENCRYPTIONMODESSID3	1.4.5.1.9.3	RW	INTEGER	219(DBh)	All possible Values	DO NOT CHANGE
GSNCONFIGCOMPLETE	1.4.6.0	RW	INTEGER			DO NOT CHANGE
GSNGETCOMMSTRING	1.4.10.0	R	STRING	GSN_GET		DO NOT CHANGE
GSNSETCOMMSTRING	1.4.11.0	R	STRING	GSN_SET		DO NOT CHANGE
GSNTRAPCOMMSTRING	1.4.12.0	R	STRING	GSN_TRAP		DO NOT CHANGE
GSNTRAPCONFIGINTNEWTMR	1.4.13.0	RW	HEX	0x0000001400000000 (byte reversed HEX string =10 Seconds)		Interval for config traps. May be set to 0 to disable. See Section 3.3 - Configuring Timers
GSNTRAPLINKUPINTNEWTMR	1.4.14.0	RW	HEX	0x0000002800000000 (HEX string = 20 seconds)		Interval for linkup traps. May be set to 0 to disable. See Section 3.3 - Configuring Timers

Notes

1. The OID column includes the ending 'instance identifier' which must be included in the MIB variable.

Table 5: Wi-Fi Terminus NT-220LT OID Table

## APPENDIX 1 continued

OID Relative to .1.3.6.1.4.1.28295.1.

NAME	OID <sup>1</sup>	Access	Type	Default	Range	Comments
GSNFWUPDATEIP	1.6.1.0	RW	IPAD-DRESS	192.168.1.2	All possible values	Consult Factory before use.
GSNFWUPDATEPORT	1.6.2.0	RW	INTEGER	8355	All possible values	Consult Factory before use.
GSFWUPGRADENEED	1.6.3.0	RW	INTEGER	0	0	DO NOT USE
GSNHRDWAREVERSION	2.10.1.0	R	INTEGER		All possible values, not defined	The hardware version is loaded at boot time by the software from a hardware register.
GSNBOOTROMVERSION	2.10.2.0	R	INTEGER		All possible values, not defined	The boot ROM version is loaded at boot time by the software from a specific memory location
GSNWLANFWVERSION	2.10.3.0	R	INTEGER		-	Firmware version
GSNBUPVERSION	2.10.4.0	R	INTEGER		-	BUP version
GSNMODEMBVERSION	2.10.5.0	R	INTEGER		-	Modem B version
GSNSTREAMVERSION	2.10.6.0	R	INTEGER		-	Stream processor version
GSNLASTERRCODE	2.10.7.0	R	INTEGER		-	Last error code
GSNLASTERRPARAM	2.10.8.0	R	STRING		-	Last error parameter
GSNFRANDOMVECTOR	2.10.9.0	R	STRING		-	Rx timestamp LSBs for random calculation
GSNFRANDOMELEMENTS	2.10.10.0	R	INTEGER		-	
GSNLOWPOWERXTAL	2.10.11.0	R	INTEGER		-	

**Notes**

1. The OID column includes the ending 'instance identifier' which must be included in the MIB variable.

Table 5: Wi-Fi Terminus NT-220LT OID Table

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## APPENDIX 2

### Configuration Options for GPS Fix

Because fix accuracy in the short term is very dependent on time, two variables for controlling when the unit should report a 'valid' fix have been created - the first variable is NTNUMFIX. NTNUMFIX can be set to count the number of 3D fixes a unit should have before starting to report. This OID can be used in conjunction with NTSENDFIX, which controls whether the device sends all of the GPS data until it has a 'good' fix \*(when NTGPSNUMFIX is satisfied) when set to 0 or whether the device sends no data until it has a 'good' fix when it is set to 1+. If this variable is set to more than 1, then the NT-220LT will report that number of position solutions over the 802.11 connection.

Example: Set the device to send only fixes, wait until it has had 45 fixes, and then send out the next 5 position solutions.

```
NTGPSNUMFIX = 45
NTSENDFIX = 5
```

Example: Set the device to send all data, but wait until the 50th fix to go to sleep (essentially the same as the previous example, except that even non-fixes are sent out).

```
NTGPSNUMFIX = 50
NTSENDFIX = 0
```

The second variable for controlling when the unit should report a fix is NTGPSHDOPFIX, which changes determination of a 'valid' fix from simply a fix, to a fix solution with an HDOP <= the configured value. If the value is set at 0, then the unit uses only fix status to determine solution quality. If this number is 1 or greater, then this value considers the first 'good' fix to have an HDOP <= the configured value. IMPORTANT: this variable uses the HDOP field in the GPGSA string, so this string MUST be enabled for this setting to work properly. Failure to turn on this sentence will result in the GPS staying on until the GPS safety timeout has elapsed.

If NTGPSHDOPFIX = 1, then the first 'good' fix will be the first value that has HDOP <= 1.9 (digits after the decimal are ignored). The unit might have a fix for several seconds, or possibly longer, but if the HDOP is not <= to 1.9, the controlling logic considers it an insufficient fix and the NT-220LT continues to wait. This variable can be used in conjunction with NTGPSNUMFIX and NTSENDFIX.

Example: Set the device to send only fixes, wait until 45 fixes after HDOP is less than 2, and then send out the next 5 positions.

```
NTGPSHDOPFIX = 1
NTGPSNUMFIX = 45
NTSENDFIX = 5
NTMSGENABLE must have GPGSA enabled.
```

Because a cold fix will generally take at least 45 seconds, a sleep mode has been implemented that will allow the device to enter a lower powered state for a configured time prior to sending out any GPS messages. The controlling variable is called NTGPSWAIT. This variable sets the time, in seconds, that the NT-110ST will be in sleep mode while the GPS tries to acquire a fix (and ephemeris/almanac information).

Example: Set the device to sleep for 65 seconds, then wait until the HDOP is less than 2 and send out the next position solution

```
NTGPSWAIT = 65.
NTGPSHDOPFix = 1
NTGPSNUMFIX = 1
NTSENDFIX = 1
NTMSGENABLE must have GPGSA enabled.
```

Assumptions:

```
NTAPPPERIOD (default value of 600 seconds – 0x000000B004000000)
NTGPSTIMEOUT (default value of 590 seconds)
```

### Fix Accuracy vs. Time

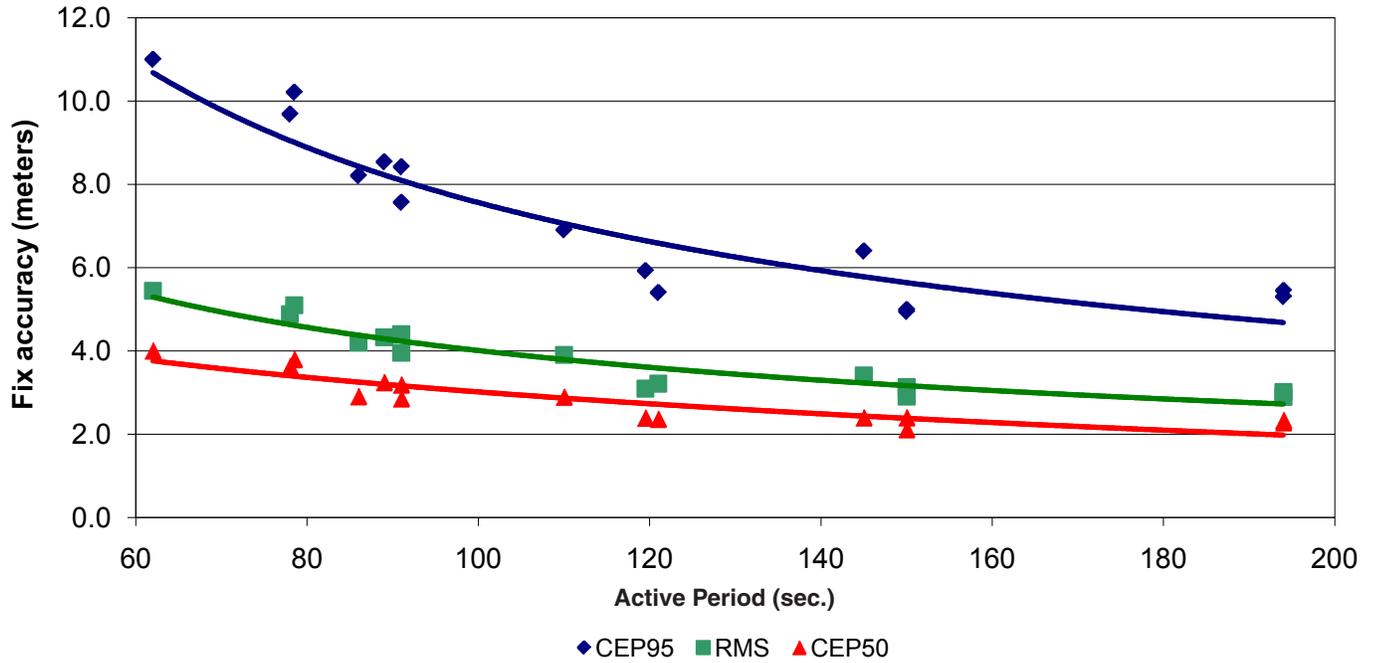


Figure 5 Fix Accuracy vs Time

# Wi-Fi Terminus NT-220LT Terminal

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## Revision History of Version 3.0

Revision	Date	Released By	Note
A00	05/26/11	Steve Overmyer	Advanced Release

Table 6 Revision History

## Other Documentation

The following additional documentation may be of use in understanding this document.

### Document

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Configuring for Wi-Fi Networks

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Wi-Fi Terminus Quick Start Guide

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CW25 Dev Kit User Manual

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CW25 Evaluation Kit User Manual

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Table 7 Additional Available Documentation List



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